march 2024 Cropproduction cpm best read specialist arable journal* magazine

Balancing fungicide spend Page 8



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Take a chance on grain maize page 54

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Dynamic drills page 70

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Volume 26 Number 2 **March 2024**



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Editor's Pick

Hasn't February flown by in a flash? But more concerningly for me, it's an entire year since I joined CPM. Looking back, I was seeking a chance to reconnect with what makes me tick — sharing people's stories and perspectives. And now, 12 months later, I find myself the editor of this prestigious magazine.

For a girl from lowly Stoke-on-Trent, admittedly from a farming family, I sometimes have to catch my breath just to recognise how far I've come. It's been quite a whirlwind! I never for one moment thought I'd be allowed to do this, especially when I feared I'd 'lost my touch' at points along the way in my career.

There's an element of learning on the job, so I do hope you'll stick with me as I find my feet.

One thing I do know is at the time of signing off this issue, the weather hasn't really improved and questions surrounding fungicide investment remain unanswered. Although we're not in a place to provide bespoke per-farm advice, we kick off with broad thoughts from four independent agronomists on page 8.

For a different slant on weed management, we join an industry take on 'Question Time' hosted by the Association of Independent Crop Consultants (AICC) on page 26. Although we couldn't cover it all, we share some of the most pertinent questions from the floor. To that end, a claim to fame of mine is that I was once on Question Time and bumped into David Dimbleby at Stoke train station the morning after. Sadly they didn't air my question although they did broadcast footage of me looking suitably enthused, and I managed to take a selfie with the man himself.

Back to the magazine ---a highlight for me has been revisiting an on-farm trial on page 33 which investigates alternative sources of nitrogen and if it's possible to reduce conventional rates and bridge the gap. We don't feature that many mixed

farms in CPM, but I do recognise that there are plenty of you out there, so this is part of a commitment to showing you a level of representation.

While pulling the issue together I've noticed there's a concurrent theme across the magazine ---making more of what's in the tank. We look at adjuvants in cereals on page 42 and in sugar beet on page 96, whereas Melanie explores the role of water conditioners in oilseed rape on page 46.

Mike Abram has been busy traversing the country to provide reports from the Hutchinsons agroecology conference (page 61), an IPM workshop (page 64) and the BASE-UK conference (page 67). Among the take-homes are organic matter's role in soil resilience and dive into the role of cover crops and soil health. We very much appreciate Mike's willingness to hit the road.

It's a drill bonanza on page 70 where Melanie shares highlights from recent kit releases which overall, seem to celebrate a move towards low disturbance and direct drilling. She then collates advancements in smart technology on page 79.

In the roots section we explore what has the potential to cause potato growers an even bigger headache than ever - the combination of seed shortages, mancozeb uncertainty and more resistant blight strains (page 89). It's quite a technical read so strap in.

Mike then concludes his

nationwide tour when he joins delegates at BBRO's BeetTech to find out whether progress has been made in the fight against virus yellows (page 91).

Thank you to everyone who completed our readers' survey and gave words of support and constructive criticism - the team and wider Kelsey management will be reading all comments to see if it's possible to make the CPM brand even more ready for the future.

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Some of the current challenges facing potato growers including new blight strains and planning for a future without mancozeb.

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smith's soapbox

Perversity in places of power

Despite a few uplifting signs of spring such as an increase in birdsong and blossom in the hedgerows, there does seem to be a number of large black clouds threatening this year's harvest that won't go away.

Firstly, the wet weather that arrived in October seems

unrelenting, meaning that any attempted field work is less than pretty. That old adage of a peck of dust in March being worth a king's ransom, rings as true as ever.

It seems unlikely we'll be rewarded with a king's ransoms this spring. Secondly, cereal prices hardly encourage anyone to rush out with the drill. I reckon my break-even point is around £190/t, so if I can keep my overheads tamed then the current financial drivers for spring cropping feel all

very limp. Thirdly, the ratcheting back of the BPS safety net makes arable farming feel extra perilous making me risk averse when it comes to investing money, time and trouble into



productive farming.

Finally, the possibility of putting land into SFI or CS rather than cropping makes for a very tempting alternative given guaranteed payments of between £600 and £800 per hectare. All in all, one suspects the combines of Britain could be in for a notably inactive year in 2024 while the grain terminals that handle imports could be in for a busy one.

What's remarkable is the possibility of a small harvest doesn't seem to particularly worry the policy makers in the corridors of power, who continue to roll out their new Ag policy to replace BPS with schemes dominated by less or no production.

In times past, the prospect of lower domestic food production would have seen medieval kings jumping around like mad March hares putting taxes on exports in order to keep grain in their kingdom. Even the most powerful kings lived in fear of food shortages and a hungry population.

In current times you don't have to search very extensively to find instances of foreign governments putting wheat export bans in place to shore up national food security such in Russia in 2022. Indeed the Russians are currently restricting hard wheat exports due to concerns about shortages.

More generally, the development policies of countries such as China, India, Russia and Brazil are to grow more cereals and protein crops in the future, not less. But for some reason in the UK, the ambition seems to produce less, not more. In an increasingly dangerous world with a war taking place in the bread basket of Europe, what could possibly go wrong?

The sight of continental farmers taking to the streets to blockade their nation's capitals 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

reminded me of a farmers march I joined as part of an NFU delegation in 2016. It started out as a good natured affair with a carnival feel to it as thousands of farmers marched through Brussels.

But in the afternoon things took a far more ugly turn with an unpleasant atmosphere that reminded me of being outside crowded football grounds in the 1980s. As I stood in one of the Belgian capital's prettier central squares to witness hedges and trees being set alight by a handful of individuals who didn't look like farmers to me, I resolved never again would I join a protest march.



After joining a farmers march in 2016, I resolved never again.

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Cereal disease control

With no letup in weather conditions, questions continue to be raised regarding balancing fungicide spend with crop yield potential. *CPM* spoke to four independent agronomists for their take on the situation.

By Janine Adamson

If there was little inclination for how the season would pan out in the February issue of *CPM*, it appears to be no better a month later. For many, the rain and associated misery continues, but the key message from many agronomists is to not lose hope yet.

"We're still speaking very academically as there's not much that can be done practically at the moment," says Association for Independent Crop Consultants (AICC) member and Ceres Rural agronomist in the Shrewsbury region, Dan Matthews. "What we can say is it feels as though spring will be short; the long-range forecast suggests an unsettled March."

Input versus output

Dan believes that where there is an opportunity to travel, for those with winter cereals in the ground, there'll be much to address in a very short space of time. "In that window, growers will have to balance nutritional deficiencies, present disease pressure and weed management all at once. It won't be easy."

Love and attention

Agronomist Will Spurdens, also with Ceres Rural and the AICC, says the first port of call is to give crops some love and attention, and that fungicides should remain the final armour in a disease management programme. "Even with the huge spread of crops on the cards, all will require a level of nutrition. In some cases, it's the more forward crops which will be hungry and require nitrogen quicker than a smaller, more backward crop. Equally, the role of trace elements shouldn't be neglected," he stresses.

Dan agrees that given the multitude of challenges this season, fungicides could be perceived as less of a priority. "Soil-based nutrition is very depleted this year so there's likely to be a lot going on in tank mixes when there is an opportunity to travel. It might seem obvious, but being organised will pay dividends."

He says because some growers will have a greater area of spring crops to drill than usual, it could be tempting to let **>**

66 Be regimented with timings if conditions permit, there's no margin for error **99**



Dan Matthews says it feels as though spring will be short; the long-range forecast suggests an unsettled March.



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Cereal disease control



According to Will Spurdens, even with the huge spread of crops on the cards, all will require a level of nutrition.

► those take precedent over what's already in the ground. "Margins should still be good for those winter crops even if they're not at their best. Be regimented with the timings if conditions permit, there's no margin for error."

Across their region, both Dan and Will have noted some 'strange things' happening in crops due to the extreme conditions. "We're seeing brown rust which is unexpected but will of course be a result of high stress plus the recent mild temperatures," says Dan. "Equally, septoria pressure is high in forward crops depending on varietal resistance."

Will echoes messaging from February *CPM* — strategic use of biostimulants and PGRs will help to divert energy into rooting to aid crop recovery, he says. "However, whether it's fungicides etc or plant health

products, calculating the appropriate spend based on yield potential and disease pressure will be imperative," stresses Will.

Being pragmatic, Dan says in reality, there's not that much between current fungicide product options as growers head into T1s. "In the West, the main problem is always septoria and when it comes to this disease, the available chemistry all offers adequate cover. I think it'll likely be a commercial decision as to exactly what's used," he explains.

Standard pressure

AICC member Scott Martin is part of Apex Agronomy and works from North Essex throughout Suffolk and into Norfolk. He says given the mild weather, he's seeing the usual septoria pressure in winter wheat crops as well as yellow rust in susceptible varieties.

"For those going with a T0 due to the risk of yellow rust, usually in juvenile susceptible varieties which are showing pressure, we're looking at tebuconazole in most cases.

"But it's T1 where things get more interesting. Across my area we have two crops — those drilled before 10 October and then those which were planted at the end of December and into January. For the early crops, disease pressure appears quite high due to the weather and in this case, they'll likely require a higher level of inputs.

"Without pricing to refer to at the moment, it's difficult to predict a return on investment for the grower in those scenarios," he says.

For the later drilled crops, Scott says

Eliciting a response

If considering elicitors, SRUC's Neil Havis says they should be used early at T0 timing and crucially, they shouldn't be used as an alternative to fungicides. With this in mind, the most commonly used elicitor in wheat programmes (lodus) has a last application date of just before GS30.

"An important part of managing disease should be the choice of a variety with good resistance — this will help minimise the spread of disease. Elicitors work by inducing the natural defence mechanism of that variety to maximise the level of the host resistance present.

"It's then a case of tailoring the rest of the fungicide programme accordingly, based on subsequent disease pressure," he says. According to Neil, trials at SRUC have shown early elicitor use can mean a reduction in the chemistry used later in the programme. "Of course, this is very important when considering the return on investment of inputs."

ADAS's Rebecca Joynt agrees — she's been looking at lodus specifically, the laminarin-based elicitor from UPL. "2023 Trials in Herefordshire have investigated the relationship between applying lodus at T0 and doses of T1 fungicides.

"In some trials, we've seen the same level of disease control and yield response when using lodus followed by a lower rate fungicide at T1, compared with using a full rate product at T1 without T0 lodus," she explains. septoria pressure will be lower and fungicide spend should reflect that, but focus should be on building biomass and canopy management. Higher than usual early nitrogen applications are to be expected, he comments.

But even if cereal crops aren't looking amazing right now, Scott believes protecting their potential will be worthwhile. "It's important to look after those early drilled cereals," he says.

Up in the North, AICC member Ben Boothman advises on farms from Doncaster to Scotch Corner, as well as to the East Coast. He says for growers with added grassweed pressure to contend with, they're still weighing up crop survival. "Being unable to get on with a pre- or post-em last year due to poor ground conditions has meant some crops are filthy with blackgrass.

"Equally we have septoria bubbling away in wheat, particularly in older, more susceptible varieties. As for barley, key diseases are evident such as rhynch osporium and the usual brown rust, mainly hosted by hybrid varieties, and crops are sat wet and yellow."

For his region, he likens fungicide programmes to car insurance — from basic third party, fire and theft through to fully comprehensive cover, all dependent on the status of the crop.

"Looking at T0s, in trials, varieties with good disease scores don't see a financial benefit of an early application, which will be a bonus this year on crops with low potential. Being realistic, farmers are unlikely to want to spend much on those crops this year," says Ben.

That said, growers who were able to drill early without severe grassweed pressure have good, thick crops, he adds. "They should be aiming for a more rounded programme to protect the yield potential and push them on."

Ben says he's hoping that the spring dries up a little so septoria pressure is minimal, but assessing the risk on a per-field basis should be the main goal. "Although balancing financial input on crop potential is important, I'd still advise using the best chemistry on those stronger crops if disease pressure is a concern but with the option to reduce the rates."

"This is because of the resistance issues with some of the older chemistry and the importance of getting the best out of those stronger crops. We can't lose sight of longer-term goals such as resistance management and best practice," he stresses. ►

HERBICIDE PLANNING SAVES TIME IN BUSY SPRING SEASON

EFFECTIVE SPRING HERBICIDE STRATEGIES HINGE ON TIMING SPRAY WINDOWS WITH PERIODS OF ACTIVE WEED GROWTH



Georgina Toung Syngenta Grass Wood Technical Manager

Following the wet conditions in the autumn which compromised most herbicide applications, many winter crops have large populations of both grass weeds and broad-leaved weeds. Planning herbicide sequences and the potential for tank mixes now, will make the best use of every opportunity that arises.

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a range of broad-leaved herbicides, tackling a wider spectrum of weeds in one hit, will reduce application time and costs.

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Where control has been poor in the autumn, there's a high possibility that there could be multiple spring herbicide applications, therefore, it's important to note that where AXIAL® Pro is used first e.g. to target overwintered grass weeds, SU/ALS inhibitor or hormone herbicides can be applied just seven days later. However, if the SU/ALS inhibitor or hormone herbicide is applied first in the sequence, growers should wait 21 days before applying AXIAL® Pro – by which time grass weeds will have grown progressively larger and may require higher rates for optimum control.

ACTIVE GROWTH

Active weed growth at the time of application is essential to achieve high levels of control from all herbicides, and to minimise the risk of temporary crop effects.

Trials have shown that it is better to wait until conditions are favourable for weed growth before a herbicide application, even if higher rates are then required to tackle larger weeds.



Target larger overwintered grass weeds as a priority: ryegrass, wiid oats and black-grass

Syngenta research with NIAB has demonstrated that larger, overwintered grass weeds are more competitive and produce far higher seed returns compared to later spring-germinating weeds. Targeting overwintered weeds should therefore be a key driver for herbicide timing and rate decisions. However, if applications are delayed due to unfavourable field conditions, it will mean that any later weeds that have emerged will also be controlled but rates must be adapted to target the largest weeds in the field.

TOP TIPS

- Plan for AXIAL® Pro herbicide tank mix opportunities
- Target larger overwintered weeds first
- Be aware of sequence limitations with some herbicides.

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Cereal disease control



Even if cereal crops aren't looking amazing right now, Scott Martin believes protecting their potential will be worthwhile.

► In order to provide truly independent advice to his customers, Ben says he'll wait until price lists are made available and then calculate an appropriate spend based on wheat prices and perceived crop potential. "The good crops certainly still require spraying but variety and disease pressure as always has a big impact on the chosen chemistry.

Considered perspective

"Equally it'd be quite naïve to think that poorer crops shouldn't be treated at all, that seems like an unwise perspective to me," he states.

His parting comment is to not underestimate the importance of timing. "Opportunities to travel will be infrequent if the weather pattern continues, so if you are reducing the rates, hitting exactly the right point in the crop's development will be crucial.

"Good timing means you have the capacity to adjust what's in the tank, but of course, it's all weather dependent," he concludes. ■



It'd be quite naïve to think that poorer crops shouldn't be treated at all, stresses Ben Boothman.

Leaf layer emergence study

Work undertaken by NIAB has been investigating leaf layer emergence and variability across different winter wheat varieties. The two year study took place across four different sites and monitored the time of emergence of leaf three, leaf two and the flag leaf, plus percentage of disease progression.

NIAB's Dr Aoife O'Driscoll says this is important because leaf layer emergence dictates the time that leaves are exposed to infection, and together with disease risk, impacts spray timings and control efficacy.

"It's mainly the variety and thermal time



Work undertaken by NIAB suggests leaf layer emergence can last up to 10 days in certain varieties under cooler conditions, and is especially variable for leaf three.

which affects leaf layer emergence — late sowing and cooler temperatures will both have an impact," she explains.

For T1, the optimum time to spray is when two thirds of leaf three has emerged from the main tillers. Aoife says this year, given in-field variability, she anticipates that may be very difficult to gauge.

Such variability was also a key theme of the trial, whether conditions were dry in the spring or warm and wet; Aoife says this was surprising. "At the Cambridge trial, spring 2022 was dry followed by a deluge in May which drove septoria pressure. T1 was applied at 28 April and T2 at 17 May, with leaf layer emergence monitored from 12 April-17 May.

"Of the eight varieties trialled, there was large variation in the time taken for leaf layer emergence, especially for leaf two and flag leaf. If you take leaf two, to observe two thirds of that layer emerged across the varieties assessed, the dates ranged from 25 April-7 May despite the same drilling date."

In contrast, at the Sutton Scotney site in 2023, April was warm and wet and Aoife says she hoped to see a more regular pattern of emergence across the trial. However, this wasn't the case.

"At this site, taking the flag leaf and observing two thirds of emergence, some varieties reached this on 17 May while others didn't reach this point until 10 days later. Large variation once again."

The study also looked at the rate of leaf



Dr Aoife O'Driscoll says leaf layer emergence dictates the time that leaves are exposed to infection, and together with disease risk, impacts spray timings and control efficacy.

emergence within each variety, for example, how many individual flag leaves were 25%, 50%, 75% or 100% emerged at a certain date. This again showed much variability, which Aoife says makes it difficult to know when a crop is 'ready' to ensure optimum timings.

To conclude, she says the work suggests leaf layer emergence can last up to 10 days in certain varieties under cooler conditions, and is especially variable for leaf three. This year she advises reconsidering how spray timings are assessed.

"Many crops are sitting shorter than usual so it might not be wise to rely on the distance between internodes as an indicator of leaf layer emergence. Further inspection should be done to ensure accurate spray timings," concludes Aoife.

This work was sponsored by BASF.

Powering up spring weed control

To maximise the control of difficult grass and broadleaved weeds, a range of active ingredients must be applied at the optimum timing (s) and rate. Using multiple active ingredients in a single tank mix is one way of easing workload pressures, with pre-mixed formulations eradicating any concerns regarding product compatibility.

TOWER[®], a unique three-way formulation of chloratoluron (250g/L), diffutenican (40g/L) and pendimethalin (300g/L) is effective at controlling weeds in spring-sown wheat and barley and can be used either as a pre-emergence. treatment, or as a postemergence application to control annual meadow grass, common chickweed, mayweed, common poppy and many other broadleaved weeds.

For spring barley fields with a history of difficult blackgrass or ryegrass, an additional mode of action such as flufenacet can be added at the pre-emergence timing. TOWER" brings residual option to spring rye and triticale weed control with activity against key weeds



Delivers better than 95% control of many problem weeds

TOWER* is also approved for use in spring rye and spring triticale and is one of only a handful of herbicides labelled for grassweed control in these crops.

Difficult weeds

TOWER® afters growers the patential to 'Power Up' the control of ALSresistant weeds and can be applied at its full rate as a pre-emergence residual treatment to deliver better than 95% of control including shepherd's purse, red dead nettle, speedwell, poppy, chickweed and mayweed.

TOWER® can also be used as an early postemergence contact treatment (when the grassweed target has one or two leaves) when it will deliver a level of performance on a par with its pre-emergence function. Its efficacy as a postemergence treatment will, however, be hampered in



excessively dry conditions, so the best advice is to apply pre-emergence to insure against dry conditions postdrilling.

Non-label weeds

TOWER® also gives good control of a number of non-label weeds including groundsel, fool's parsley, fat hen, field bindweed, black bindweed and small nettle, all of which are susceptible to TOWER from pre-emergence up to two leaf growth stage.



TOWER[®] is a unique residual herbicide containing a three-way mixture of chlorotoluron (250g/L), diflufenican (40g/L) and pendimethalin (300g/L). It provides excellent standalone control of annual meadow grass and broad-leaved weeds and can be used pre- or past-emergence in winter and spring cereals.

Power up with straight pendimethalin

ADAMA's herbicide range also includes a straight pendimethalin product, ANTHEM® (400g/L pendimethalin).

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And, thanks to its suspension concentrate formulation, ANTHEM* can be used just as effectively as a standalone product or as a tank mix partner with many other chemistries.

ANTHEM[®] (400g/L pendimetholin) is a long-lasting residual herbicide for the control of a broad spectrum of grass and broad-leaved weeds in cereals.



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Product in focus

As Revystar XE enters its fifth season of use, *CPM* takes a deep dive into the active ingredients in it to understand the journey so far and the science behind the product's consistent performance.

By Janine Adamson

Launching a new plant protection product into the market is no small feat particularly when it includes an active ingredient which is the first of its class. It takes years of work and considerable investment to obtain regulatory approval, and now, approaching five years later, the success of Revystar XE stands firm.

At the heart of the product is Revysol (mefentrifluconazole) — an isopropanol-azole molecule which falls into the azole group of chemistry in combination with SDHI Xemium (fluxapyroxad). It's used on wheat, barley, triticale, oats, rye and sugar beet to offer consistent control of a wide range of diseases, mainly septoria, ramularia, rusts and cercospora.

In a class of its ow

But how did this success story begin? The starting point was screening molecules for pesticidal activity. "This takes place at BASF headquarters in Limburgerhof, Germany, where thousands of naturally-occurring and synthetic molecules are tested every year; every now and then we find one with promise," says BASF's head of registration for UK and Ireland, Jonathan Howarth.

Regulatory profile

"We first heard about Revysol as a team back in 2012 and colleagues were already excited about it because of its favourable regulatory profile. Back then we were part of the EU and the UK was nominated to evaluate the active on behalf of all member states, first submitting to the HSE's Chemicals Regulation Division (CRD) in 2016," he explains.

The evaluation was completed in 2017 but in the meantime, the UK had voted to leave the EU. "At this point we realised there was an opportunity to evaluate products using national processes, rather than the EU's zonal evaluation system, a separate procedure to registration of the active ingredient. It was a chance to get ahead of the EU and launch early 66 Other modes of action come and go and differ in performance, to have something which remains so effective is quite amazing. 99

into the UK," says Jonathan.

He believes this fast-track was a game-changer given fears time was running out for epoxiconazole, BASF's previous 'blockbuster' azole.

"The recently introduced EU pesticide regulation 1107/2009 was a hazard-based system, replacing the old risk-based legislation. With some established chemistry such as epoxiconazole in danger of being phased out, this meant a race to launch Revysol and associated products to avoid a gap for growers."

After much work and commitment from BASF's regulatory and R&D field-trial teams, Revysol came to market in 2020 — the same year that epoxiconazole was

Product in focus

phased out. "Regulatory hurdles keep getting higher so it was a huge effort across the whole company to push the new products over the line and achieve the first Revysol product authorisation in Europe," explains Jonathan. "I remember in the early days being told Revysol stood for reliability, vitality and yield solution it's good to reflect back on that."

According to Jonathan, the molecule has an advantageous regulatory profile because it's effective at disease control in-field without compromise, yet is not an endocrine disruptor and has a favourable human health classification, which he says is rare for the azole group.

"Products have to be as safe as possible so it's imperative that we are held to strict regulations — after all, it's our license to operate," stresses Jonathan.

Being a 'sub-class' of azole has proven central to the success of Revysol and in turn, Revystar XE. BASF's Steve Dennis says although azoles have been used for nearly 50 years as a standard input to control winter wheat diseases, they remain just as important. "Other modes of action come and go and differ in performance, to have something which remains so effective is quite amazing," he says.

Sensitivity shift

Steve explains the class' longevity is in part due to their slow, gradual shift in sensitivity rather than a severe step, as is the case with strobilurins. "Azoles aren't immune to resistance issues but the change in sensitivity is less significant than for other classes."

This is even more the case for Revysol due to the molecule's unique ability to flex — its flexible 'hook' lets the molecule assume different positions, enabling it to bind to the fungal pathogen's target enzyme even if mutations have developed. This gives the molecule a flexible chemical structure distinct from all other azole molecules.

"As a result, Revysol's sensitivity to pathogens hasn't changed despite



Jonathan Howarth says Revysol isn't an endocrine disruptor and has a favourable human health classification, which is rare for the azole group.

entering its fifth year of use," says Steve. "It's an active which seems to have a high tolerance to resistance so is an important

Cornerstone consistency

Having first used Revystar XE as part of pre-commercial launch farm trials around six years ago, Richard Budd of Stevens Farm (Hawkhurst Ltd) in Kent says the product has become a building block of his fungicide programmes.

Farming 1400ha, of which 1200ha is arable, Richard focuses his cropping rotation on winter wheat, winter barley, oilseed rape, winter beans and spring oats. The remainder of his business is top fruit production with some grassland for grazing agreements.

"Our rotation is a result of farming on Wadhurst clay which we've chosen to direct drill for the past decade or so, currently using Sumo DTS and DD direct disc drills. We chop all straw and return residues to the soil as well as applying a lot of organic manures and digestates," he says.

It was being a part of BASF's Real Results Circle from the beginning which meant Richard was given early doors access to Revystar XE. "I always take the hype surrounding a new product with a pinch of salt but with Revystar XE, it actually worked.

"During this initial trial I applied it to a block of winter wheat which tends to senesce early down here due to our location in Kent. Having applied Revystar XE, it was noticeable that the crop stayed greener for longer which translated positively in yield," he explains.

Richard recalls that around a similar time, he

felt as though fungicide options were dwindling and resistance management was becoming a greater conundrum. "But all of a sudden we had Revystar XE and the results could be seen with your own eyes, plus, backed by official ADAS trial data which is important."

In terms of disease pressure at Stevens Farm, Richard says he'd always been under the impression that septoria wasn't a problem. However, having conducted leaf tissue analysis, he was proven wrong. "The results showed that latent septoria was present, so I believe the disease is far more widespread than currently understood."

He's also seen a shift in climatic conditions as Kent becomes more unsettled, further increasing the risk of septoria and overall disease pressure. With risk on the rise, Richard stresses the importance of plant genetics in preserving vital chemistry such as Revystar XE. "The answer will never lie in a can, so it's important to make careful varietal choices.

"It's taking this hand-in-hand approach between genetics and chemistry which will help to preserve the plant protection toolbox and avoid abusing what we have," he says. "This is vital because we have to avoid yield robbing latent septoria."

Because seeing is believing, Richard has now made Revystar XE a consistent part of his fungicide programmes across the farm. And following the loss of chlorothalonil (CTL), he says



Richard Budd has seen a shift in climatic conditions as Kent becomes more unsettled, further increasing the risk of septoria and overall disease pressure.

more pressure is on effective T1 sprays.

"T0s can be difficult to get right now there's no CTL. Also, having flexibility on timings due to the Xemium aspect of Revystar XE means the application window is slightly wider, which is particularly useful when leaf layer emergence isn't consistent.

"Revystar XE is a building block for me — in high disease pressure years with dirty varieties we use it at T1, otherwise it's my go-to for T2. In really difficult years we'll use it at both timings," he concludes.

Product in focus



Although azoles have been used for nearly fifty years as a standard input to control winter wheat diseases, they remain just as important, says Steve Dennis.

► tool for protecting other modes of action and creating diversity across a fungicide programme."

When it comes to fungicide resistance management and septoria control, Revysol is perceived as a lower resistance risk active ingredient, says Jared Bonner. "It really does buck the trend — despite being highly efficacious, it has a high tolerance to resistance.

"Although in practice, Revystar XE is rarely used in the same tank mix as something like Inatreq (fenpicoxamid), it does help to support other integral actives when used elsewhere within a fungicide programme. Ultimately, if a best-in-class azole such as Revysol isn't used somewhere in the programme, it places greater pressure on those active ingredients classed at higher resistance risk," he explains.

Steve believes delivering a robust fungicide programme which considers resistance management is going to be even more essential this season given the sheer variability within crops.

"Crops are always irregular in regard to leaf emergence within the field but this year will be particularly inconsistent due to the autumn weather conditions. It'll be especially challenging to identify the optimum moment to spray and hit the key timings," he says.

However, a glasshouse study conducted by ADAS in 2022 evaluated the effects of fungicides on the speed of a disease epidemic. Leaves were inoculated with septoria spores the day after recommended rate fungicides were applied to ensure the fungicides were working in a protectant scenario. Revystar XE was shown to slow down the visual symptoms of septoria by almost a week more than fenpicoxamid.

"Because the heart of the epidemic was decelerated, this meant additional green leaf tissue in the crop which is of course vital for photosynthesis and development. When you relate this to spray applications, it offsets the impact of those which aren't timed perfectly, slowing the spread of spores to the new leaves and affording greater flexibility," explains Steve.

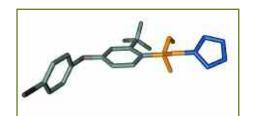
But, it's not just effective at septoria control, which will again prove valuable this season due to the wide window of drilling dates and therefore, varying susceptibility to other diseases such as yellow rust and eyespot.

Broad-spectrum control

"It's important to remember that Revystar XE is broad-spectrum. For those crops which have been drilled much later than usual, septoria risk will be lower, but, the chance of yellow rust could be higher," says Jared. "Both Revysol and Xemium offer strong activity against yellow rust and brown rust, providing reassurance around early season disease considerations without compromising septoria control.

"Equally, if you consider a disease such as eyespot, prothioconazole has been the go-to azole as part of a T1 spray. However, both the Revysol and Xemium components of Revystar XE have been shown to offer at least as good, if not greater control than prothioconazole, providing a strong level of eyespot suppression across both strains. For the grower, this means there's no reason to switch product if there's risk of eyespot at T1."

This versatility also presents itself in regard to crop approvals and practical application, with Revystar XE approved for use on all cereals, and as of last year, sugar beet. "Revystar XE can be used twice in a programme and offers excellent dose rate flexibility. For winter wheat, we've carried out numerous, robust



Revysol's flexible 'hook' lets the molecule assume different positions.



According to Jared Bonner, Revysol bucks the trend – despite being highly efficacious, it has a high tolerance to resistance.

dose response trials and recommend a 0.75 l/ha rate for the T1 timing and 1.0 l/ha at T2," says Jared.

In barley, Revystar XE's following has been steadily growing, he comments. "Revystar XE is well placed as a T2 solution, with the Revysol component delivering market-leading ramularia control, and Xemium proven as the strongest active for rhynchosporium control, while also improving straw quality". ■

Product in focus

Revystar XE (Revysol+ Xemium) is a systemic fungicide with protectant and curative properties for disease control in wheat, barley, oats, rye, triticale and sugar beet.

Revysol is the only molecule within the triazole group where the triazole 'head' sits on the 'neck' of a flexible Isopropanol unit. This unique chemical structure allows the molecule to assume different conformations, resembling a 'hook'. Due to its flexible 'hook', Revysol binds to the target enzyme up to 100 times more powerfully than conventional triazoles, also where target site mutations have developed.

CPM would like to thank BASF for kindly sponsoring this feature, and for its assistance in providing access to the relevant experts and contacts required to produce it.

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Adapting disease management

Adaptability in a T1 programme can help to set growers up for unpredictability in weather and disease pressures. *CPM* explores fungicide options and approaches as we move into the spring.

By Melanie Jenkins

Boots on the ground indicate that a reasonable amount of winter wheat has been planted in the early part of 2024, despite the tricky autumn and testing conditions.

And while growers had a few favourable weeks during late January and early February to plant late sown autumn crops, the wetter conditions since have likely instigated a switching point where growers start to look at spring cropping.

The good news is that crops are looking better than many might have expected, due in part to the recent mild spell, explains Syngenta's Joe Bagshaw. "We're at the stage where growers are looking to apply nitrogen and trace elements, but we're still in a situation where it's essential to manage crops on a field-by-field basis."

Dr Tom McCabe, of the University College Dublin agrees, noting that the drier conditions in late January have helped crops to improve, bringing growers nicely into T0. "There'll be some very good crops going into T1 and confidence levels have improved but keep in mind the context of your crop as there'll be variability. Factors such as soil type, which usually wouldn't make as much difference, have had a bigger impact this year and crops are far more varied than normal."

Yellow rust risk

And as far as inoculum level goes, yellow rust still appears to be the most high-risk disease. "The cold spell we had did knock it back but there remains high pressure to be aware of, especially in susceptible varieties. We've seen temperatures of 10-14°C and with moisture, yellow rust can cycle very quickly."

According to Tom, the disease is notable for its unpredictability. "Although it can appear predictable, the disease can be elusive some years and in others it can arrive in January and be present the rest of the season. Currently, the feeling is to be reactive, but it should be taken as a serious concern because you don't want to be chasing it. So the key is to get ahead of it using a planned programme for prevention."

If yellow rust has been present in the crop, hopefully a T0 has been applied and then a T1 will be the most important spray for maintaining control, says Joe. "Elatus Era (benzovindiflupyr+ prothioconazole) is effective in this slot due to its performance against yellow rust. Looking at the AHDB dose response curves, the straight Elatus Plus (benzovindiflupyr) is outperforming newer products, with a

25% dose doing a better job than 100% dose of other chemistry."

Tom also suggests including an SDHI and strobilurin. "You don't want to be applying azole after azole — a fungicide strategy should include as much diverse chemistry as is available."

If there's rust in crops at all, Joe

66 A fungicide strategy should include as much diverse chemistry as is available. **99**

stresses treating it as a priority. "There are obviously some varieties with seedling resistance, so you wouldn't expect to see rust early doors, but if a variety is seedling susceptible you might see the disease at T0 and T1. You can't rely on adult resistance at these stages because it can take up to GS39 for it to fully kick in — it's



Inoculum maps indicate that yellow rust still appears to be the most high-risk disease.



Adapting disease management

a gradual process and not a switch.

"Aim to control the disease before it becomes an issue as it can be too late if you wait until T2 — be proactive as it's easier to protect against it than to try to cure it."

In contrast to last year, septoria pressure is lower due to crop biomass being more modest, says Tom. "However, if there's a strong growth period in the coming weeks this could change."

Joe highlights that whatever the pressure, it's still important to keep on top of septoria. "Looking at disease forecasting maps the risk was low as of mid-February but it's pertinent to keep an



If yellow rust has been present in the crop, hopefully a TO has been applied and then a T1 will be the most important spray for maintaining control, says Joe Bagshaw.

Barley and beyond

Overall, winter barley crops appear reasonable, says Joe Bagshaw. "Generally, crops were planted ahead of the wet spell and look good, but any that were delayed until November or December might not look as smart."

Dr Tom McCabe feels that winter barley crops are more uniform than wheat, meaning the key challenge will be protecting against rhynchosporium and net blotch. "In barley, ideally you'll want a combination of an SDHI and an azole, with the optional addition of a strobilurin. Prothioconazole is still a cost-effective option at T1 in barley and SDHIs are well proven in terms of adding to the level of protection against the key diseases."

In terms of management, Joe advises keeping an eye on varieties with their disease resistance scores in mind. "If you're growing hybrids, apply early nitrogen to get the crops away and be aware that certain hybrid varieties are more at risk from brown rust in particular.

"Elatus Era at T1 will cover all of your bases against rust," he says. "And if there's a risk of ramularia, include folpet. In high-risk situations, use folpet at T2 as standard — the paintbrush or GS45 is a key time to get good active reduction in ramularia from your fungicide programme."

In general, disease pressure in winter barley appears low so far without much sign of mildew, notes Joe. "However, if conditions



If there's a risk of ramularia, the advice is to include folpet at T2 as a standard.

become mild and wet this will drive the spread of disease in the crop."

Tom advises growers to keep an eye on temperature spikes in March and April as these can result in brown rust outbreaks in some areas. "You can have fungicide plans in place but you'll have to be reactive to changing weather conditions to cover yourself against brown rust. We've certainly seen the disease and weather dynamic become more complex over the past three-to-five years, creating a lot of unpredictability, so there's much to be gained from being able to change your plans quickly."

To deal with this unpredictability, he suggests growers work with broad-spectrum products and to not rely on single molecules or options that don't have much flexibility. "It might be that some of the latter products include good chemistry, but the trick is to make sure your choices cover you for changing situations."

According to Joe, using Elatus Era will provide all-round cover, but where there's signs of early net blotch, Kayak (cyprodinil) is a useful addition to the programme at T0 or T1.

"But generally, if you've included prothioconazole then this is the main triazole you'll want to use to cover your bases, just make sure the timing is right for early stem extension to help protect the lower canopy."

In conventional winter barleys there's a greater yield benefit from T1 fungicide applications than T2, says Joe. "This is why it's important to get protective applications on at T1 as it'll put plants in a better situation to build yield."

However, it's still important to apply a T2 when it comes around, he stresses. "Although you can use Elatus Era in either slot, in situations where brown rust is more of an issue it's probably best suited to being applied at T1."

Joe feels that spring barleys could be a challenge this year, depending on when they are



Dr Tom McCabe feels that winter barley crops are more uniform than wheat, meaning the key challenge will be protecting against rhynchosporium and net blotch.

planted. "There'll probably be more of a focus on T2 applications for spring barley, but some might choose the cheaper option of a T1 based on how well crops go in. It'll be down to adapting rates and products to disease pressures and how well crops look."

Exploring the situation with other cereals, Joe notes that there's quite a bit of rye and triticale which has been drilled. "Generally, there's reasonably high risk of rust in most of the varieties we grow, meaning Elatus Era is a good fit at T1. Once you've knocked the disease out of these crops, it normally doesn't come back as hard as it does in wheat."

Looking at oats, he feels Elatus Era is also well placed at T1 to control both powdery mildew and crown rust. "It has good rate adaptability, so if you're growing a spring crop you can reduce rates accordingly, or, if you're in a high-pressured powdery mildew situation you can increase rates.

"If you're worried about the product keeping oats too green and delaying harvest, you can reduce rates of Elatus Era and follow with Amistar or a tebuconazole product," says Joe.

"Including an SDHI — both in oat and barley programmes — will also help reduce lodging and therefore keep crops standing which is especially important this year as there's a possibility of poor rooting."

Adapting disease management



Applying a T1 spray will help to stop the spread of disease above leaf three, protecting 75% of the yield which is produced by the top three leaves and the ear.

► eye on this as there's potential for the weather between March and May to push up pressure, driven by the intensity and level of rainfall."

The key window, based on work done with ADAS, is between 16 April and 15 May, he explains. "This period is where septoria inoculum spread, leading to later disease development, which is why at T1 it's important to apply a persistent product protectively at leaf three. This will provide protection between T1 and T2 during that key window known as the firebreak.

"If you apply at T1 it'll help to stop the spread of disease above leaf three which then protects 75% of the yield which is produced by the top three leaves and the ear — it's about keeping the plant as clean and green as possible."

Joe also advocates including a multi-site in the T1 slot. "Folpet is an important part of the programme in terms of efficacy but it's also helping to protect the chemistry. Ideally, we'd recommend using 1-litre of folpet with Elatus Era at T1 to give you the best coverage between T1 and T2.



Disease forecasting maps indicate a low risk of septoria as of mid-February, but there's potential for the weather between March and May to push up pressure. "Looking at the biokinetics of Solatenol (benzovindiflupyr), you can achieve 35-40 days of persistent protectant control which covers you between the key timings when applying robust rates of 0.8-1.0 l/ha. This can depend on the variety and a lot of growers have opted for those with strong septoria resistance. But those growing quality milling wheats have a lot less choice and rust can be a bigger risk for these too, so adapt your programme accordingly."

Eyespot pressure

Current data from disease risk maps indicates high levels of eyespot pressure, so including prothioconazole at T1 is important, says Joe. "Ideally, you'll want 100g or more of prothioconazole to achieve any useful reduction in eyespot."

The other disease that can be influenced with T1 sprays is take-all, he says. "Looking at inoculum maps there appears to be higher than normal pressure from this disease. So if you have second wheats or know you're in a high risk situation, adding Amistar (azoxystrobin) at T0 or T1, or a split between the two timings, can reduce the risk by suppressing the pathogen and will help crops to scavenge more nutrients from the soil. An early nitrogen application could also be helpful against take-all risk."

Tom is an advocate of contact fungicides as a partner to all key chemistry at T1. "As you go from higher septoria pressure you want contact and therefore folpet plays an important role, but where there's high yellow rust pressure the extra spend should be focused on controlling this."

Joe highlights that the key with T1 is timing. "I frequently see people basing T1 on date, but it should be based on leaf emergence. Even the nodal growth stage doesn't really matter at T1, you really want to be hitting leaf three at least 75% emerged, to provide protection for the whole leaf. This will put a firebreak in to stop disease spreading up the plant."



The other disease that can be influenced with T1 sprays is take-all, and inoculum maps suggest there appears to be higher than normal pressure from this disease.

Adapting disease management

Managing cereal diseases from one season to the next is rarely the same.

Disease pressures and grain prices fluctuate. And drilling dates, cropping areas and crop potential are at the mercy of the weather.

Indeed, this year sees a wide spectrum of winter wheat crops — from high potential early-drilled fields to lower potential late-drilled ones, and crops in the middle. Not to mention a potentially inflated area of spring barley.

All of which means adapting disease management on a field-by-field basis will be key. There isn't a 'one size fits all'.

Against this background, *CPM* has joined forces with Syngenta to help growers

negotiate the different scenarios through this series of articles.

At Syngenta our purpose is to bring plant potential to life.

With a range of proven fungicides – from Elatus Era with its outstanding rust capability and long-lasting protection against Septoria tritici in wheat and barley, to the reassuring multi-site activity of folpet, and enduring treatments of Amistar and Kayak – we offer a flexible choice of cost-effective solutions.



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from theory to field

Aiding disease control decision making

AHDB Fungicide Performance trials provide farmers and agronomists with key information to help decision making. *CPM* looks at both the project's history and latest results. *By Mike Abram*

From mostly forgotten fungicides such as Bayfidan (triadimenol) to new additions like Vimoy (isoflucypram), plus six others where data hasn't yet been released pending registration, the AHDB Fungicide Performance trials have had a long-lasting impact.

Since 1994, over 60 products containing more than 40 different active ingredients have been tested in projects that have cost in excess of $\pounds4.5M$ in total to deliver. And that's just the actives tested in wheat trials; others have been evaluated in barley and oilseed rape too.

The results matter, not least when a new product is launched. From the head office of the manufacturer where the result will help to confirm likely market penetration, to agronomists and farmers for whom the data provides valuable independent verification of performance against key diseases.

During the 30 years of trials, active ingredients have moved from being based mostly on azole chemistry to strobilurins (Quinone outside Inhibitors), followed by SDHIs (succinate dehydrogenase inhibitors) and most latterly a Qil (Quinone inside Inhibitor) in the form of fenpicoxamid.

As well as practical day-to-day information concerning relative product performance, some of the most valuable information has been in highlighting the first indications of resistance, suggests Jonathan Blake, technical director of crop protection for ADAS.

Critical moment

"A key moment for the project was when strobilurins failed," he recalls. "We saw a sharp change in field activity following the development of the G143A mutation in both powdery mildew and more critically, the Septoria tritici population.

"It was a mutation that conferred complete insensitivity to the strobilurins, a change in efficacy that clearly identified that growers had to change what they were doing with immediate effect."

The first indications of poor control of septoria by strobilurin fungicides were seen in 2003, when mean data from three sites in eastern England, Scotland and Ireland showed that the straight strobilurins in the trials that year were less effective as protectants and gave very poor control as eradicants, compared with previous years.

It gave agronomists and farmers the data to start making changes to programmes, which was definitely required in 2004 when the trials showed strobilurins gave very little control of the disease, says Jonathan.

Over a much longer period, the project has also tracked the slow decline in azole performance against septoria and changes in SDHI performance as less precipitous changes in sensitivity have been selected for by the septoria pathogen.

"More recently, we've seen changes in the relative performance between Univoq

66 This project gives sound independent information, which gives growers confidence to try something in the first season and then expand use subsequently. **99**

(fenpicoxamid+ prothioconazole) and Revystar (fluxapyroxad+ mefentrifluconazole), where Revystar started off as the stronger of the two but now we've had a switch and Univoq looks stronger against septoria," says Jonathan.



As well as practical information concerning relative product performance, some of the most valuable information has been in highlighting the first indications of resistance, says Jonathan Blake.

Theory to Field

That was the case in 2023 Fungicide Performance trials, adds ADAS's Rebecca Joynt. "The mild, wet autumn followed by a warm, dry February and very wet March, especially across southern Britain, resulted in a high septoria pressure leading into T1 — perfect for testing efficacy until hot, dry weather from late May into June limited the disease's progression," she says.

"In some places this caused early senescence, but in other trials rainfall in late June created a late season rise in septoria which tested the persistence of T2 applications."

In total, there were 10 wheat trials in the Fungicide Performance network last season, seven of which targeted septoria, says Rebecca. Nine registered products,



The project has tracked the slow decline in azole performance against septoria.

including Bayer's new fungicide Vimoy were tested, along with the six as yet unregistered products — the data for those will be released on registration. Four of the trials provided protectant data, one eradicant and three were mixed (see box 1).

"For protectant activity against septoria, Myresa (mefentrifluconazole) and Vimoy showed very similar activity, with Peqtiga (fenpicoxamid) giving better control than either, especially at lower doses," says Rebecca.

"There was a step up in control from the inclusion of mixture partners, for example with Revystar versus Myresa. As with the solo products, the product containing fenpicoxamid, Univoq, which is co-formulated with prothioconazole, gave the highest level of control," says Rebecca.

The results mirrored what a larger data set of 17 trials has shown, she adds. "Eradicant data over the past three seasons highlights a drop-off in control from all products compared with protectant activity. This reflects the importance of spray timing," stresses Rebecca.

The trials are also taken to yield, and perhaps not surprisingly, the benefit of using a mixture over a single active is apparent with yield benefits for both Univoq and Revystar over Peqtiga and Myresa respectively.



According to Rachel McGauley, it would only take a few hundred thousand hectares treated with superior products to cover the cost of the project.

"At a full label rate, yields of Vimoy and Myresa are comparable, while yield responses of over 1t/ha were achieved from the strongest products sprayed at full rate in a single application."

Providing quick access to independent data of how a new product compares with market standards is crucial for helping farmers and their agronomists to make immediate decisions about whether that product should fit into programmes, says Jonathan.

"There'll always be hesitation when new chemistry is introduced and farmers won't

Trial protocols

Right from day one, AHDB says the trials were designed to maximise differences between active ingredients. But by using high risk locations growing high risk varieties, and, perhaps controversially to some, just one spray timing, it means it doesn't always reflect commercial reality.

In an ideal world, products would be tested in a programme, suggests Jonathan Blake. "But the truth is, it's impossible to test chemistry reliably in programmes and get sufficient precision and clarity. The way we test at least allows us to separate treatment differences out."

A range of timings are now used for the one spray in septoria trials from leaf three emerged through to the flag leaf, increasing the chances of the trials achieving both protectant and eradicant data for the products.

"Data collected from the target leaf of fungicide application or leaves that emerge after that leaf is classed as protectant activity," explains Rebecca Joynt. "Leaves that emerged prior to the target leaf are used to assess eradicant activity."

There's also a mixed category which was used

in 2023. "This is where we look at leaves that emerged prior to the spray application as an eradicant, but saw activity from products known to only have activity as a protectant."

Another advantage of the single spray approach is that in low disease pressure seasons it's still possible to see differences between products that otherwise might not be seen, she adds.

Those type of seasons, plus ones with very high disease pressure or where mixed diseases have infected leaves, require careful evaluation to avoid skewing the overall results from the trials, says Rebecca.

"If necessary we'll exclude data but we have clear guidelines how to make processing data fair and consistent," she explains.

Where possible, the project prefers to compare single active ingredients rather than multi-active formulated products, something which has become easier in recent years as registration of co-formulated products has seemingly become more challenging.

"The single actives are the building blocks within those different mixtures and within programmes, so it's important to understand



An advantage of the single spray approach is that in low disease pressure seasons it's still possible to see differences between products, says Rebecca Joynt.

what each active is doing against target diseases," says Rebecca.

But key mixtures are also tested — in 2023 that included Univoq (fenpicoxamid+ prothioconazole), Revystar (mefentrifluconazole+ fluxapyroxad) and Ascra Xpro (bixafen+ fluopyram), she concludes.

Theory to Field

► switch 100% from using one product to another overnight. But, this project gives sound independent information which gives growers confidence to try something in the first season and then expand use subsequently," he comments.

Calculating returns on investment for such projects isn't easy, suggests AHDB's Rachel McGauley. "The project's information is just one part of a complex decision-making process, and often results arrive at the farm indirectly via an agronomist," she points out.

An independent evaluation commissioned by AHDB in 2021 working with 150 farmers advised by independent agronomists, identified a typical net yield gain worth £17.67/ha from farmers switching to a superior fungicide product.

"With this figure in mind, it would only take a few hundred thousand hectares treated with superior products to cover the cost of the project, which is approximately £125,000 per year," says Rachel.

While the calculation didn't include any costs saved or incurred, or use of reduced doses, it did give the sector council confidence to continue investment in the project.

A smaller number of telephone interviews (17) conducted as part of the evaluation

highlighted that agronomists felt well informed and were reasonably happy with the data. "This is why AHDB releases the results at the AHDB Agronomy Conference," says Rachel. "We work closely with agronomists because of their role in developing practical field-level recommendations."

Communication channels

But that focus has perhaps come at a cost, with a feeling that the project is too disconnected from farmers. In response, the sector council has instructed project leaders to promote the project more directly, notes Rachel.

"That's perhaps a little trickier than it sounds, as the best way to reach a wide audience of farmers is through the agronomist network, who might not highlight directly to farmers how the Fungicide Performance project helps with their decision making.

"So, we're trying to communicate with agronomists that, if they want this project to continue to be funded, to highlight to farmers its importance," says Rachel.

In addition, AHDB is encouraging the researchers from ADAS, NIAB, SRUC and Teagasc on the steering group to disseminate results directly with farmers

Research roundup

From Theory to Field is part of AHDB's delivery of knowledge exchange on grower-funded research projects. *CPM* would like to thank AHDB for its support and in providing privileged access to staffand others involved in helping to put these articles together.

For more detail about the project, visit ahdb.org.uk/fungicide-performance



at events. "We also want to engage with farmers at Monitor Farm meetings where appropriate," explains Rachel.

The latest results and historic reports are housed on the AHDB website. "On our website it's one of the top rated pages for hits at key times of year, so we know it is being used and valuable information," she concludes. ■

Septoria challenge forces RL rethink



Paul Gosling says AHDB can't keep disease below 5% in fungicide-treated trials with the chemistry currently available.

Increasing difficulty in controlling septoria in AHDB Recommended List (RL) trials has forced a rethink in how yield data from the project is used.

The RL aims to assess genetic potential by removing barriers that could help to prevent a variety from achieving its maximum yield at a trial location. That includes in fungicide-treated trials using up to five sprays in a programme containing the strongest products (see table) applied at robust rates.

In the past, the aim was to keep disease below 5% in these trials, with the yield information discarded from the main data set if levels rose above this, explains Paul Gosling, who leads the RL project at AHDB.

But with declining activity in azoles and SDHI fungicides, keeping disease below 5% has been increasingly difficult in recent seasons, he says. "The 2023 season was a good example with a septoria epidemic driven by a relatively wet March and cool April boosting septoria disease levels in many areas, and in some trials, even in the most septoria-resistant variety on the RL, Mayflower, levels reached over 5%.

"We now recognise we can't keep disease below 5% in our fungicide-treated trials with the chemistry we have available," says Paul.

Septoria-active parts of RL fungicide programme

Timing	Product	Rate
TO	Arizona (folpet)	1.0 l/ha
T1	Revystar XE (mefentrifluconazole+ fluxapyroxad)	0.8-1.25 l/ha
	Arizona	1.0 l/ha
	(Elatus Era (benzovindiflupyr+ prothioconazole))	(0.6 l/ha)
T1.5	Prothioconazole	0.6 l/ha
	Arizona	1.0 l/ha
T2	Univoq (fenpicoxamid+ prothioconazole)	1.0-1.5 l/ha
	Arizona	1.0 l/ha
T3	Prosaro (prothioconzole+ tebuconazole)	0.8-1.0 l/ha
	Arizona	1.0 l/ha

Note: Arizona is compulsory at T1 and T2 but can only be used at one other timing. Elatus Era is an optional extra primarily for rust control in very high pressure situations but has activity against septoria. Mildewicides and other non-septoria acting fungicides in programme not shown above.

That prompted a change in approach where yield data will be used in the main data set even if disease gets to 10%. "If a disease exceeds 10%, we'll look at whether the protocol was followed. If the protocol was followed, the data will still be used," he explains.

The data won't be used where a protocol wasn't followed, for example, if a timing was missed or

delayed significantly, or the incorrect product was used.

"So now when we look at genetic potential of varieties in treated trials, we're looking at it in context of what we can do with the fungicides that are currently available, not what they can do if we completely exclude disease as that is no longer possible," concludes Paul. Reprising its role this spring.

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Weed Control

Slow herbicide discovery, resistance development and a rapidly changing farming landscape are all threats to sustainable weed control in UK arable systems. CPM attended a recent debate to see what leading experts view as potential solutions.

> By Janine Adamson and Rob Jones

A warning about new weed threats and the call for speedier adoption of alternative control methods were some of the take home messages from a recent 'Question Time' grassweed control discussion.

Held at the Association of Independent Crop Consultants (AICC) annual conference and chaired by AICC director Matthew Paterson, a panel of three renowned researchers were quizzed by agronomists on the rapidly changing weed control landscape.

The panel included Rothamsted Research's weed ecologist Richard Hull, who's been central to extensive herbicide resistance work during recent years, particularly in blackgrass populations.

He was joined by weed biologists Lynn Tatnell of ADAS and NIAB's John Cussans, who is also a research member of AICC.

Both are experts in the implementation of practical integrated weed control strategies in agriculture and horticulture.

To begin, John points out the reasons behind why weed control has become trickier, particularly during the past 20 years. He explains that while herbicide discovery hasn't stopped, with new actives like cyclopyrimorate from Japanese company Mitsui and tetraflupyrolimet from FMC being recent examples, it has slowed significantly.

Access to innovation

John outlines that the cost of developing and registering such actives has doubled between 1995 and 2014, limiting the sources of discovery to just a few major players, and there are further issues on the horizon that could limit herbicide availability or use.

He says Northern Europe, including the UK, is a small market for those major players and growers may not get access to innovation as quickly as it requires to replace older chemistry identified as a risk by regulators and coming off the market.

"Producing a new grassweed herbicide for use in a crop which isn't globally important may not be commercially viable and we're already beginning to see the effects of that. It's going to get more difficult for us from an herbicide availability point of view," warns John.

He adds that the upcoming microplastics

66 Rotations have to be longer and more diverse, and the adoption of non-chemical approaches should be accelerated. 99

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According to Richard Hull, resistance >



John Cussans says while herbicide discovery hasn't stopped, it has slowed significantly.



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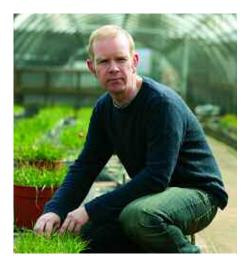
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Weed control



According to Richard Hull, resistance has also become a lot more complicated, particularly as scientists have learnt more about non-target site or enhanced metabolism resistance.

► has also become a lot more complicated, particularly as scientists have learnt more about non-target site or enhanced metabolism resistance.

He says of the two types of herbicide resistance, target site resistance is relatively simple and well understood, with a single genetic mutation in the target weed stopping the active substance from binding to its target site, rendering it ineffective.

Examples include ALS-inhibitor and ACCase herbicide target site resistance, which are now widespread in UK blackgrass populations and in some broadleaf weed populations, including chickweed, mayweed, and poppy.

But with non-target site resistance, weed populations can cope with a range of herbicide modes of action and recent work at Rothamsted has shed light on the mechanisms behind it.

Richard says two of the 'toughest to control' blackgrass populations from Peldon (Essex) and Oxon were tested, with researchers looking at the phenotypic response to a range of pre- and post-emergence herbicides and broad-spectrum glyphosate.

Both populations responded to sprays in the same way, being less sensitive to all the herbicides applied in glasshouse pot tests, he explains.

However, latest molecular techniques revealed that the genes associated with this non-target site resistance were very different in each population, exposing a complexity that should be better understood in order to manage it.

In response, Lynn states 'the time is now'

for farmers to adopt alternative weed control strategies, which will reduce reliance on existing chemistry, slow non-target site resistance development, and prolong herbicide efficacy. However, she says she accepts there are barriers.

Furthermore, Lynne explains there's a 'huge mountain' of evidence on the efficacy of herbicides, but not on the alternatives at least in a modern context — and this is something ADAS and other research groups are trying to address within the European Oper8 project (www.oper-8.eu).

The Europe-wide network aims to gather and share information on alternative weed control strategies, including cultural controls and mechanical or technological solutions.

"We'll hopefully use this network to put forward policy recommendations for the future, bringing alternative weed control higher up the agenda," concludes Lynne.

Question one: Are regenerative farming and sustainable weed control compatible?

According to Richard, from a resistance point of view, it's concerning that there's such a big reliance on one active substance. "Glyphosate is the only herbicide option



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Weed control

for controlling weeds between crops in regenerative systems and the more it's applied, year after year, the greater the chance of selecting for resistance.

"With no soil movement, there's also no burying of seed and mixing of the seedbank, so you're selecting from the same population each time. We've done modelling at Rothamsted and found that without glyphosate, either through regulation or resistance, it would be very difficult to control weeds in a no-till situation," he answers.

Question two: What are the biggest barriers to adoption of alternative weed control methods?

"Cost is the major factor — there's already been a significant uptake of mechanical weeders, robotic weeders and precision application kit by big high value field veg producers where the economics make sense," says Lynn.

"Other sectors can learn a lot from those situations, but there'll have to be help for farmers to invest in the technology and that's coming through SFI and the Farm Equipment & Technology Fund.

"The Oper8 project's recommendations will hopefully continue pushing policy makers to offer attractive funding options

in the future," she adds.

Lynn says the other major problem is a perceived lack of reliability and the hassle of these options, which leads growers to stick with herbicides, which are still relatively reliable and cheap.

"Using mechanical methods or changing rotations requires considerable planning and management. To push things forward, farms will require help from experts before it really takes off," she says.

Question three: Should growers reconsider late drilling to control grassweeds given the proportion of winter crops undrilled?

John says in weed management, it can be easy to overcomplicate things. "Fundamentally, it's all about preventing seed return and depleting the seedbank at the same time, using a variety of methods.

"One thing we've learnt through our challenges with blackgrass and, more recently, ryegrass, is that a longer gap between crops, the greater the natural seed loss. Application of residual herbicides in later drilled crops also helps maximise their efficacy," he explains.

"These factors have driven us to an



The slow uptake of alternative weed control techniques is first due to cost and then a perceived lack of reliability, says Lynn Tatnell.

obsession with late drilling as a tactic to manage these grassweeds, but the risks are getting so high now, as we've seen in recent seasons where winter crops have not been established at all."

According to John, growers shouldn't rely on that one tactic in isolation across the rotation, particularly as arable businesses increase in size. "There'll have to be an ►

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No-till weed control

The transition to a reduced tillage system can have an impact on weed pressure — whereas those who follow a min-till approach report a difference in species compared with those who use the plough, a similar shift can also occur when switching from min-till to no-till.

However, this doesn't mean it's not possible to achieve effective weed control in regenerative-type systems, even if the commonly appearing species are a change from what would usually be expected.

George Fraser farms and runs contracting business A&R Fraser in Dorset and says he's started to see such changes in his weed populations. The farm has been operating a no-till system for more than eight years, currently using a strip tine drill for seedbed preparation and then running a subsoiler through where required.

"I've had a really good experience with no-till so far and fortunately haven't seen yield reductions since transitioning to a regen-ag based system," he says.

"Being no-till requires more attention to detail than traditional seedbed preparation and it's presented a few different challenges, primally, there's greater pressure from slugs. But when it comes to weeds, we've noticed a difference in the species cropping up," he explains.

The first change to note is blackgrass pressure. George says the farm had issues with the grassweed in the past but deploying a no-till system has helped to reduce it. "Brome, however, has become more of a problem for us since switching systems.

"To control grassweeds, we use a stubble rake where required and in higher risk areas we'll go in with a disc drill slowly to reduce the level of disturbance to the soil as well as use peri- and post-emergence herbicides to help clean up the weeds," he adds.

Like many arable farmers, George says much of his spring weed control is targeted at broadleaf species.

"Broadleaf weeds haven't become worse or uncontrollable since going no-till, but we've seen different populations cropping up," he confirms. "We farm in quite a high charlock area, with many neighbouring farms having issues and we've dealt with it ourselves since becoming no-till.

"I've seen cleavers appear over the years too, but the biggest difference since moving towards a regenerative system has been the presence of burdock and hemlock, which are more common in no-till systems," says George.

George explains that to control these weeds, he uses a standard procedure for broadleaf weed control centred around spring applied sulfonylurea herbicides (SUs). He aims to apply as early as possible when the weeds are small to help to optimise control.

"One standout positive about no-till is that we can get our herbicide applications on much earlier than when we operated in a plough-based system," he says.

"If you've ploughed and then drilled a spring cereal, you often have to wait a while before making spray applications as the ground can be too soft to travel. This means you could risk missing the weeds when they're at the ideal timing to be controlled.

"With no-till we have more opportunities to travel as the soil isn't as soft, meaning you have that extra opportunity to apply the herbicides before weeds become too big," he comments.

For growers following in similar footsteps and moving towards a regenerative-based system, George advises that it's key to pay attention to detail.

"Ensure you make well-timed applications of herbicides with the correct water rate and the right nozzles. Make sure everything adds up and focus on the small percentages which can make a significant difference when it comes to weed control," he says.

According to FMC's Mat Hutchings, the key to controlling weeds in regen ag is being aware of the different species and having the appropriate tools to control them.

"In theory, in regen ag there shouldn't be as many weeds as you're disturbing the soil less and aren't bringing as many viable seeds to the surface to establish. However, perennial weeds can become more of a problem as you're not cultivating and these types tend to be less familiar to growers and agronomists," he explains.

Mat says species can also vary across the country and between systems. "Willowherb in particular seems to be common in no-till systems — we commonly receive enquiries from farmers about this weed.

"Glyphosate is not reliably effective on willowherb, which is why it can become prevalent in systems where glyphosate is often the cornerstone of control.

"If farmers have concerns, I'd recommend an application of glyphosate and Shark (carfentrazone) which will improve the efficacy against the weed, before following up with an SU in the spring if required."

Mat explains that burdock and hogweed tend to be hedgerow plants, so in many fields that have been cultivated it's rare to see large populations of them. "However, they're starting to creep into no-till systems from the hedgerows. This is likely because people are less familiar with them, and



George Fraser says being no-till requires more attention to detail than traditional seedbed preparation.

they can become large very quickly.

"For optimum control, these weeds should be targeted with an SU while they're as small as possible yet actively growing," he says.

Mat highlights that growers in regen systems should be cautious of how moving the soil less between the rows could have an impact.

"This can lead to spring weed flushes coming later," he says. "So, it's important for growers to regularly walk fields to monitor emergence and have appropriate control measures in place to tackle weeds once they do emerge to avoid missing such late flushes."

For Mat, he believes applying SU herbicides before T1 spray timings is essential when considering more difficult weeds. "Harmony M SX (metsulfuron+ thifensulfuron) and Ally Max SX (metsulfuron+ tribenuron) both contain the active metsulfuron which has a wide spectrum of control and can be used in combination with other herbicides to pick up a wide range of weeds."



According to Mat Hutchings, applying SU herbicides before T1 spray timings is essential when considering more difficult weeds.

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Weed control



ALS-inhibitor and ACCase herbicide target site resistance are now widespread in UK blackgrass populations.

► acceptance that some wheat has to be drilled earlier to maximise economic returns from a first cereal.

"To enable that, people will also have to accept that rotations have to be longer and more diverse, and the adoption of non-chemical approaches should be accelerated," he stresses.

Question four: Are integrated control strategies and changes in farming systems applying selection pressure to weed populations?

To answer, John explains that selection is happening on two different levels. "The first is within weed species when using harvest weed seed control (HWSC) options like seed destructors fitted to combines, or weed surfing machines that cut off grassweed heads as they emerge from cereal crops.

"Seed destructors can select for earlier maturing weeds, or those that are more prostrate within the crop if using a surfer. The concept has been proven by weed researchers in Australia," he says.

However with herbicide resistance, John believes there isn't a significant fitness penalty to resistant weeds, and that's why it's such a challenge.

"We're fortunate that there is a significant fitness penalty when selecting weeds adapting to late season, surfing, or seed capture technologies, so it isn't such a problem. At NIAB, we have a PhD student looking at genetic selection within ryegrass and blackgrass populations through changes in rotation practices and spring cropping.

"There's evidence that selection of different germination patterns or behaviour is happening," he says.

According to John, the second level of selection is on the weed flora level which he believes is the much bigger issue. "There's already a move towards brome grasses after the uptake of some systems.

"Bur chervil is an invasive species widely distributed in natural and semi-natural habitats and where farms are adopting low or no disturbance systems, it will invade from those areas. There are limited herbicide options, with sulfonylurea herbicides giving some control. The worry is that overreliance on that one group would lead to resistant populations," he says.

John wants to 'up' awareness of these potential changes in weed flora. "Biosecurity is also on our radar with the uptake of cover crops, Sustainable Farming Incentive (SFI) options and the creation of new habitats.

"People are bringing all sorts of species

on to farm, even bulking them up themselves and planting the seed. We're seeing different species in crops that we never considered an arable weed."

Queston five: Why is there such variation in how ryegrass responds to control measures between farms and fields?

John says ryegrass is like a biological soup of genetics, with wild perennial ryegrass, wild Italian ryegrass, and cultivated Italian ryegrass, which all potentially hybridise. "The complexity that is creating is giving us different problems.

"We started to look at this and found that from populations of ryegrass on the same farm, but different fields, plants could be totally susceptible to totally resistant.

"We're also seeing different traits including vernalisation requirement — some can start to flower in no time at all and others have quite a high requirement, making some populations more problematic in winter crops and others in spring crops."

For John, ryegrass is like blackgrass, but where the dials are turned up to 11/10. "The frequency of herbicide resistance is higher, the rate of development for non-target site resistance is higher, and the diversity in biological traits mean populations respond differently to cultural controls.

"Culturally, everything that works for blackgrass works for Italian ryegrass, but not as well. Using current tools and approaches, where you might be able to reduce bad blackgrass to manageable levels within a relatively standard arable rotation, more fundamental changes — like introducing fallow periods or using non-crop SFI options — might be needed to clean up ryegrass," he concludes. ■

Seedbank management

For this season, Bayer's Tom Chillcott stresses the importance of considering long-term seedbank management and the role of spring weed control. "Usually, the benchmark for a successful programme which is degrading the seedbank is 95% or more total control from cultural and chemical controls. Although, in higher pressure situations, it can be even higher.

"Quite often, spring weed control is crucial in pushing total control beyond 95%, which can make a huge difference in the long-term."

Tom sees three main options on the table for current wheat crops. "You can use a post-em like Atlantis Star (mesosulfuron+ iodosulfuron+ thiencarbazone) in early spring, wait to patch spray the worst areas with glyphosate, or hand-rogue in May," he says.

Tom points out that patch spraying wipes out yield entirely and hand rogueing is only really viable for mild infestations, so in many situations, spring post-em remains the best option to reduce seed return.

He explains that in Bayer trials last year, applications of Atlantis Star showed a sustained improvement in ryegrass control of 11% compared with a pre-em only programme. This equated to 21 fewer ryegrass plants/m². "Assuming each plant produces 1000 seeds, this means 2,100 fewer seeds per m² that can potentially germinate in subsequent crops," concludes Tom.



In trials last year, applications of Atlantis Star showed an improvement in ryegrass control of 11% compared with pre-em only, says Tom Chillcott.

Bridging the gap

Nitrogen management & nutrition

An on-farm trial investigating a two-pronged approach to NUE has now concluded. *CPM* catches up with the team in Darlington to assess the results and understand if it's possible to reduce reliance on traditional nitrogen.

By Janine Adamson

CPM first spoke to William Maughan back in May (see June 2023 issue) when he was in the midst of hosting trials to investigate two elements of NUE in wheat — optimisation of what's being applied through plant uptake and identifying alternative sources.

The farm, a 200ha mixed system in Darlington, was selected to host because with 30,000 free-range hens, 200 beef cattle and a cereal-based cropping rotation to contend with, optimising nutrition isn't always the easiest task.

William cited 'muck management' as one of his priorities — making the most of what's already available while applying principles similar to those of regenerative systems. He also said having increased his hen numbers, he was having to rethink how the farm balances the additional poultry manure with conventional nitrogen applications.

Alternative N

Casting back to last year, the trial protocol involved investigating how three 'alternative N' products respond within different nitrogen regimes, based on the farm standard of 180kgN/ha (100%) and two levels of reduced input. This was combined with a range of biostimulant technologies that aim to improve nitrogen assimilation.

The purpose was to understand how each product (SR3, Encera and Pro+ N-Viron 28) performs in isolation, as well as the potential of stacked benefits across the whole programme. For the varying nitrogen regimes, the first application was a consistent 60kgN/ha with subsequent doses reduced by 25% (30kgN/ha) or 50% (60kgN/ha).

Now, the results are in and ProCam says it's a positive message for both William and other growers with similar objectives.

"To benchmark, William's wheat yield from a full 180kgN/ha nitrogen regime without the products being trialled, was 11.35t/ha. When this was reduced by 30kgN/ha the yield dropped to 10.9t/ha, while reducing by 60kgN/ha resulted in 10.66t/ha," explains ProCam's Nigel Scott.

"An important take-home from this is that the farm is still achieving good yields despite a reduction in nitrogen, which is likely to be as a result of **66** Where the true benefit lies is in carbon footprint gains. **99**

residual soil-based nitrogen from applied livestock wastes."

Nigel says this supports William's initial concerns regarding balancing poultry manures with synthetic applications, >



William Maughan hosted an on-farm trial which investigates how three 'alternative N' products respond within different nitrogen regimes.

Nitrogen management & nutrition



Rob Adamson says selecting the right product for the right scenario and desired outcome is crucial as understanding of biostimulants and their different modes of action improves.

► while compounding the importance of quantifying what's already available in the soil. The next step is to understand the impact of the two biological fertilisers — SR3 and Encera, which are essentially derived by 'bugs', he adds.

"At full rate nitrogen, the results show that there hasn't been a yield benefit from either of these products, suggesting nitrogen isn't a limiting factor in this scenario. William would have to look at other ways to build yield further, such as plant health products, when applying full rate nitrogen.

"However, if we look at bridging the gap when reducing nitrogen by 30kgN/ha, adding either SR3 or Encera into the programme gives almost exactly the same yield as the full rate of nitrogen alone,



which is a powerful message.

"Then, when reducing by 60kgN/ha but adding either SR3 or Encera, the yield is in fact better than the 150kgN/ha (30kgN/ha reduction) dose alone. So in essence, this shows us that you're getting more than 30kgN/ha from either of these products," explains Nigel.

But in William's scenario, ProCam has deduced that the best outcome given what's been learnt about the nitrogen dose response, is to reduce by 30-40kgN/ha and supplement with one of the biological fertilisers.

Carbon footprint gains

"Nitrogen prices have reduced considerably now, but that's not to say they won't rise again in the future. Where the true benefit lies is in carbon footprint gains — this is something the farm was keen to do given potential supply chain pressures," says Nigel. "It also provides diversity of nitrogen sources, which provides a level of insurance and de-risking."

William believes this seems solid advice. "Given the yield plateau on farm, my objective is to find alternative sources while maintaining crop performance. Having the trial data from my own farm to support future decisions is reassuring, and if this can be done while contributing to a more sustainable approach, it's a no brainer," he says.

Looking at the reason why these products have worked, ProCam's Rob Adamson explains that it lies in the mode of action. "The bugs (rhizobacteria) in SR3 colonise the soil rather the plant, and one outcome of this beyond fixing atmospheric nitrogen, is making phosphorus, potassium and zinc more available — so enhancing other nutrients aside from nitrogen.

"Although providing a similar amount of nitrogen to the crop, Encera is a bacterial endophyte which colonises the plant cells, so a different mode of action, but the trial confirms we have confidence that both will deliver in terms of yield uplift in this specific scenario," he says.

The third product trialled on William's farm was Pro+ N-Viron 28 — foliar-applied efficient urea polymers. According to Rob, the manufacturer's claim is that 20l of the product should provide the crop with around 40kgN/ha. "And the trial confirms that this is correct, whereas when applied alongside a full rate of nitrogen, it backed up that the crop was at its maximum N capacity." ►



Inhibitors

With government regulations now in place which restrict the use of urea fertilisers in England, understanding what this means on-farm will be critical to avoid further clamp downs and to support the goal of reduced emissions.

Monitored as a new Red Tractor farm assurance standard, the regulations apply to any fertiliser that contains more than 1% of urea nitrogen, with two distinct timeframes in place. Untreated solid urea/liquid UAN fertiliser can be applied between 15 January to 31 March each year, whereas outside of this, a urease inhibitor must be used.

Untreated liquid UAN fertiliser can be applied after 1 April if agronomic justification is provided by a FACTS-qualified advisor, demonstrating ammonia losses will be at or below the level of including a urease inhibitor.

So what's to be said about urease inhibitors, how they work and their impact on crop performance? BASF's Jared Bonner explains there are three recognised urease inhibitors available in the UK — NBPT (N-(n-butyl) thiophosphoric triamide); NPPT (N-propyl thiophosphoric triamide); and 2-NPT (N-(2-nitrophenyl) phosphoric triamide. However, NPPT is exclusive to BASF.

"Inhibitors work by binding the urease enzymes which slows down hydrolysis and volatilisation — it's really important that we prevent this from happening on the soil surface, to minimise ammonia losses.

"At the same time, different enzymes require different inhibitors because they're non uniform in size and binding sites. By combining NBPT with NPPT in one product we can inhibit a wider range of enzymes," he says.

The product is Limus — a dual-active inhibitor available in protected, granular urea and as a tank mix additive for liquid fertiliser (UAN). Jared says not only does



Limus-treated urea performs comparably to ammonium nitrate but is cheaper per kgN, says Adrian Whitehead.

Limus deliver on slowing down volatilisation, but it does so while delivering on yield and NUE.

To test these claims on-farm, independent trials are being undertaken by Velcourt. Technical director, Nick Anderson, says the results show that Limus-treated urea performs at least as well as ammonium nitrate alone.

"We've also conducted trials which show that nitrogen recovery is higher where urease inhibitors are used, improving the efficiency with which nitrogen applied as urea is recovered. This means that Limus-treated urea has the potential to reduce crop production's impact on our external environment while improving financial performance," he says.

Farm manager Adrian Whitehead confirms that the numbers make sense. "Limustreated urea performs comparably to ammonium nitrate but is cheaper per kgN. You also have to consider the wider benefits — it spreads well with no impact on ballistic status, can be accessed as one product for simplicity in the shed, all while reducing the environmental risk.

"It's efficient and improves margins, with the latter being critical. We now opt for a first application of liquid nitrogen with sulphur, followed by a combination of Limus-treated urea and ammonium nitrate. Because it delivers on results we continue to move more towards Limus," concludes Adrian.





Knowledge grows

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Use **YaraMila** 52 S followed by **YaraBela** AXAN in your crop nutrition programme this season.

Both include essential sulphur for increased Nitrogen Use Efficiency, meaning less nutrient wastage and more yield for your money.

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Nitrogen management & nutrition



Nigel Scott has advised William Maughan to reduce his nitrogen applications by 30-40kgN/ha and supplement with a biological fertiliser.

 For the wheat treated with 150kgN/ha (30kgN/ha reduction) plus two applications of Pro+ N-Viron 28 at 1.0 l/ha (T1 and T2), the yield was 11.3t/ha --- pretty much the same as the crop when a full rate of nitrogen was applied.

Nigel says again, William can reduce his conventional synthetic nitrogen dose but supplement with a more efficient foliar nitrogen and achieve the same result. "When faced with dry conditions, having the flexibility to apply a foliar spray is useful. But again, the carbon footprint credentials of Pro+ N-Viron 28 are much better than conventional fertiliser due to an improved manufacturing process," he explains.

The final aspect of the trial considered the role of biostimulant products such as ProFusion Bio WDG and Twoxo Pro. All products provided a yield uplift across all doses of nitrogen, even at full rate, however it was the inclusion of Profusion in combination with 180kgN/ha that was most significant.

"ProFusion Bio's mode of action relates to photosynthesis and the chlorophyll function in plants, rather than being associated with nitrogen utilisation. Whereas the aim of Twoxo Pro is to improve nitrogen assimilation with the

2-oxo metabolites in the product, hence why we've not seen the same level of improvement at full rate nitrogen as that's our limit," explains Rob.

Beyond yield, the trial has also indicated that using ProFusion Bio at both T1 and T2 timings can generate a 15% lift in GLA (green leaf area) as a result of facilitating chlorophyll production.

"The greening effect really stood out and there was a marked difference between the plots," says William. "Given the farm grows wheat for feed, our aim is always maximising yield so ProFusion Bio would be of most interest to me."

Conversely, the best product for improving grain protein was found to be Twoxo Pro, which Rob says is no surprise due to its mode of action being associated with nitrogen assimilation. "All in all, selecting the right product for the right scenario and desired outcome is crucial as we further our understanding of biostimulants and their different modes of action," he concludes.

Managing manganese

Following the relentless wet weather, growers will be acutely aware of the impact on soils, namely potential nutrient deficiencies. For those aiming to plant spring cereals, offsetting these effects will be high priority.

Origin Fertilisers' Toby Ward says persistent heavy rain and flooding can cause leaching of highly mobile nutrients, especially when fields become waterlogged for lengthy periods - a major problem for nutrients such as manganese.

"50% of UK soils are already deficient in manganese, and recent flooding may have depleted reserves further. Spring barley is particularly sensitive to manganese deficiency, but on the plus side, it's usually very responsive to an application either at drilling or very soon after," he explains.

Toby advises correcting manganese deficiency as soon as possible to avoid impacting spring crop yields. "Manganese has an essential role to play in the soil nutrient synergy as it stimulates photosynthesis, which increases yield and NUE.

"It's the activator of many enzyme reactions involved in the production of lignin, amino acids and chlorophyll — the compound by which plants photosynthesise, so it's integral to have plant-available levels of the nutrient. Without it, photosynthesis can be restricted and therefore inhibit early growth stages," stresses Toby.

Deficiency is common in soils with high

organic matter content and high pH, as manganese requires clay particles within the soil to bind to. Manganese losses are also common where root to soil contact is poor, he continues.

"Unconsolidated, fluffy seedbeds are a common cause of manganese deficiency. This can be soon after establishment so rolling fields to ensure adequate consolidation will help to limit losses."

Plants with a manganese deficiency show a yellowing between the leaf veins and discoloured spots (interveinal chlorosis), which can often be attributed to poor field drainage, says Toby. However, fields that contain healthy plants on a tramline and weaker, yellow plants in the middle of the field, will offer a clear indication that manganese, and not drainage, is the issue.

Although granular forms of manganese may not be preferred due to the nutrient quickly becoming unavailable to the plant, trials by Origin Fertilisers show applying it as a coating to a fertiliser granule helps to place the nutrient in the right place to assist the uptake and conversion of other nutrients.

"An even coating of manganese will ensure consistent application and nutrient distribution to the areas that require it. It also means plants can access the manganese as soon as it's spread," explains Toby.

A trial on spring barley supports this theory. Alongside a standard fertiliser programme for



Toby Ward says manganese has an essential role to play in the soil nutrient synergy as it stimulates photosynthesis which increases yield and NUE.

the spring barley crop, a foliar application of manganese was compared to a manganese coating on the seedbed fertiliser, to assess how the crop responds to each treatment and evaluate end yield and NUE. The manganese coating on the seedbed fertiliser was applied using Origin's Micro-Match service.

"The trial showed the fertiliser-coated manganese treated area returned improved results compared with the two applications of foliar manganese, offering a significant yield increase of 4.7% and increased nitrogen uptake by 5.4%. A further increase in NUE of 8.2% resulted in a return on investment of 6:1," concludes Toby.

Innovation Insight

Regulations are now in place which restrict the use of urea fertilisers and it's anticipated this will lead to a surge in uptake of urease inhibitors. *CPM* looks at the latest on a product which promises to deliver the goods for both the environment and farm businesses.

By Janine Adamson

The new urea fertiliser regulations — they could be viewed as both an opportunity and a threat. Although uptake of inhibitors has been slower than expected so far, Omex Agriculture's David Booty believes this could be a chance to demonstrate positive industry action.

"If growers don't abide by the rules, the regulations will tighten further and it's likely Defra will legislate. However, this is an opportunity for a clean slate by showing

a proactive response to a problem. It could be a real success story for British agriculture," he says.

Farm assurance standard

Monitored as a new Red Tractor farm assurance standard, the regulations apply to any fertiliser that contains more than 1% of urea nitrogen, with two timeframes in place — untreated solid urea/liquid UAN fertiliser can be applied between 15 January to 31 March each year, whereas outside of this, a urease inhibitor must be used.

And the reason why? Urease inhibitors work by blocking the urease enzyme found in nature from hydrolysing urea and leading to ammonia losses in some situations. It's believed doing this will help to meet the government target of reducing ammonia emissions by 70%.

In terms of the three recognised urease inhibitors, David says NBPT (N-(n-butyl) thiophosphoric triamide) is the only one that can reliably deliver the 70% reduction targets the government is seeking. "It's the most obvious active ingredient to use, so now it's a case of getting everyone on board with using urease inhibitors," he comments.

Although NBPT has been available as an active for around two decades, having originated in the USA, interest in the UK ► Where there's
 risk, we advise using
 inhibited urea not
 because of regulation,
 but because it's the right
 thing to do. ??



This is an opportunity for a clean slate by showing a proactive response to a problem, says David Booty.

Innovation Insight



Nick Anderson says the Red Tractor farm assurance standard should be the bare minimum because the risk of volatilisation doesn't start on a given calendar date.

 primarily came about in response to the government targets.

NitroShield benefits

This resulted in NitroShield — an NBPT-based urease inhibitor for use with liquid nitrogen applications. David says one of its selling points is the fact it's supplied as a separate product. "Inhibitors become most relevant in high risk scenarios so really, they want to be used when it's truly necessary.

"It's back to the old adage of applying the right product at the right time; all with a view to avoiding waste," he says.

This is a mantra which no doubt strikes a chord with Velcourt's technical director, Nick Anderson. He says the Red Tractor farm assurance standard should be the bare minimum because the risk of volatilisation doesn't start on a given calendar date.

"Where there's risk, we advise using

inhibited urea not because of regulation, but because it's the right thing to do," he says.

Nick explains that Velcourt has been taking a close look at NUE measurements for the past two years and the reasons behind poor nitrogen recovery. "If it's not recovered it's wasted, harming the environment and having an impact on farm business ROI. That's why it's important to identify sources of inefficiency, which are most likely to be biological lock up, leaching during winter, or in this case, volatilisation from urea fertiliser."

The company has been undertaking trials to evaluate urease inhibitors which according to Nick, clearly demonstrate that the technology increases the amount of nitrogen recovered.

Looking specifically at NitroShield, field trials on winter wheat are comparing a range of nitrogen (Nitroflo 30) rates from 0 to 240kgN/ha applied mid-March and

On-farm POV

From a farmer's perspective, obligatory use of urease inhibitors could be viewed as further unnecessary input cost, adding more pressure to profit margins. But, claims that they can deliver the 70% reduction in ammonia emissions target while increasing yields and grain proteins by 0.3t/ha and 0.2% respectively, means they are starting to pique interest.

That's been the case for Lincolnshire grower Mark Stubbs who set up his own independent field trials across more than 400ha to compare 50% untreated crop with 50% treated with NitroShield. He's keen to stress that although Omex isn't sponsoring the trials, results will be shared to compare notes.

"We've considered other options for reducing nitrogen emissions including molasses formulations, but these don't have Defra approval, and amino acids, but we haven't seen any evidence to support their use."

Mark admits that if it weren't for the new regulations, he probably wouldn't have considered using urease inhibitors. Regardless, his trials aren't over a small area and as a result, his expectations are high.

"We know that we have to see an improvement in nitrogen-plant efficiency, which can be partly achieved through reducing volatilisation. The regulation has made me think of our options two years ahead of the deadline," he says.

Mark looks after Beaconsfield Farm a 110ha arable enterprise based near Marshchapel that's used Omex liquid fertiliser for the past four years, having switched from a granular fertiliser regime. The main holding is Manor Farm in Calcethorpe which operates over a further 590ha. The combined acreage includes 280ha of cereal crops, 280ha of oilseed rape, 100ha of spring barley and around 40ha of rye.

Due to the rising cost of fertiliser and pressure on yields, Mark says his focus has increasingly been on the role of nitrogen in the crop growing cycle having found that too much nitrogen can have a negative impact on yield.

"Nitrogen will help a crop to reach a threshold, but where on occasion we apply more than is necessary, yields have reduced by about 5%. We're trying to find the sweet spot," he says.

In terms of fertiliser approach, Mark starts in late February with the first of three liquid applications in equal splits of Omex 22N+10S03 (Nitroflo 22+S) at a rate of 250 l/ha. This replaces an early granular fertiliser 21N:60S03 application in February. The second and third liquid applications are applied at the end of March and April respectively, providing 69kgN/ha and 31kgS03/ha at each application. The spray timings coincide with pesticide applications at GS30, 31 and 32.

"Applying the granular sulphur fertiliser in one hit meant a risk of losing much of the sulphur to leaching," explains Mark. "But, when applying sulphur along with the liquid nitrogen in smaller doses and more frequently, both elements are taken up more efficiently by the plant. We're applying half of the sulphur that we used to and getting higher yields."

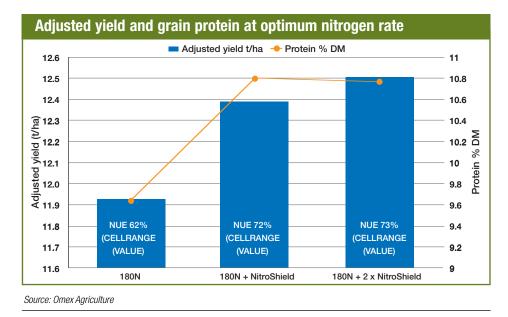


Mark Stubbs has instigated independent field trials across more than 400ha to compare 50% untreated crop with 50% treated with NitroShield.

Mark has already decided to include NitroShield on his winter wheat and OSR and possibly spring barley, due to it optimising nitrogen use efficiency and demonstrating a 10:1 return in independent trials.

He says he anticipates a successful outcome from his own trials this year, with the goal of yield and grain protein increases. Mark also says there should be a positive impact on the environment and an ability to extend his nitrogen application window, which offers greater flexibility to his fertiliser regime.

Innovation Insight



mid-April. with and without NitroShield.

Nick says so far, the trial results look promising in terms of Nitrogen Fertiliser Use Efficiency (NfUE). But recognising the importance of replicated data across years, OMEX and Velcourt have committed to another season of trials focusing on the continual development of inhibitor use in real-life farm practice. Nick says this is to ensure growers are equipped with the most accurate scientific data to achieve the best outcome for their farm.

But what's understood so far about volatilisation and urease inhibitors from a practical perspective? In terms of conditions, Velcourt agronomist Tom Watkins says dry, warm and windy are most conducive to volatilisation and therefore day-by-day assessments should be made before taking action. "As climatic conditions become increasingly unpredictable, the UK can certainly experience those conditions before the stipulated date of 1 April."

He agrees that a benefit of NitroShield is its flexibility. "As with all inputs, they should only be used when truly required to minimise wastage. Being a separate product makes this easy to achieve. Equally for the operator, it's simply added to the induction hopper and it's business as usual."

Tom believes the facts make sense and using urease inhibitors addresses a lot of key objectives. "It's a conscious product — it improves NUE while making a positive contribution to the environment."

Omex has also conducted three years of trials on NitroShield. These demonstrate that the product meets the government target of reducing ammonia emissions by 70% when mixed with Nitroflo or Nitroflo S grades prior to application.

The trial work was conducted in UK conditions, which David says is critical. "Trials have taken place both in the lab and in-field, so we're confident that the product will deliver consistent results for UK growers.

"Application-wise, rates can be reduced when soils are neutral or slightly acidic, or the crop canopy provides full coverage of the soil, the ambient temperature isn't expected to be more than 15°C within 24 hours of application, or a FACTS-qualified advisor has recommended," he explains.

Full rate use

"Full rates should be used when soils are alkaline (pH>7.0) or when the crop canopy doesn't provide full coverage of the soil, or the ambient temperature is expected to exceed 15°C within 24 hours of application."

On the topic of soils, David stresses that NitroShield doesn't have a long-term

Innovation Insight

Specialising in complex liquid formulations for use in industries ranging from agriculture to energy, Omex develops, manufactures and supplies liquid fertilisers and crop nutrition solutions.

NitroShield is Omex's innovative urease inhibitor which aims to reduce ammonia emissions to help growers to farm more sustainably, and can be utilised within all liquid fertilisers including their own Nitroflo N+S and Multiflo NPKS liquid fertiliser range.

The product has undergone three years of rigorous testing to establish the most efficient



According to Tom Watkins, dry, warm and windy are most conducive to volatilisation and therefore day-by-day assessments should be made.

effect on soil biology, despite the reservations of some growers. "The role of inhibitors has been a topic of discussion especially within the regenerative agriculture community.

"It's important to outline that inhibitors have been robustly tested and evaluated by independent institutes such as Rothamsted Research and Teagasc to assess microbial activity. Unsurprisingly, there isn't a long-term effect. Avoiding volatilisation on the soil surface incurs a delay for just a few days, so without lasting potency, there can't be a lasting impact on soil health," he concludes.

Untreated liquid UAN fertiliser can be applied after 1 April if agronomic justification is provided by a FACTS-qualified advisor to demonstrate ammonia losses will be at or below the level of including a urease inhibitor. ■

and effective form of urease inhibitor available to farmers.

CPM would like to thank Omex for kindly sponsoring this feature, and for its assistance in providing access to the relevant experts and contacts required to produce it.



A spoonful of sugar

66 It's important to reverse trends and start to rebuild soil organic matter. ??

"Molasses are a natural source of carbon and energy. When the high carbohydrate content is supplied in a molasses-based

> liquid nutrient package it can stimulate microbial populations in the organic layer and drive microbial activity through to the topsoil, stimulating greater nutrient uptake," explains Alistair. "This improves crop establishment and helps to stabilise soil nutrients, supporting crop growth.

"In addition, the subsoil layer typically has lower microbial activity levels, however, a molasses-based liquid nutrient can provide a substrate for the aerobic microbial populations which can help to

improve the living soil biome." Delving deeper into the ED&F Man portfolio, the product range incorporates four key molasses-based solutions: Black Label, Gold Label, Blue Label and Red Label.

To test the full extent of their benefits, the firm has carried out a number of trials with its own researchers and with independent agronomists on-farm to test them in a 'real life' scenario.

"Black Label was our first product and has high carbon and free sugar content which makes it particularly effective for pairing with foliar nitrogen applications," explains Alistair. "This helps to mitigate against both sun and frost scorch and improve the metabolism of nitrates, which increases the efficiency of fertiliser absorption."

Black Label was also the first of the ED&F Man products to be trialled as part of the project, with researchers starting by specifically looking a scorch mitigation, recalls Alistair. "It was incorporated into a late nitrogen application in wheat and had a



The county of Lincolnshire has lost about 5% organic matter over the past 80 years, notes Gary White.

Applied innovation

With soil organic matter levels reaching an all time low in some areas, utilising the benefits of molasses could help growers to start to rebuild these vital stocks. *CPM* finds out more.

By Charlotte Cunningham

It's often said that a farmer's greatest asset is the soil beneath their feet. However, after generations of intensive cultivations, tight rotations and the use of synthetic inputs, many soils across the country have experienced a major degradation of soil organic matter.

This is something that independent agronomist, Gary White, has noticed during recent years. Covering the East of England, Gary advises over 9,000ha of crops including cereals, sugar beet, potatoes and vegetable crops through his business G & A Crop Nutrition. "According to my research, the county I operate in —Lincolnshire – has lost about 5% organic matter over the past 80 years, which is quite a big drop. It's evident now in soils how poor water infiltration and the structure is, because of the loss of the organic matter and as such, the carbon as organic matter is 58% carbon."

The challenge with this is that reduced soil organic matter levels often correlate with less yield, explains Alistair Hugill, commercial manager at ED&F Man. "Therefore, it's important to reverse this trend and start to rebuild soil organic matter to promote more efficient nutrient uptake for more profitable and sustainable production."

Energy boost

An effective way to achieve this is by increasing the supply of energy and carbon to the soil microbiome, which in turn boosts activity and stimulates nutrient uptake. "The idea of this is that the additional supply of carbon will help to improve the soil's physical, chemical, and biological properties."

To do this, Gary says growers are considering a number of strategies. "Many people are looking at cover crops and using them but they don't always fit in with rotations or management. It's this that led me to look at other options, including the use of molasses."

The use of sustainably sourced molasses, and the benefit they could have on soil organic matter levels and subsequent crop yields, is something that ED&F Man has been looking into over a number of years.

"We've spent a lot of time researching soil organic matter and what quickly became very apparent is that a lot of sugarcane growers, a century or more ago, were given an allowance of molasses back from the refineries they sold it to in order to use on the land," explains Alistair. "These would have been fairly difficult times, so we realised there was clearly something in it, and so we launched a project to look into exactly how and where molasses could be beneficial."

So how exactly do molasses work?

Applied innovation



A substantial increase in the size and length of wheat ears – resulting in a 1.5t/ha yield increase – were observed in trials using molasses.

very strong effect. With just one application, yield was improved by 0.5t/ha."

Trial work has also shown improvements to growth quality where Black Label has been used, notes Alistair. "A few years ago we carried out some trials based around carrot growth in Kings Lynn, comparing untreated crops with those which had been treated with 6.6 I/ha of Black Label in 300 I/ha of water every 14 days, over a total of six applications.

"What we found was a decent overall yield increase in the molasses-treated carrots — 3.2% — but also far more consistency within their growth."

The same effect was also observed in a trial on apples at an orchard in Kent. "Again, far more consistent growth was observed, so what I think we're seeing where molasses are used is a general alleviation of stress which allows crops to behave in their most natural form and suffer from fewer challenges."

Moving on to Gold Label, this product includes a blend of cane molasses and fermented co-products from the sugar industry. "This gives the blend naturally high levels of carbon and amino acids, beneficial to soil health and aiding germination and early establishment.

"The plant-based micronutrients supplied in this biological complex help to facilitate the restructuring of inorganic nitrogen into amino acid building blocks for protein synthesis."

Specifically for foliar application, Blue Label is a blend of cane molasses, sugar co-products, and a concentrated Ascophyllum nodosum seaweed extract, explains Alistair. "The addition of seaweed provides a large boost of nutrients to the blend as it is particularly high in amino acids, enzymes, polysaccharides, fatty acids, lorganic glutamine, and bioactive peptides."

Trials have found that Blue Label helps to enhance the plant's own biochemistry boosting efficiency and growth mechanisms in the developing crop, he continues. "The sugars from the cane molasses promotes a more vigorous carbohydrate development in the plant aiding in a healthier, stronger cell structure which is less prone to biological and chemical stresses and disease."

Gary has been part of the trials network and says he's seen promising results on his farms. "We've done a range of trials on various crops, from winter wheat and barley to sugar beet and potatoes, so we have quite a wide experience and this year we've started to use molasses on vegetable crops too."

Among the results, one of the headline findings on a crop of winter wheat was that when amino acids and molasses were added to the programme via Gold Label, a substantial increase in the size and length of the ears was noted. "At the end of the trial, this translated into a 1.5t/ha yield increase — compared with the untreated plot," explains Gary.

Tramline trials

Other studies have included tramline trials on clients' farms to see what visual differences occurred where molasses were used, he continues. "We also carried out SAP and N-testing to further explore the benefits and have found better nitrogen efficiency in the treated plots, as well as better nitrogen levels within the crop itself.

"I use a small bit of kit called a microbiometer which allows me to quickly test microbial biomass and fungal-to-bacterial levels in soils in order to determine soil health. It also gives you a reading of carbon at the same time, and based on these measurements, we're definitely seeing an improvement where we're using molasses."

Alistair adds: "There's a principle that if you push bacteria within soils really hard it tends to be at the detriment of fungi, but in a healthy soil you're very much looking to have both. However, with our products we've very much found that tends not to be the case."

The product also contains citric, lactic and malic acids, which adds to its value, notes Gary. "They are very good at helping solubilise P within the soil, so that's another benefit – it's more than just the cane."

As well as benefits to crop health and performance, longer term observations have shown improvements to soil health, structure and drainage, he adds. "Something else we've seen which is quite interesting is that thanks to the humectant properties within the molasses, it can help to calm a particularly complex tank mix, in a similar way to an adjuvant," points out Gary. "With mixes often now consisting of several products due to tight weather windows at spraying times, this



An effective way to restore soil organic matter levels is by increasing the supply of energy and carbon to the soil microbiome, which in turn boosts their activity and stimulates nutrient uptake, explains Alistair Hugill.

is really useful."

Adding to this, all products are filtered to 200 microns, making them suitable for use through the majority of UK spraying systems, which Gary says adds to the practicality and usability of these molasses-based nutrients.

Alistair concludes: "I think the use of molasses has been one of those things people have tried in the past and had some disasters with. But this range marks a step change in how these products are designed and incorporated.

"I recently had someone tell me molasses used to be like stirring old engine oil into your sprayer, whereas now it's like pouring in orange squash.

"In an ideal world, all farms would have livestock or cover crops to ensure they'd have all the soil organic matter they'd ever require. But we know in reality that's not always practical, so harnessing the power of molasses ensures all farmers have the opportunity to start to rebuild those vital soil supplies. It's proven, it works and it's reliable." ■

Sponsors box

CPM would like to thank ED&F Man for kindly sponsoring this article and for providing privileged access to staff and material used to help put the article together.



Pushing Performance

Amid a constant battle with declining chemistry and catchy weather windows, including an adjuvant in the sprayer tank is proving essential for one Wiltshire spray operator. *CPM* finds out more.

By Charlotte Cunningham

At Clarendon Park Farms in Salisbury, quiet days are few and far between for farm manager James Kelsey.

James oversees the management of 1820ha, operating as a mixed farming system with 405ha of woodland, 1011ha of arable and 390ha down to pasture for the South Devon cross Red Angus cattle enterprise, with animals finished for Dovecote Park, supplying Waitrose with Angus beef.

"On the arable side we're growing winter wheat, winter barley and spring barley, with break crops of winter beans or oilseed rape once every three to four years, as well as a winter cover crop of buckwheat, crimson clover, berseem clover, vetch and phacelia ahead of spring drilling," says James.

"We make the most of our grass leys on the farm, mob-grazing the cattle over 20ha, split into 2ha areas, which we then back fence as they're moved on. On our flintier soils, we use sheep to graze the covers over winter."

Soil health

Being mostly light chalk soils, farming the estate comes with challenges, he continues. "We're asking a lot from our soils. But healthy soils are intrinsically linked to plant health so we've focused on improving them for some time.

"We've been operating min-till for a long time and working to improve soil structure and organic matter levels, aided by organic manure from the livestock and a straw-for-muck deal with a local dairy farmer."

As well as this, James and the team put a lot of effort into testing and monitoring soil health with help from their Agrii agronomist, Todd Jex. "Other than normal soil testing every year, we're also testing once every four years, digging a soil pit in various fields on the estate, which we geotag with Agrii's Rhiza software, enabling us to go back to the exact spot in four years' time," says James. "We're checking worm counts, infiltration rates, VESS assessments, organic matter levels and other key indices to measure the **66** Why wouldn't you be enhancing chemistry if you're able to in order to get the best performance you can? **99**

impact of our action plan.

"When we tested the fields last year, some were around 3.5% organic matter," he continues. "So it's a work in progress, but average across the farm is around 6% which I think is pretty good."

This approach goes hand-in-hand with a focus on optimising inputs and using only what they have to. "We've not been using insecticides for a while now, and we're starting to reduce our fungicide inputs where we can," says James. "But what we do apply, we make sure goes on well and it works."

Heading up the spray application programme is operator Jason Winning, who believes that incorporating an adjuvant is vital to getting the best from

Pushing Performance

his applications. "Chemistry isn't as good as it used to be, so why wouldn't you be enhancing it if you're able to in order to get the best performance you can? That's where the right adjuvant can more than pay for itself, and for me Kantor ticks that box well."

Kantor, from Interagro, is an all-in-one activator and special purpose adjuvant, which is claimed to improve tank mix compatibility, buffer spray water to pH 6-7, reduce spray drift, and enhance overall product effectiveness by increasing coverage, adhesion and penetration across plant surfaces. "In fact, it's the only one-can adjuvant solution on the market that alleviates risk across the entire spraying operation — from tank mixing, through to spraying and even down to action on target plants," says Stuart Sutherland, technical manager at Interagro. "It's for these reasons Kantor is of one of the most widely used adjuvants in the spring, because it ticks the box on so many levels."

Jason is a self-proclaimed 'huge fan' of the adjuvant, and says there are three main situations where he always runs with Kantor: in catchy weather, when there are multiple products in the tank, and when chemistry performance has to be optimised. "The crop protection products we're using cost a lot of money so it makes sense to get the most out of them as much as we can."

Delving deeper into the challenge of catchy, difficult spraying conditions, being



Including an adjuvant with a frequently complex tank mix at T1 helps ensure products are mixed well and stay in suspension.

on the edge of Salisbury Plains means the winds can whip through the valley which makes spraying with a 5000 litre Agrifac Condor 36m sprayer quite a challenge. "We have a large acreage to cover in quite often a short weather window, so the drift reducing properties of Kantor essentially buys me more time to get sprays on.

"We also have a lot of trees and shady areas on the estate which can hold the dews, adding to the challenge of keeping product on the leaf. This is particularly problematic with contact herbicides. But Kantor improves retention on the leaf, and you can see much better coverage."

This better coverage comes down to Kantor's ability to manipulate droplet size which helps crop protection products to spread out and adhere to the leaf surface more effectively, explains Stuart.

Targeted application

"In essence, adding in the Kantor reduces the number of <100 micron spray droplets — which are most susceptible to drift and the number of very corase droplets, which are prone to bounce, creating a droplet size that is optimal in size for more precise and targeted application.

"When the water droplets containing the dissolved active ingredients hit the leaf surface, the Kantor reduces the high surface tension, enabling them to spread out rather than rolling off the leaf, so they cover it properly and can be retained."

These benefits of enhanced coverage are particularly useful for challenging leaf surfaces, notes Jason. "We've inherited a bit of a sterile brome problem which we're currently working on tackling. If you give it an inch it will take a mile, so making sure our herbicide application is effective, is really crucial.

"In the autumn we'll team Pontos (flufenacet+ picolinafen) with the residual herbicide adjuvant Backrow Max to reduce drift and maximise residual activity, and then follow up in the spring with a post-em plus Kantor.

"Brome can be tricky for coverage because of its hairy surface, so we find an adjuvant is crucial in this scenario. This is also important in the OSR with phoma and sclerotinia sprays too, as OSR has a very waxy leaf, so we'll add the Kantor in with the fungicide to help maximise protection," he adds.

Optimising coverage across the oilseed rape leaves can be tricky, especially when wet, as the surface tension is even higher, continues Stuart. "So adding in the Kantor is really valuable to create a stronger



For James Kelsey (left) and James Winning (right) incorporating an adjuvant into the tank is key for getting the most out of chemistry.

barrier to the spores, leading to more effective treatment overall."

But it's Kantor's small molecular size that sets it apart from other adjuvants, enabling better penetration into plants, so active ingredients get to work faster, he says.

"Due to its small molecular packing size at the water (spray droplet) to leaf interface, Kantor is able to 'concentrate' the number of active ingredient molecules on the leaf surface, enabling more entry points. One of the other benefits is its ability to allow lateral diffusion, where active can move horizontally in the waxy cuticle."

This penetration power has been proven in multiple trials, including a study at Wageningen University in The Netherlands using UV tracer dye to look at penetration.

The research showed that Kantor delivered higher concentrations of crop protection into the leaf cuticle compared with when these products were used alone — resulting in significantly higher uptake into plants.

"With fungicide efficacy waining, enhancing fungicide uptake into the leaf with Kantor has valuable benefits for both disease control and yield, something we're seeing more and more of in trials," says Stuart.

"In 2022 Prime Crop Research trials for example, there were significant improvements in septoria control in varieties Wolverine, Gleam and Extase when Kantor was added at T1 and T2. In Agrii trials on the varieties Elation and Elicit, across an average of five different fungicide programmes on each, there was a reduction in disease levels across leaf layers and an uplift in yield, which was

Pushing Performance



Kantor is an activator and special purpose adjuvant, which is claimed to improve tank mix compatibility, buffer spray water to pH 6-7, reduce spray drift, and enhance overall product effectiveness by increasing coverage, adhesion and penetration across plant surfaces, explains Stuart Sutherland.

▶ significant in the Elicit."

And it's when paired with fungicide sprays where James says the duo really gain a lot of reassurance from the Kantor.

"We've dropped our T0 fungicide, focusing on trace elements instead to boost plant health. However, our T1 programme on wheat is typically a big mix, so we'll add Kantor in at this point.

"Last year applications were around 29 April, and the mix included an SDHI, triazole and two PGRs, plus some micronutrients and magnesium. It's a pretty big mix, but with Kantor you just know it will be fine.

"As well as a complex tank, we are sometimes mixing in cold water which can slow things down," continues Jason. "We also have hard water and a naturally high pH level which complicates the mixing operation further. Kantor helps here again, buffering and speeding up the mixing process, also improving compatibility, ensuring all products are combined much more thoroughly together in the tank."

Looking at the science, Stuart explains that as water is a charged polar molecule, variability in water temperature and quality can affect how well products dissolve into it. Any more than three products in the tank increases the risk of a mixing problem, especially if using low water volumes.

"Kantor helps emulsify all the components of the mix, and keep them stable, even in cold water. As well as the time saving benefits for operators, it also

Pushing Performance

At the heart of good crop production lies careful use of chemistry to protect the plant and maintain performance, right through the season.

But optimising the efficacy of plant protection products can be challenging, while increasingly restrictive regulations limit just how far you can go.

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

reduces the likelihood of a crop safety issue and increases the bioavailability of active ingredients for maximum uptake and performance."

Looking to the season ahead, like many growers James and Jason are feeling the effects of the washout autumn. "About 80% of the cropping on the chalks looks pretty good, but the other 20% has suffered and we've lost some of the area, with crops currently sat in anaerobic soils. Slugs are a big problem at the moment too."

The second half of February was spent stitching in winter wheat where possible, but the focus now for the spring is getting the most from inputs on what crops do remain, explains James.

"Costs are continually getting higher, and we have to try to keep things on an growers and drive crops to reach their full potential. Kantor is a unique adjuvant designed to optimise every stage of the spray delivery process to help enhance the performance of crop protection inputs and maximise yield in a wide range of crops.

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



even keel. As part of this, our long-term goal is to continue to further improve soil health and the efficacy of our inputs, which in turn should help us reduce them where we can. Embracing technology, including adjuvants, to help us do just that."

"Kantor's ability to reduce drift and lower rainfast timing gives us the flexibility to extend our working hours in catchy, bad weather seasons and having a reliable robust product which enhances compatibility in tank mixes definitely puts us at ease when applying multiple products," adds Jason.

"Having that reassurance not only improves chemical coverage and penetration, but also gives us the security that all products tank mixed will be utilised to their full potential," he concludes. ■



The farm is actively working towards reducing synthetic inputs and ensuring what they do apply is optimised as best as possible.



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OSR weed control

A difficult season for herbicide application is likely to have resulted in an unwanted bounty of weeds in oilseed rape crops. With the final window having arrived for mastering some control, *CPM* digs deeper into the role of water conditioners.

By Melanie Jenkins

With few chances to get on top of weed control during the past few months, seizing the final chance of a herbicide application is paramount, and optimising application will be central to that.

A changeable drilling period, followed by months of rain and very few frosts, means there's a mix of oilseed rape crops out there, all at different growth stages, says Corteva's Joe Martin.

But the crux of the situation is that a lot of OSR hasn't had any herbicide applied at all, says ProCam's Rob Adamson. "The combination of it being so wet over the winter and many having grown companion crops with their OSR, meant no residuals were applied.

"Normally a follow-up herbicide would have been used to take out the weeds once the companion crop dies, but poor weather conditions and doubts about whether or not OSR crops would survive has meant many held off applying anything."

Now that the window to apply products such as Astrokerb (aminopyralid+ propyzamide) has closed, this means the next opportunity will be from 1 March using clopyralid until flower buds are visible, which is a very short window, highlights Rob Adamson.

"This'll be your final chance to take out weeds in what, in some cases, are quite dirty crops. If neither a residual or winter herbicide was applied, then species like thistles, poppy and mayweed will have grown pretty big, making them a challenge to control."

Robbing nutrients

The issue with this isn't just about the unsightly visuals of weeds, but they're also robbing nutrients from and competing with the cash crop, which can reduce yield potential, he explains. "This is very topical this year due to waterlogging and nutrient leaching. OSR is becoming an increasingly challenging crop to grow, so if you've managed to establish the crop, then you can't afford to let weeds rob yield, or contaminate the seed sample at harvest — which can lead to price penalties. These things can make all the difference with gross margin."

These compounding factors means it's important to ensure that any herbicides applied from 1 March onwards are as effective as possible, stresses Rob Adamson. "If you have a viable crop, then it's now the time to start managing it to make sure that it's profitable."

According to Joe, Korvetto is one of the few options for control of broadleaf weeds in winter OSR during the spring. "Corteva suggests taking a programmed approach to achieve good broadleaf control, starting with what you've applied in the autumn, whether that's Belkar (halauxifen-methyl+ picloram), Astrokerb, Kerb (propyzamide) or a combination of those three, and then assessing what weeds you have in the spring. If you don't invest in the extra water conditioner, you're effectively throwing away your herbicide through cation lock-up. ??

ooth operato

"Korvetto (clopyralid+ halauxifen-methyl) can be applied from the beginning of March onwards, at BBCH30 until BBCH50, so stem elongation up to before flower buds are visible above the canopy," he advises.

The herbicide can be used when temperatures are between 8-25°C and product label guidance suggests water volumes of 150-300 l/ha with a maximum



According to Joe Martin, Korvetto is one of the few options for control of broadleaf weeds in winter OSR during the spring.



Rob Adamson has seen situations where herbicides haven't worked as well as would be expected because the water has been too hard.

dose rate of 1 l/ha.

It provides good control of weeds such as thistles, cleavers, poppies and mayweed, says Joe. "And it can also be used to control a number of off-label weeds such as shepherd's purse, which I've seen quite a bit of lately."

In terms of safe practice, Korvetto shouldn't be applied if frosts are forecast or if the crop is stressed, as in water-logged situations, advises Joe. "It's also advised to be careful if your OSR is near sensitive crops such as legumes, potatoes and carrots but there're no restrictions to following crops if you've applied it, meaning it can be useful in the rotation."

Korvetto has an adjuvant pre-mixed in the formulation so this is one less thing for growers to think about, but a further addition worth consideration is a water conditioner. Having done research with other halauxifen-methyl containing products, such as Belkar and Pixxaro (halauxifen-methyl+ fluroxypyr), De Sangosse has identified significant improvements in weed control when using a water conditioner, especially against less susceptible species, explains the firm's Rob Suckling.

Improving performance

Although research hasn't be done with Korvetto specifically, the related research indicates that including a water conditioner is likely to help improve performance, especially against less susceptible weeds where dose rate responses can be expected, he points out.

"We're pretty limited with what we can apply to OSR in the spring with only a few active ingredients available to us, and all of them are synthetic auxin Group 4 herbicides," says Rob Suckling. "As a group, these can all be affected — to a greater or lesser extent — by hard water as the chemistry is so similar.

"These herbicides are weak acids which can form salts with calcium and magnesium ions naturally present in water, and these salts will be less soluble and less biologically active."

This process is often referred to as 'locking-up' and the greater the concentration of calcium in spray water, the greater the potential becomes for loss of herbicide active to insoluble salt formation, he explains.

Although association between the cations and herbicide occurs in the spray tank, it's on the leaf surface as the spray droplet ►



Now that the window to apply products such as Astrokerb has closed, this means the next opportunity will be from 1 March using clopyralid until flower buds are visible.



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There're limited herbicides which can be applied to OSR in the spring with only a few active ingredients available, and all of them are synthetic auxin Group 4 herbicides, says Rob Suckling.

➤ dries that the salts precipitate. The resulting solids are then unable to diffuse through the leaf cuticle and ultimately, a percentage of the applied dose has been lost which can compromise the efficacy of the application, explains Rob Suckling.

"Water hardness varies across the country, but interestingly, the hard water areas correlate closely with the major combinable crop areas where the majority of herbicide use occurs. This is why water hardness is an important consideration," he explains.

"It's important to note the difference between water hardness and pH. Water hardness is a measure of dissolved calcium and magnesium, whereas pH is a measure of acidity. It's also vital to separate these two properties of water as their effects on agrochemicals are very different, and require different management approaches.

"The confusion often occurs as hard water (containing high levels of calcium carbonate), makes water slightly alkaline. Alkalinity can be an issue for some insecticide chemistry which can be hydrolysed in an alkaline environment. This is the chemical degradation of active substances into inactive degradation products."

Different actives have varying susceptibility to react with calcium, and this, alongside water hardness and speed of evaporation, will determine how much product is lost to cation lock-up, he says.

"Clopyralid is a weak acid with a pKa value of 2.01. The pKa value is the acid dissociation constant at a negative log scale — the lower the number numerically, the stronger the acid indicating its propensity to ionise in water. In water, clopyralid will ionise readily which allows its association with calcium ions," says Rob Suckling.

True water conditioners

Preventing cation lock-up of valuable products is where water conditioners come in. "Using true water conditioners which control calcium in spray water prior to adding the herbicide can be beneficial in supporting the best possible efficacy — particularly against hard-to-control species."

He explains that true water conditioners control cations by acting sacrificially, forming irreversible complexes with calcium ions. "When the herbicide is subsequently added, it remains free to move through the spray water, able to diffuse through the leaf cuticle of the target weed as the spray droplet dries."

But beyond this, water conditioners, such as Aquadyne — an updated version X-Change — can provide a number of functionalities including pH buffering, humectancy and foam control, he says. "We call products which include these four functionalities, full water conditioners because they control water hardness, stabilise the pH to around pH 5 for optimal herbicide uptake, whilst mitigating any hydrolysis of pH sensitive pesticides.

"In addition, humectants prevent spray droplets from evaporating too quickly, allowing for maximum diffusion through the lead cuticle. The anti-foam agents control

OSR weed control

foaming during sprayer filling."

Growers should be aware that water conditioners are unregulated products unlike pesticides and adjuvants — meaning the labels won't necessarily declare the effective components or their concentration, he advises. "Not all products are equal, and many won't control cations and prevent the damaging consequences they have on pesticide performance. Many are based on ammonium sulphate which doesn't control cations and this is the most important aspect of a water conditioner." In the field, Rob Adamson has seen situations where herbicides haven't worked as well as would be expected because the water has been too hard. "In some cases, growers have used a water conditioner but not enough to provide full cation control. Water conditioners should be used at a relative level to water volume and if you increase your water rate, then it's essential to up your dose of water conditioner.

"And although water conditioners aren't expensive, it might be off-putting to have to double your spend on them because you've doubled your water rate. But if you don't invest in the extra water conditioner, you're effectively throwing away your herbicide through cation lock-up," he warns.

Glyphosate is well-known to be affected by water hardness, but so are many other foliar applied, systemic herbicides, says Rob Suckling. "We're continuing to lose approvals for effective chemistry, so it's important to get the best out of what we have available to us, especially in challenging situations, with limited spray windows like we're seeing this year." ■

Precision nutrition

Implementing strategic tactics and precision nutrition has enabled Hertfordshire grower Rob Fox to boost oilseed rape establishment and increase crop resilience heading into spring.

Through implementing a combination of SOYL nutrient mapping, regular soil testing and understanding the farm's history, Rob says he adapts to the requirements of each field where soil type can vary considerably across the 800ha farm.

He says this ensures nutrition requirements suit different conditions, while applying variably reduces fertiliser use and increases nutrient availability because efforts are focused on the highest yielding areas.

"When working with light, gravel soils but also medium loams and heavy clays, having a soil-first approach has put us in good stead for the spring growing season, particularly with OSR," says Rob.

In a bid to reduce nitrogen use and maximise organic matter, he began executing his OSR nutrition strategy with an early autumn 'sprinkling' of PinKstart starter fertiliser, closely followed by an application of soil conditioner, Humistart+.

"This made the most of the natural mineralisation that occurs in warm, moist soils and meant the crop had a chance to form deep



Companion cropping is an additional tool that's been implemented on the farm to aid water drainage and lock in nutrients, with buckwheat and berseem clover planted between the OSR.

rooting and quickly establish ahead of excessive winter rainfall," he says.

With the opportunity to travel, an early February application of TOP-PHOS fertiliser was made, which contains Complex Super Phosphate (CSP).

"It's crucial to have a consistent supply of phosphorus and sulphur throughout the growing season, not just in periods of rapid growth. However, it's more for the soil than for the crop as it aids longer-term maintenance and soil fertility building for years to come."

Rob explains that potash will be applied in the spring between nitrogen applications in March (urea) and April (ammonium nitrate). "The OSR has an early, front-loaded spring dose of nitrogen along with sulphur which is ahead of our other crops because it starts and finishes early."

In the past 12 months the farm has received 150% of its annual rainfall. Rob says regardless of how wet the weather has been, he's still assumed there'll be a long dry spell in late spring which has become the norm in recent years.

"Although it's been wet it's also been mild, which has led the OSR to establish better while building resilience for the rest of the growing season. Luckily, most of the OSR has been planted in fields with gravel soils which have drained pretty well. There have been a few wet corners, but the crop has fared well overall.

"It's all a mixture of luck and judgement — a combination of selective drilling and application dates and an early approach to providing nutrients to get the roots down and the crop away from the ground when conditions are favourable."

Rob says he aims to apply fertiliser in the most economical and environmentally conscious way. "I find it's better to farm smart, making decisions based on soil, crop and weather conditions rather than adhering to textbook dates, to remain cost-effective and reduce environmental impact.

"It's all in the preparation — you want to get the crop in the best possible place to withstand adverse weather events, whether that's an extremely wet winter or dry spring," he comments.



n a bid to reduce nitrogen use and maximise organic matter, Rob Fox began executing his OSR nutrition strategy with an early autumn 'sprinkling' of PinKstart starter fertiliser.

Companion cropping is an additional tool that's been implemented on the farm to aid water drainage and lock in nutrients, with buckwheat, fenugreek and berseem clover planted between the OSR.

"It can allow excess water to infiltrate three-four inches below the crop while helping soils to hold on to nutrients and avoid leaching. However, it's important to not try too many new things at once otherwise it'll be difficult to define what's making a real difference.

"It's hard to quantify, but switching up the nutrition strategy and trialling a new variety (Resort — HEAR from LSPB) seems to have led to the crop getting well away from the ground early doors.

"Growing OSR has always been a battle but it suits our rotation. Last year, we achieved an average 3.2t/ha at harvest selling at £525/ha. But I'm happy with how it's established this season and the way it looks now heading into spring," concludes Rob.

Putting the 'pea in predictions

Pulse Progress

In this special edition of Pulse Progress, *CPM* explores how the development of a new modelling tool could revolutionise the forecasting of maturity and yield in vining peas.

By Charlotte Cunningham

Anyone who's grown vining peas will know firsthand what a notoriously unpredictable crop they can be.

Vining peas typically have a very short harvest window — often only one or two days — which can be expedited by hot weather. This effect was seen in full force last summer, with the hottest June on record creating far from ideal conditions for crops across the country.

As well as the obvious negative impact on yield, the challenge with these

fluctuating weather patterns is that it makes the advanced prediction of harvest dates difficult, explains Leah Howells, data scientist at PGRO. "With the increasingly hot summers that we've been getting, and the Met Office predicting this to continue, it's going to be even more crucial to accurately predict harvest dates.

"We're also seeing highly unpredictable yields. While high and low yields can be estimated using pod and seed counts, there's currently no standard method of prediction."

Manual process

At present, measuring the maturity of peas is done via grower groups sending out fieldsmen to each field to take tenderometer (TR) readings to see if the crop is ready or not. This manual process isn't only inefficient, but it disrupts harvesting schedules and makes intake management at the freezing plants challenging, meaning some fields can be left to go over, or loads can be rejected if they're over capacity, explains Leah.

It was this challenge that sparked the idea to develop a tool that uses algorithms, crop data, weather patterns and other variables to give grower groups **66** With the increasingly hot summers that we've been getting, it's going to be even more crucial to accurately predict harvest dates, **99**

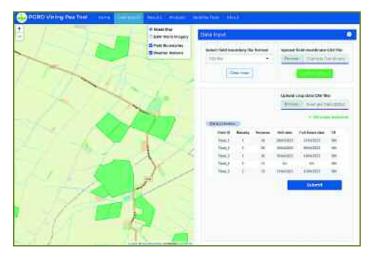
accurate forecasts of when individual fields will be ready.

The PGRO project, which has been partially funded by Innovate UK, commenced in 2019, with the objective of reducing wastage caused by crop bypassing and inefficient factory processing through the advanced forecasting of harvest dates and yields in vining peas. In doing so, this would allow processors and growers to anticipate the peaks and troughs in vining pea production to ensure that crops aren't reaching maturity too quickly to

Pulse Progress



The Vining Pea Forecasting Tool enables more accurate prediction of maturity and yield than currently possible.



The simple interface only requires a small amount of data input to generate predictions.

be processed.

The development of the tool has been based on machine learning, explains Leah. "Machine learning is an example of what AI can do and how it can be used practically in agriculture."

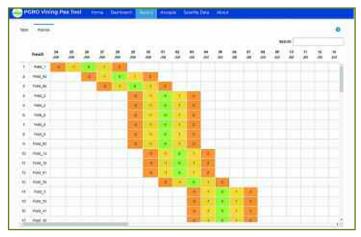
In terms of the information that went into the machine learning models, the research team started with a huge body of commercial historic vining pea crop data, she adds. "This comprised more than 18,000 crops grown between 2001 and 2023 and included all key crop information such as drilling, flowering and harvest dates, as well as variety information and quality — the TR — and yield at harvest."

This was combined with satellite data which provided the research team with multispectral canopy reflectance measurements, derived from the Sentinel-2 system, and daily weather data.

"These data sources were fed into the machine learning models to produce two separate models as a result — one for harvest date and one for yield," explains Leah. "These models essentially find trends and patterns in the data and then can apply that to any new data which comes in, in order to generate predictions.

"As a result, we were able to generate predictions which are more accurate and further in advance than is currently possible for vining peas."

The models can make predictions from full flowering onwards, which gives growers a lead time of around 10 days ahead of harvest, compared with just a few days when using TR readings alone, she adds.



The new tool features a downloadable results planner function which shows users harvest date, yield and total tonnage for each crop.

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The machine learning is combined with satellite data which provides the platform with multispectral canopy reflectance measurements, derived from the Sentinel-2 system.

"This results in a window of certainty around harvest date, which in some cases can half the number of quality samples that have to be taken in the approach to harvest in any given field."

In terms of accuracy, Leah says for the harvest date model, the average error is around one day, whereas in the yield model, the average error margin is around 15%, which equates to about 0.7t/ha.

"For the harvest date model, we've found the most important data set to go into the platform is the full flowering date. While the multispectral canopy reflectance indices were most influential in the accuracy of the yield model because they provide a snapshot of the field as pod development is occurring and can give an indication of potential yield."

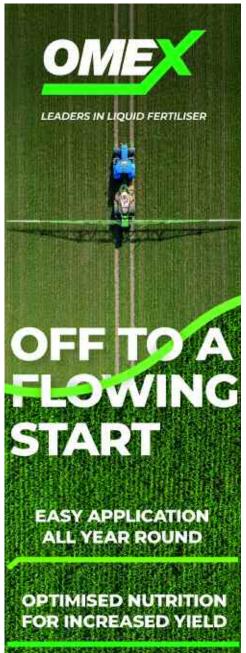
One of the farms which has fed into the machine learning models is A & EG Heading in Cambridgeshire who supply garden peas to Princes, at long Sutton, for canning.

Director Marc Heading says tools which improve the accuracy of maturity predictions could be a game changer for vining pea management. "We're a family business based in the Cambridgeshire Fens growing potatoes, onions, cereals, sugar beet, maize for the onsite AD plant and vining peas.

"The vining pea enterprise has been a part of the business for a long time and is run entirely in-house — we do all the growing and the vining operation ourselves and we're delivering into Princes."

The company is farming 2300ha in total with around 400ha of this down to the vining peas, making it a core part of the business, he adds. "The biggest challenge to our peas is the weather and the ►

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Leah Howells has been heading up the four-year project to use machine learning to improve maturity and yield predictions in vining peas.

► fluctuations we have in that peak growing window of flowering — which is anytime between June onwards."

Predicting maturity

"As we get drilling blocks that come together and have naturally less days growing, if we have a fluctuation in temperature, it has the potential to increase differentiation between them, which is when we start struggling to predict maturity accurately."

Looking at the current system for maturity predictions, technical manager Myles Forber adds that his biggest concern is not being able to predict more than a few days ahead. "We drill lots of different varieties on different soil types. Obviously, they all have different maturity dates, and the weather can impact this, but if that means a certain variety is going to overtake another one it really messes up that harvesting sequence." At present, the farm is testing maturity via a fieldsman coming out to measure TR levels, he explains. "However, generally this is only accurate for about three days ahead. Naturally, until we can get a TR reading from the pea, his task of testing is irrelevant. Therefore, if we can use flowering dates and machine learning, combined with TR readings, it helps us to more accurately plan everything from daily workloads to delivering into factories."

Myles adds that the latter is particularly important due to the obligation of growers to have to alert factories of how many tonnes they have per day.

"When we get these predictions wrong, the implication is that we fall outside of the TR bracket that factories want. There's a balance between being at 100 TR and where we want to be in terms of maximising yield, but there's probably only about a day in that where we have to grab the peas before they're out of sync.

"If this happens, crops end up being bypassed, left or taken in early. So with better tools, we'll be able to make a more informed decision about harvest strategies.

"At the moment, we're only able to make that decision three days ahead. But if I'm able to half make it a week or two in advance, and then only have to plan the key day-to-day operations three days ahead, our planning will be much more efficient."

As well as the managerial benefits this brings to a busy farm business, there are also advantages from a practical farm management perspective, adds Myles. "For managing labour and irrigation periods, it's quite key that we know what's coming."

Turning focus to the involvement with the new tool, Myles explains that while the business has been in contact with PGRO throughout the project, last year was the

PGRO's Vining Pea Forecasting Tool – key features

- User authentication and secure login
- User-friendly interface, with minimal data input required from the farmer
- Yield and harvest date forecasts available from drilling
- Crop mapping function to visualise field boundaries
- Downloadable results table showing harvest date, yield and total tonnage for each crop
- Day-to-day harvest date visualisation using the planner tool
- Visual representation of daily total expected tonnage and hectares to be harvested, enabling peaks and troughs in production to be pictured
- True colour (RGB) and NDVI Sentinel-2 satellite imagery, with two new images available every two to three days in cloud-free conditions, giving users and aerial view of individual fields. *Source: PGRO*

Pulse Progress

first year they sent data in to feed the machine learning development. This included variety, drilling date, field location, full flowering date and harvesting dates and the TR each field was harvested at. "We then met up just before Christmas to relay what our actual flowering and harvesting dates were, to compare it beside what Leah had forecast, and I was pretty impressed with the accuracy.

"All the way along, the model was clearly following the right trend lines, which is promising because the more data you put into tools like this, the more accurate the algorithms are going to be. Leah was also able to predict a TR window for a certain date, depending on which market we wanted to target, which is really useful."

Looking to the season ahead, the farm will once again input their data into the model but will be using it as more of a management tool this year, explains Myles. "Leah has shown me how to input our information and it's really simple. So as soon as it stops raining and we can get drilling, we'll be able to start adding our data and managing the crop from there.

"My ideal scenario is that I can use the system to avoid me having to do the field

walking every day to see what stage the peas are at, and I can share the data with the people doing the TR reading so they know what's coming and plan their own routes which will make the management a lot smoother and free up that time for me — and them."

Future steps

In terms of future plans, with the tool now in place and set for launch at the end of February, Leah believes it has the potential to revolutionise vining pea harvesting and processing. "The launch of the tool will enable both processors and growers to access the models and use them as part of harvest scheduling in vining peas.

"It's a very simple interface — the only data that's required is a small amount of crop information — as well as field location — which are uploaded into the platform and predictions are generated as a result.

"The platform automatically pulls together the satellite and weather data, meaning that predictions are generated and updated on an ongoing basis to help growers be prepared in an era of continually changing weather patterns."



Myles Forber believes that by using the new tool, he'll be able to make a more informed decision about harvest strategies.

As for further developments, the nature of machine learning means it'll be possible to adapt the models to fit any crop, adds Leah. "Providing there is a sufficient body of historic data for the machines to pick out trends, the potential is huge across all crops," she concludes.



ake a chance on Grain maize **grain maize**

Maize is fast growing in popularity with increasing numbers of arable farmers believing it capable of delivering significant production, economic and even environmental benefits. **CPM** evaluates its potential.

By Rob Jones

With the challenging autumn and winter period making drilling difficult for many producers, coupled with reports of cereal seed stocks selling out by the end of November, maize has come under the spotlight as a contender for arable rotations.

Better genetics, greater knowledge and improved management techniques means the crop has the potential to break out of its traditional livestock home and become a mainstream arable player, many believe.

It's certainly a crop that stacks up well against more conventional spring options, says KWS' technical maize specialist Andrew Cook, with many arable producers reporting strong gross margins and a range of associated benefits under the new Sustainable Farming Incentive (SFI).

"Significant reductions in nitrogen use, low-input agronomy and soil improvement opportunities are just some of the appeal, and managed properly, maize can bring a welcome diversity to arable rotations.

"If you're located close to a dairy farm, beef producer or AD plant, there could be a local market for forage maize, but there's growing interest in maize as a grain crop too," he says.

Preparation steps

"If you're growing maize for grain, it's important to load things in your favour to ensure you have a crop that's going to get to harvest. That means looking at the best site, the right crop establishment method and the most appropriate varieties.

"You're going to be harvesting later than forage maize because of the time required for the grain to dry down as much as possible, so you have to plan things as much as possible around achieving this."

Whether growing maize for forage or grain, the first objective is to choose the best site as this plays a key role in determining maize yield and quality, he points out.

"The easiest way to increase yield is to avoid sowing maize on non-performing fields. It's a crop that favours sheltered locations with a south-facing aspect which will permit earlier drilling and maintain soil temperature for longer in early spring.

"Sheltered fields also offer higher retention of heat units and radiation into the canopy, benefiting total yield potential. The recommended maximum altitude for maize is 1,000 feet (300m) above sea level."

66 I'm sure the deep-rooting effect of the maize has improved the soil profile. ??

According to Andrew, maize favours sandy/sandy loam soils, a well aerated soil structure and no compaction. "Clay soils hold water and are slow to warm up although maize can be grown on soils with a clay content of up to 25% if earlier drilling is used.

"Chalk is unsuitable because it's slow to warm up in the spring and can reflect sunlight. However, chalk downland soils can support maize if soil depth is sufficient. Poorly aerated soils will limit root formation and can cause premature crop senescence," he explains.

AICC member Howard Nason of Crop Advisors says cultivations for maize should be targeted to alleviate compaction and create a seedbed conducive for rapid establishment but minimised to avoid risks of soil damage and excessive fuel usage.

"Maize is the one crop that'll show up any form of soil compaction, so tramlines or heavy traffic areas of the field have to be

Grain maize

dealt with pre-drilling, but, there's no need to burn diesel unless you have to.

"Dig a hole to find the compaction depth and set the subsoiler point 1" (2.5cm) below the compacted soil — this will give optimum lifting of the soil. Where moisture isn't limiting, seedbeds can be left unrolled to help with water infiltration through the soil profile and avoid the risk of capping."

He explains that as the season progresses, if there's a concern about soil moisture it's advisable to Cambridge-roll the ground. "The seedbed has to be good enough to allow any planned pre-emergence weed control to be effetive, while not being over worked."

Andrew agrees, saying maize doesn't usually require the energy-intense cultivations required by many other crops. "If you have a relatively well-structured soil, as a general rule you don't have to subsoil or plough before drilling which represents a considerable saving on machinery and diesel costs compared with other crops.

"Although maize likes to put deep roots down and doesn't do well in compacted soils, modern thinking is to deal with such areas individually rather than carry out wholesale heavy duty cultivation," he says.

Once soils and field conditions have been factored in, variety selection largely revolves around heat units available, points out Andrew.

"Whatever the variety, a grain to stover ratio of at least 50:50 is desirable and this should be combined with good standing power to support the cobs as they mature. KWS Anastasio is a great choice for grain maize due to its high grain yield and excellent standing power. If you're in an area with a higher number of heat units available, then KWS Papageno would be a sound choice too.

"While KWS Exelon would be a good option for slightly more marginal areas, ultra-early varieties with FAO ratings of 150-160 aren't recommended for grain due to the risk of brackling, where plants break below the cob as they mature," he says.

"You can select the best varieties with the correct FAO based on the average heat units for your location and get an idea of the predicted harvest date by using online tools."

According to KWS' Thomas Turner, while modern hybrids have a high degree of cold tolerance, they shouldn't be drilled before soils have reached an even temperature to give the best possible establishment.

"This is 8°C for light soils and 12°C for heavy soils for 3-4 consecutive days. If you drill earlier, you're likely to have poor



The easiest way to increase yield is to avoid sowing maize on non-performing fields, says Andrew Cook.

germination, uneven emergence and reduced nutrient uptake germination, while drilling too late could delay harvesting, risk poor maturity and increase lodging risk.

"Optimum drilling depth depends on time of planting with this being 3-5cm for crops drilled April to early May, 5-7cm from early May onwards and 7-9cm from mid-May onwards," he says.

Secure rooting

Sowing at the right depth will allow buttress roots to develop and anchor crops securely, which is important when harvesting later, and a plant population of 85,000 plants/ha is ideal for dried grain maize with crimped grain maize slightly higher at 90,000 plants/ha, says Thomas.

"Row widths of 75cm are the most popular for grain maize as these work well with most maize combine headers at harvest, but 50cm is an option too — check this before you drill.

"Nitrogen applications once the crop is growing aren't usually necessary, particularly if full use of organic sources has been made. The crop is unlikely to require much in the way of agronomic interventions unless you're in area where maize eyespot occurs."

According to Howard, yield responses to starter fertiliser can be variable although it will increase the speed of establishment and earlier tasselling and maturity.

"Heavier, colder soils, particularly those without a history of FYM, will show the largest responses. Foliar polymer ureas which slowly release nitrogen over a six-week period can be particularly useful for those fields that may run short of nitrogen by tasselling. Uptake is only via the leaf so a good canopy is required for optimum results.

"Maize requires relatively high levels of potash – it helps to maintain the water content within the plant and the turgor of the cells, and is important for the plants' natural ability to maintain stem stiffness and utilise nitrogen efficiently."

As for SFI, Thomas says there are several options complementary to maize production under the scheme.

"For example, if you're planning on undersowing maize crops under IPM3, you'll be eligible for £55/ha plus SAM2 offers £129/ha for growing an over winter multi-species cover to protect soil nutrient losses.

"Using integrated pest management (IPM4) on a whole field parcel of land to reduce insecticide use attracts payments too, but any specific advice on this should be sought from your agronomist," he says.

Frontier's head of grain (digital and procurement) Richard Johnston explains that the market for UK produced grain maize has been largely 'de-risked' in recent years with confidence growing and a steady demand for the crop now in evidence.



Howard Nason says cultivations for maize should be targeted to alleviate compaction and create a seedbed conducive for rapid establishment.

Grain maize



James Faulkner began growing grain maize a few years ago after a positive experience producing forage maize as a feedstock for a local AD plant.

► "During the past few years, the UK has imported 1.5-2.2M tonnes of grain maize for a variety of end uses, so any market where that's the case has significant potential for the domestically produced crop to grow and replace imports on a tonne for tonne basis.

"While in the past anybody considering growing maize for grain would be encouraged to make sure they had a contract before even considering planting the crop, demand is now sufficiently stable that it's as reliable an option as wheat or barley, in marketing terms," he says.

"As the largest global crop, grain maize, or corn as it's known in many markets, often dictates grain commodity prices so UK wheat and grain maize tend to be priced similarly. During the past three years, prices have been very strong and although they've dipped a little recently, so too have those for other commodities."

Richard says the domestic crop goes mainly for livestock feed with regional contracts, such as the one Frontier has set up with feed producer GLW Feeds — an example of how the market is developing.

"We've worked hard to develop a market for UK-produced grain maize and are now able to offer forward prices, which is another marker of how much things have moved forward in recent years. You can drill a crop now and fix a price for say, December, so you have the same level of security as you would with any combinable crop."

Maize has proved to be a perfect rotational fit on the 1350ha arable farm managed by James Faulkner near Colchester in Essex. Not only does it provide a useful break from cereals, it also generates significant income from forage sales to a nearby AD plant as well as grain maize sold for livestock feed manufacture, he says.

"We began growing grain maize a few years ago after a positive experience producing forage maize as a feedstock for a local AD plant. We currently grow 200ha for grain and 1000ha for forage, with another 700ha harvested for other growers.

Soil type considerations

"The maize is grown on land that you wouldn't usually consider suitable for cropping, but the low average rainfall of just 500mm in the region means we can grow it on soils that might be considered too heavy in other parts of the country. The farmland runs down to the sea and the majority is a very heavy London clay with the remainder Hanslope, which has a calcareous, chalky texture.

"Ironically, we tried growing maize on the lighter land and rye on the heavier soils, but in fact performance was improved when the reverse policy was introduced," explains James.

Advised by Frontier agronomist, Marcus Mann, the maize has always performed well and the cereal crops that follow are always impressive, he says.

"It's probably due to the amount of potash left in the soil and the maize has really



The standard policy is to sow maize from 15 April to 10 May and to harvest the crop in early September.



According to Richard Johnston, the market for UK-produced grain maize has been largely 'de-risked' in recent years.

helped clear up our grassweed issues, especially blackgrass and ryegrass. I'm sure the deep-rooting effect of the maize has improved the soil profile, too," comments James.

He says KWS Anastasio and Keops have been the standout varieties in recent years with both used for grain and forage.

"We chose KWS Anastasio for the first time in 2021 because of its high yield potential and it's more than met our expectations and demonstrated the flexibility we were hoping for.

"We've seen fresh weight yields as high as 53t/ha and produced up to 11t/ha of dry grain. It's a true multi-purpose variety with tremendous yields and an early harvest date which allows time to plant the following wheat," says James.

Equally, KWS Keops has impressed. "Production is very similar to KWS Anastasio and we've combined it for grain, but its real strength is as a forage variety with average fresh weight yields 54-55t/ha seen."

The standard policy is to sow maize from 15 April to 10 May and to harvest the crop in early September. James believes that some growers might be wary of the late harvest associated with the crop, but because of grassweed issues, he doesn't drill the following wheat crop until the middle of October.

"Because we're combining you can run on the crop trash and keep trailers out of the field so you aren't churning the soil up. If it gets too late, we can simply put in another crop of maize in the following spring which works well.

"The margins are good and given that the UK imports around 2M tonnes of maize a year, demand is strong and can only get higher," concludes James. ■

naturenatters by Martin Lines

No Nature. No Farmers, No Food

During the past few weeks I've spent a lot of time on trains travelling to different parts of the country for meetings and conferences. While it's nice to sit back, relax, and let the train take the strain, when I look out of the window I see crops that farmers were unable to harvest — soil in poor condition and pooled with water; a patchy landscape where once crop growth would have been full and consistent across the fields.

The erratic weather events and degradation of the land that's talked about as a problem of the future is already happening, and it's very depressing.

With falling figures for commodities and any price increases reversed the very day after they're announced, the market news during the past few months surely can't have been beneficial for arable farmers' mental health.

Seed and input costs are so high — farmers looking at planting spring crops this year won't be in good spirits. I sometimes wonder if other actors in the supply chain have ever stood up from their desks and looked out into the sorry fields outside their windows.

Crop production across the UK and Europe won't be breaking yield records this year. It's not just us that are suffering extreme and unseasonal weather — it's happening around the world. Anyone who's seen the data for the increases in sea temperature this year will be truly concerned. When a body of water heats up, it results in an increase in moisture evaporation into the atmosphere, meaning we'll be getting very wet in the months ahead.

It's not just the sea that's holding more heat, but the land, too. Heated masses of land and sea drive more energy into our already skewed weather patterns. It's crucial that everyone understands that the much-speculated climate change impacts are already here, and will only intensify in the years to come. If you're farming in the southeastern side of the UK, the predictions are hotter, drier summers and warmer, wetter winters. What we have had to deal with these past few years is really only a taste of what's to come.

With the instability this brings, many farmers in England see the opportunity to be paid to deliver public goods and provided a fixed income for the next three years as a positive. We hear the usual cries of "What about food security?" and "We shouldn't be improving our environment at the expense of food production!".

In reality, much of our landscape already produces goods that aren't part of a nutritious human diet, such as crops for livestock, energy crops or fibre. The role of farmers is to maintain the profitability of the businesses they are running, but it's the job of the Government to ensure we have a trading structure that doesn't disadvantage UK farmers.

It isn't up to the farmer to feed the nation, but to manage their piece of landscape for production of what society and the market requires and is paying for. Sadly, for decades now, the agriculture industry and Government in this country have allowed the supply chain to be over dominant and not fairly reward producers, farmers and growers for food production, so the fear and skepticism is understandable.

However, if you're farming in England, many offerings in the Government schemes are incentivising actions for nature; the public is investing in our landscape for long-term food security by addressing the climate and biodiversity crises, offering business stability via diversifying.

Yet I see farmers declaring on social media: "We shouldn't be concentrating on mitigating climate change and restoring biodiversity!". I can't help but wonder – what business model are they planning to employ? How will they manage the risks for which the evidence is already before us?

Farmers investing in soil health and its ability to hold and store water, farmers who are planting trees and hedgerows to shade and cool our soils and animals, providing habitat and increasing biodiversity — these are the farmers that will help to provide food production and 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. @LinesMartin martin.lines@nffn.org.uk

security in the future. Implementing actions for nature isn't a separate concept to running a profitable, sustainable business or producing quality yields — quite the reverse, they're inextricably linked.

I often see the slogan 'No Farmers, No Food'. The reality is, food production is underpinned by nature and our climate. With irregular weather having such an impact on our supply chain, the only option for farmers is to cultivate a sustainable landscape.

I strongly believe, therefore, that the slogan should be: 'No Nature, No Farmers, No Food'.



Implementing actions for nature isn't a separate concept to running a profitable, sustainable business or producing quality yields – quite the reverse, they're inextricably linked.

Success in flexibility

Sustainable Solutions

Taking a flexible and adaptable approach to farming has helped Ed Walton to successfully manage multiple challenges, proving the area of land doesn't always matter, but the way it's farmed does. *CPM* speaks to him to learn more.

By Melanie Jenkins

Adapting to the constantly changing farming landscape can pose a challenge but one farmer has become more sustainable while remaining flexible in his approach, attributing elements such as variable rate adoption and careful variety selection to his continued successful operations.

Farming as J. W. Walton and Son, at Underhill Farm in Winderton, near Banbury on the edge of the Cotswolds, in both an Area of Outstanding Natural Beauty and a conservation area, Ed Walton operates the predominantly arable enterprise and Agrii iFarm alongside his father.

The family has been working the land since 1917 when Ed's great grandfather took on the tenancy. "The vast majority of the land is on the Marquiss of Northampton's estate, consisting of around 190ha as well as contract work on several neighbouring farms," explains Ed. "We're largely working on Grade 3 medium soils, but it can vary from sand right through to heavy clay. Cropping consists of wheat, spring barley, oilseed rape and peas, with the OSR and peas grown as break crops."

One of the major adoptions for the farm has been a variable rate approach. The journey started in 2014, the same year that Ed was involved with Agrii's iFarms project, when he began implementing variable potassium (P) and phosphate (K) to his system. "Introducing this was as much to do with cost saving as it's about doing the right thing, but overall the aim is to be more efficient."

Since then he's introduced variable rate seeding and nitrogen to his system. He says implementing the former has meant investing in a newer drill and luckily he was able to buy a 4m Väderstad Rapid from a neighbour three years ago.

Variable rates

"We're on quite steep, hilly land and with the range of soil types it means it can be hard to grow even crops. I don't think applying variable rate seeding has helped me save on seed, but has instead meant we've drilled more seed where it's required and less where not as much is warranted."

When he first started applying P and K variably, he didn't have GPS on the farm so he purchased a new spreader with GPS incorporated. "Impressively, the spreader and GPS paid for itself in two years which demonstrated just how much variation there was in the fields. I've since bought a tractor with GPS and linked it all together with the variable rate seeding."

Soil testing has been integral to variable rate applications on the farm, explains Ed's agronomist, Sarah Hookway of Agrii. "We soil test on the farm every five years and have created maps to work from. In addition, we've utilised green crop satellite imagery from Rhiza as well as using Ed's visual **66** The spreader and GPS paid for itself in two years which demonstrated just how much variation there was in the fields. 99

assessment of bad patches to work from."

During autumn 2022 Sarah and Ed worked with Agrii to introduce nitrogen scanning using DroneAg's Skippy Scout in his OSR crops. "We had the crop scanned that autumn and this was then followed up by another scan in the spring which allowed us to calculate variable rate nitrogen applications," she explains.



Ed Walton feels the best way to deal with unpredictable weather conditions is to have large enough kit on farm that it can operate quickly in small weather windows.

Sustainable Solutions

"The process was the first time for Ed but it has proved so valuable that we'll look to use it on farm again. It showed up a lot of irregularity in the field and as a result Ed applied a variable rate application of nitrogen in the spring which helped to even the crop out."

The latest addition to the farm comes in the form of a Massey Ferguson Ideal 7 combine which is due to be rolled out of the shed for the first time in the coming harvest. "This is a significant investment for us, but we bought our last combine in 2013 so it was due upgrading. Since buying the combine a neighbour has asked me to take on the harvesting on his farm, so it's generating more work before we've even used it," Ed explains.

One aspect of the combine that Ed is

looking forward to using is its ability to create yield maps. He hopes that this will allow him to determine not only the effectiveness of his variable rate applications, but will also mean he can better plan for future cropping.

Like many other farmers, one of Ed's biggest challenges has been OSR, says Sarah. "The farm has been fairly successful with the crop, due in part to planting in September after the higher flea beetle pressure in late August, but during the wet autumn of 2019 it completely failed. Conditions were so unfavourable that we weren't able to get the iFarm trial plots planted that year either, so instead of changing Ed's rotation, we planted cover crop mixes and turned these into trials and used them as a means to improve soils."

Ed feels the best way to deal with



Soil testing has been integral to variable rate applications on the farm, with tests taken every five years and used to create variable rate maps.

unpredictable weather conditions is to have large enough kit on farm that can operate quickly in small weather windows. "There's always a window you can get out in but you have to be prepared to get the work done when it comes along which can mean having bigger machinery to get the job done. Our investment in the larger combine

iFarm trials

Involvement in the Agrii iFarms project has helped Ed Walton finetune a more precise way of growing crops based around local information and specific insight into his own farm's climate and resources.

"For us, sustainability is as much about using the inputs we have available as effectively as we can, as it is about taking positive steps forward to protect the environment and wildlife," he says.

"During the near 10 years that we've been involved in the iFarms initiative, we've carried out trials on a range of topics including cover crops, spring cropping with both barley and peas, seed rates, nitrogen use efficiency, fungicide options and variety choice.

"All of which have informed how we approach the way we farm here, as well as providing a valuable resource for other growers in the area to benefit from specific local information through demonstration and trials days."

Agronomist Sarah Hookway points out that the comparison between Ed's farm and neighbouring iFarms in Brackley, Northamptonshire and Bromsgrove in Worcestershire, has delivered



During the period that Underhill Farm has been an Agrii iFarm, it's hosted trials on a range of topics including cover crops, spring cropping, seed rates, nitrogen use efficiency, fungicide options and variety choice. particularly interesting results that reinforce just how much local growing conditions affect production and profits.

"Although these farms are only 20 miles away, results from the trials in Brackley have been very different from Ed's trials, particularly around variety performance and disease prevalence," she explains.

"The height above sea level produces a completely different micro-climate from Brackley with the noticeably wetter conditions meaning Ed really has to prioritise septoria resistance and control.

"It's a different situation in Brackley with yellow rust being far more of a concern there, so that 20 miles or so can really make a big difference to decision making and management. In addition, varieties that work the best for Ed, often don't work very well over there and this becomes very obvious when you look at all three of the iFarms in the area together."

Results from nitrogen trials carried out at Winderton have also shown some interesting results, adds Sarah. "We've undertaken a lot of work on best use of fertilisers, which is a subject close to most farmers' hearts with many looking at it as practical to cut down on nitrogen from both environmental and cost efficiency points of view.

"At Ed's farm we found that of three applications rates used, 270kgN/ha gave the best yields but in terms of return on investment, an application of 220kgN/ha gave the best economic response.

"Cutting back to 170kgN/ha dropped both yields and financial benefits considerably. So, there are obviously ways growers can reduce the nitrogen inputs to the benefit of both the environment and their overall productivity,



Sarah Hookway points out that the comparison between Underhill Farm and neighbouring iFarms has delivered particularly interesting results that reinforce just how much local growing conditions affect production and profits.

but, you have to be careful."

Ed highlights that the farm's use of variable rate nitrogen applications is very much part of their drive to use fertiliser more efficiently, as is their recent use of drone technology to estimate green area index (GAI) more accurately.

"It's early days but we're impressed by the concept of the Skippy Scout drone system Agrii use and it's something we can hopefully build more into the trials and the mainstream farming operation in the future," he says.

"I think that's the real advantage of the iFarms initiative — we can learn about new developments as they emerge and contribute to the overall Agrii R&D push, as well as getting some real regional knowledge that we can share with other growers.

"We can then finetune this even further with specific activities such as strip trials on our own land looking at varieties and how they perform in both treated and untreated scenarios. You add all of that together and you start to build some real insight into how we can farm in a sustainable, environmentally sensitive and, hopefully, profitable way in the future," concludes Ed.

Sustainable Solutions



During autumn 2022 Ed Walton and Sarah Hookway worked together to introduce nitrogen scanning using DroneAg's Skippy Scout.

➤ is partially justified because I know I'll be able to go out and get crops harvested in good time when the conditions are right."

A further tactic to keep operations running smoothly on farm involves kit maintenance during the winter months. "I hate breakdowns — they're an unknown cost and are time killers. I prefer to spend time over the winter ensuring kit is well maintained so that during the rest of the year we're minimising break-down and maintenance time."

This coming autumn, Ed plans to conduct his first organic matter and carbon audit on the farm. "I want to benchmark where we are now so we know where to aim next. But at the end of the day, any environmental changes we make will have to stack up financially." With this in mind, he intends to explore the Sustainable Farming Incentive (SFI) options later this year to see how they could work with the business. "I've been involved with previous schemes and where we're situated there's a lot work with in terms of trees and hedges. The farm is 600-900ft above sea level so it's really hilly with a lot of diversity around us, so there's likely to be options we can implement."

Business evolution

Over the coming years, Ed hopes to continue to grow the business but is open-minded about how this will unfold. "We never stand still but the direction of travel can change. It could be that we're more involved with environmental schemes in the future but all it takes is for the world to have one bad harvest and we're all back to growing wheat, so I feel we have to be flexible in our approach to farming and to where government policy will take us."

He believes that sustainability means something different to each farmer but feels that it's unanimously about balance. "Pre-Covid and the war in Ukraine, the government's aim was to heavily promote environmental management, but now the thought process has evolved back towards food production. I feel that we can get a balance between both the environment and food production that means neither ends up in a vulnerable situation."



The latest addition to the farm comes in the form of a Massey Ferguson Ideal 7 combine which is due to be rolled out of the shed for the first time in the coming harvest.

Sustainable Solutions

The leading agronomy development network

Extending from the tip of Cornwall to the Black Isle, north of Inverness, iFarms are part of the country's most comprehensive arable agronomy development network.

Hosted by forward-thinking growers, the network undertakes a range of practical trials and demonstrations overseen by Agrii agronomists in parallel with detailed scientific research delivered by R&D teams at Agrii's six principal Technology Centres.

Each of the 18 main iFarms has its own unique set of conditions, requirements and challenges which are reflected in the trial work undertaken and solutions explored and developed.

The current programme includes fully-replicated national and regional trials as well as field-scale demonstrations with the widest possible range of winter and spring wheat, barley, oats, rye, oilseed rape and maize varieties.

Specific studies are also conducted with a broad range of integrated crop management strategies including pest, disease and weed management, macro and micro-nutrition approaches,



and tillage regimes; cover, companion and alternative cropping options; and a variety of biological, soil improvement and environmental land management opportunities.

A full programme of meetings throughout the year and summer open days give growers the chance to experience the latest iFarm and Technology Centre work first hand — share in their most-up-to-date findings while discussing innovative agronomic thinking in thoroughly local contexts. Don't miss opportunities from the network this season scan the QR code below to explore what's happening where and when, and link to 'invitation-only' events which might be of interest.





Why organic matter builds resilience

Agroecology conference

What's the true value of organic matter? A Rothamsted researcher explained how it builds resilience in soils during the recent Hutchinsons Agroecology conference.

By Mike Abram

What is the true value of building organic matter in soils? For Rothamsted Research soil microbiologist Professor Andy Neal, it isn't increased yield or to gain access to carbon markets.

Indeed, albeit perhaps surprisingly, Andy highlights that research suggests organic matter additions to soils don't increase yields in autumn-sown crops, although there's some evidence that it has a positive impact in potatoes and spring-sown cereals.

Evidence is also lacking that increasing soil organic matter will provide value through revenues from carbon markets, he says. "Yes, there's potential to sequester carbon, but it's not sufficient to make a dent in the real climate issues we have."

Instead, the real value lies in the

microbial interactions with organic matter and the impact on soil structure, he says, and the increased resilience that it can ultimately bring to soils.

Most soil organic matter originates from plant tissue, which goes through a complex cascade of degradation, first by shredders such as earthworms, then fungi and bacteria and other microbes.

Sequestration

"The important part for organic matter sequestration in the soil is getting small enough molecules to be absorbed onto mineral surfaces and so no further microbial activity can take place," explains Andy. "Once it's locked away, it creates this wonderful structure that's vitally important to the way microbes work."

Andy studies at a scale smaller than the average diameter of a human hair, which allows him to focus on pore structure. "That's where the water holding capacity of soil occurs, because with pores that size, capillary action holds water in soil once it drains. But it's also where we see greatest enzyme activity, fine roots and organic matter being deposited directly from roots into soil, and mycorrhizae fungi," he says.

Detailed analysis has found that soils with less than 1% organic matter have very little porosity or connectivity between pores. "My suggestion is that connectivity in soils is what drives soil health. The more connected the pore spaces, the ► **66** Connectivity in soils is what drives soil health. **99**



According to Andy Neale, the important part for organic matter sequestration in the soil is getting small enough molecules to be absorbed onto mineral surfaces.

Agroecology conference

► healthier your soil will be as you increase organic matter."

Just a 1% increase in soil organic carbon gives around a 354,000 l/ha increase in water storage capacity in the top 30cm of soil, he estimates. "There's a real advantage to increasing pore space in soil, and the way you do that is to pump more organic matter through the soil, which the microbes use, break it down to a form that can stick to mineral surfaces and build this fabulous architecture."

That holds true for clay soils, but less so for sandy soils, he notes. "In extremely sandy soils, research suggests that organic matter has virtually no influence on the soil structure because a sandy soil is made up of larger particles, all similar in size and shape, and you end up with huge voids in between those particles that can't form any architectural structure." that it allows the plant growth hormone ethylene to diffuse away from root tips, explains Andy. "If ethylene increases to a high enough concentration, it stops root growth. If you have a well-structured soil, you don't get that and roots continue to grow so not only are you storing more water, you're also allowing roots to explore more of it because there's no barrier to their growth."

Rothamsted Broadbalk

But how you manage soils doesn't change the soil's intrinsic carbon to nitrogen ratio, according to evidence from Rothamsted's Broadbalk long-term experiment, says Andy.

"All that changes is the more nitrogen you have in the soil, the more carbon you can sequester, so don't worry about changing it as it's under the influence of microbial metabolism and mineral content." Using CT scanning, Rothamsted was able to show the soil structure in the plots receiving high 35t/ha/year FYM inputs in the experiment was virtually identical to nearby long-term woodland and unmanaged pastures.

"So if you have enough carbon to hand, which is the challenge, you can still plough every year and have the equivalent soil structure at these small scales to pasture or woodland."

The research also revealed that inorganically fertilised soils had only a half to two-thirds of the soil pore space, even at field capacity, compared with the plots receiving FYM. "In the FYM plots, because of the increased structure there was an awful lot more oxygen availability."

That matters for nitrogen use efficiency, he explains, because when microbes run out of oxygen, they have evolved to use either nitrate or sulphate to respire. "When

One benefit from improved structure is

Food company investment

Together with farmer interest, there's also been a surge in interest from food companies in transitioning their supply chains towards regenerative farming practices.

Major global brands such as McDonald's, PepsiCo and General Mills are just some of those who've set seemingly ambitious regenerative agriculture targets, although companies in the UK are still only running pilot projects.

But a 2023 report by the FAIRR Initiative, a collaborative investment network that raises awareness of environmental, social and governance risks and opportunities in the food sector, suggested the food sector was making more promises than progress on regenerative agriculture.

The report found 64% of the 50 agri-food companies that publicly report on regenerative agriculture as an opportunity, don't have in place formal quantitative targets for how they're going to achieve those ambitions, and only 8% had financial commitments to support farmers in their supply chain to incentivise the uptake of regenerative agriculture.

Commenting on those findings, Shropshire regenerative farmer Clare Hill says it's disappointing there's a lack of investment at grassroots level.

"How can you make claims that you're doing regenerative agriculture without actually investing in it?" she asks. "We require capital to start flowing in the right direction back down to the land from which it was first extracted.

"An additional observation is we often see

food brands want the same product, to the same spec, from the same breed. The onus is on farmers to become regenerative without food companies considering what changes they have to make in order to support that transition," says Clare.

For many regenerative farmers, the more likely route of getting value from agroecology is to sell direct to reclaim the approximate 80% of the value which is used up in the supply chain, she points out.

"Innovation is rising in this area with hub models, such as the one Ooooby [veg box platform] has created, showing impressive returns."

The FAIRR Initiative report also found instances of companies using regenerative agriculture as 'greenwashing', which was something McCain Foods GB vice president James Young was keen for his company to avoid.

Globally, McCain has set the target of 100% of its potatoes being supplied by farmers involved in regenerative agriculture by 2030, including the 700,000t grown in the UK.

One of the ways McCain hopes to avoid falling into that trap is to make sure the marketing claims are made after plans, targets and frameworks for delivering the objective are set, says James.

The main reason McCain chose this direction was for the long-term sustainability of its potato supply, he explains. "While we've diversified to some non-potato products, we're effectively still a potato business and therefore completely



Clare Hill says the onus is on farmers to become regenerative without food companies considering what changes they have to make to support that transition.

reliant on the supply of potatoes and good relationships with farmers, and by extension, soil health."

The firm has established a framework of seven indicators to define what it considers to be a regenerative grower in the northern hemisphere, together with targets that growers meet to be considered at a beginner, master or expert level.

"But we leave flexibility for growers to pick and choose to make sure it is not prescriptive," says James. Support for the grower base includes preferential financing through NatWest Bank, research projects designing new machinery to reduce cultivation depths and soil movement, as well as advice and support, he concludes.

Agroecology conference

Charter to smooth transition hurdles

According to Hutchinsons' head of agroecology, Ed Brown, an encouraging surge in interest and adoption of regenerative farming practices is happening but has brought its own challenges.

Those challenges include risks for both farmers and agronomists. "Unfortunately, agroecological practices are often poorly understood and poorly implemented, which means it inevitably goes wrong sometimes with a potential loss of income for the farmer and liability for the agronomist."

That's why Hutchinsons is about to release its Agroecological Charter, he says. "The charter will clearly define the meaning of agroecology so all parties are clear on what they're trying to achieve, and secondly, detail some of the key management processes required to make agroecology a success, including objective setting and resource building.

"It will also highlight some key risks with implementing agroecological practices and the associated crop management, and how these risks can be mitigated. Our intention is the



Hutchinsons is about to release its Agroecological Charter, says Ed Brown, which aims to define the meaning of agroecology.

Charter will help to guide farmers and agronomists through and beyond the implementation phase to remove a lot of risk," he concludes. they do this, they grow much more slowly, but for the farmer they're using nitrogen in ways you didn't expect, wasting money, and producing a lot of nitrous oxide."

When Rothamsted compared soils receiving FYM and inorganic fertiliser at equivalent rates, the FYM soils were releasing less than half the nitrous oxide, says Andy.

"So I think the greatest challenge you have as farmers looking for healthy soils is getting as much access to oxygen in your soils as possible. Fortunately, you can do that if you have sufficient organic matter or if you build it up."

All of those benefits — the better soil structure, greater access to water, oxygen and improved nutrient use efficiency ultimately provide resilience, he suggests.

"You don't see that resilience every year, but when things get tough, you'll appreciate that resilience — and organic matter gets you there." ■

All people quoted either presented or spoke with *CPM* at the Hutchinsons' Agroecology Conference.

Wildfarmed tweaks rotation plan

Growers will no longer be required to put fields into a three-year rotation as part of a Wildfarmed agreement after the firm discovered it was acting as a barrier to farmers signing up.

Wildfarmed is encouraging farmers to transition to soil-focused farming by following five core standards, which include growing cash crops, predominantly wheat, with either pulses or companions, minimising bare soil by growing cover crops and integrating livestock into the cropping system at least once in a three-year rotation.

The standards also specify that nutrition is based on requirement up to a maximum of 80kgN/ha and that no pesticides can be used on the growing crop.

Wheat grown to these standards is then sold to a range of customers from artisan bakers to Marks & Spencer, with farmers receiving a fixed premium price of £310/t in 2023.

The firm is also developing other premium markets for crops such as barley and oats, work that partly started as a result of planning three-year rotations in conjunction with its grower supply base, while continuing to offer annual grain growing contracts.

The gross margin from a three-year rotation of a legume-fallow (NUM3), which pays £593/ha under the Sustainable Farming Incentive options, followed by two Wildfarmed bi-crops, for example, is an exciting prospect potentially, according to Wildfarmed cofounder Andy Cato.

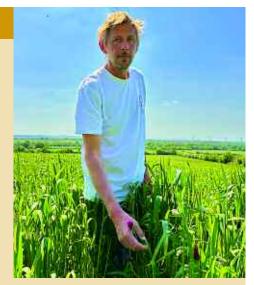
However, the firm's assumption that working towards a three-year commitment would be required to drive systemic change is proving to be untrue with farmers often taking some Wildfarmed-led practices, such as bi-cropping and sap testing into their conventional fields.

In fact, insisting on a three-year rotation from the get-go on top of excluding the use of all pesticides and significantly limiting fertiliser use was creating a block on sign-ups, notes Andy. "Given our mission is landscape change, the last thing we want to do is create barriers. Perfection can be the enemy of progress," he says.

That means a Wildfarmed field can continue to be moved around the farm, with the firm suggesting growing Wildfarmed wheat, which has a lower protein spec, at the place in the rotation conventional milling wheat would occupy. Under Wildfarmed standards the no pesticide rule begins when the crop is planted, allowing glyphosate to be used pre-drilling.

"The Wildfarmed standards are a radical shift," says Andy. "They require a change of mindset, and changing mindsets requires successful outcomes.

"From the beginning the Wildfarmed standards were about supporting growers and



Insisting on a three-year rotation as well as excluding the use of all pesticides and significantly limiting fertiliser use was creating a block on sign-ups, says Andy Cato.

helping them to reduce the risk of trying something new on an area of the farm."

Further research has led to a second tweak in the rules to allow the 80kgN/ha to be all soil-applied, rather than the last 40kgN/ha having to be foliar applied. "What we found after looking at the sap analysis data, the costs, and farmers' experiences, was that insisting on foliar nitrogen was adding cost and complexity without any benefit."

66 There isn't a clear way of linking IPM activities with profitability and crop performance. **99**

IPM workshop Pushing IPM forward

As integrated pest management continues to gain importance, *CPM* looks at some of the research projects and tools aimed at helping growers to adopt it more widely.

By Mike Abram

It may seem as though since leaving the EU, UK research institutions are no longer able to access and take part in EU-funded projects. But, that's not the case.

As part of the Trade and Cooperation Agreement, the UK agreed it would associate to some of the EU's research programmes including Horizon Europe $a \in 95.5$ billion funding programme for research and innovation. Soil health and food is one of five key mission targets for the programme.

Research into integrated pest management (IPM) in particular has benefited from the continued access to Horizon Europe funding with three projects currently receiving support.

Equally, two other UK-based projects (see boxes) are also supporting research into IPM, which is crucial in helping to deliver sustainable crop protection practices that are practical and effective, while reducing the reliance on pesticides, and their associated risks to the environment, human health, and non-target species.

Reducing pesticide use by 50% by 2035 through farmers adopting IPM is the overall aim of IPM WORKS, one of the Horizon Europe-funded projects, says Andrew Christie, an agronomist from the James Hutton Institute.

The project involves 31 partners from 16 European countries, coordinated by the French National Research Institute for Agriculture, Food and the Environment (INRAE). It uses a network of farmers to progress further adoption of IPM through peer-to-peer learning and other activities, and to demonstrate IPM works — e.g. it lowers reliance on pesticides while reducing costs and enhancing profitability.

Climatic challenges

Achieving that aim in Scotland is not without its challenges, explains Andrew. "We have a cool, damp climate, short weather windows, a long growing season and it's often difficult to travel on fields due to ground conditions."

Cropping is dominated by malting barley, with limited varietal selection, plus some winter wheat and potatoes, but options for break crops are restricted to mostly oilseed rape, vining peas, and beans, he adds.

Andrew has put together a network of Scottish farmers in Perthshire, Angus and Fife to demonstrate IPM techniques, such as implementing cover and companion cropping, intercropping, using biostimulants, and improving nitrogen use efficiency.

Hub farms are used to demonstrate these practices to other growers in the area, while also using events such as Arable Scotland and Potatoes in Practice to show off new technologies such as steam and electrical weeders.

Farmers can also test IPM techniques more scientifically in the project using in-field trials, says Andrew. "Through the project, I can provide resources to measure outcomes from a comparison of a new technique versus the farm standard, which helps our hub farmers to assess the effect of a new approach relating to the context of their own farm."

An example has been tramline trials in Skyscraper winter wheat, which have compared a standard four-spray fungicide programme with an alternative 'biofortification' programme using elicitors to trigger plant defences, adding foliar nutrition to improve plant health, and the use of biological plant protection products.

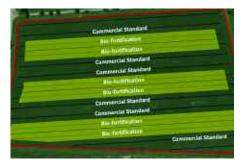
During the two years of comparisons, Andrew says the alternative approach achieved comparable control up to flag leaf, which showed potential savings could be made early in programmes. "We still have colder winters in our part of Scotland, so perhaps we see the benefit from hard frosts to help knock back pest and diseases early in the season."

In year one, differences were more



Andrew Christie says demonstrating IPM works in Scotland can prove challenging due to climatic conditions and reduced field travel time.

IPM workshop



Tramline trials through IPM WORKS compared a standard four-spray fungicide programme with an alternative 'biofortification' programme.

apparent after a late season yellow rust outbreak, although Andrew suggests if there was a decision support tool that could identify when an infection was likely, the biofortification programme could be more effective with more timely applications.

That led to a 0.75t/ha yield difference in favour of the fungicide treatment, and although it cost £55/ha more to apply, the higher yield more than paid for the extra cost. High septoria pressure was the main challenge in the second year, where the trial also included an untreated tramline. "Septoria infection reached over 50% in the untreated, but incidence in both the fungicide programme and alternative biofortification programme remained below 10%."

The comparable control between the two programmes wasn't what Andrew was expecting, but, while final yield analysis is still being carried out by ADAS, there also appears to have been a yield penalty from the biofortification programme again.

"In year one it was clear that disease was the major cause of the yield penalty, but in year two it was less clear. Was there an asymptomatic level of disease that caused the effect or is there an issue with diversion of energy for the elicitors to induce resistance within the plant that reduces yields?

"A trade-off between induced resistance and yield has been reported previously in other trials but it's difficult to know for certain in a field trial with so many other triggers for plant defence responses."

A second split-field trial has also

IPM management plan help

With £989 per year now available under the Sustainable Farming Incentive for assessing integrated pest management on a farm and producing a plan in conjunction with a BASIS-qualified adviser, ADAS has developed a tool to help achieve that aim.

Under IPM1 in SFI Paid Actions, the aims are to understand the benefits, costs, impacts and risks of the farm's current approach to pest, weed and disease management, and to create a plan for how to adopt a range of appropriate IPM methods.

Producing your own plan will be for many growers, not that straightforward, suggests ADAS's Philip Walker. "IPM planning can potentially be fairly extensive and complicated, and requires a wide knowledge base of effective IPM strategies across a range of crops."

That's why as part of a DEFRA Test and Trial project during SFI development, ADAS developed a simplified, user-friendly online programme to help amalgamate IPM information and actions across a range of arable and horticultural crops, he says.

The IPM Planning Tool, hosted on ipmtoll.net, and also found via the Voluntary Initiative and NFU websites, provides users with guidance to create crop-specific IPM plans for problem pests, weeds and diseases on their farms. Once registered, users can add IPM plans for multiple farms which is useful on estates or for those with multiple holdings, or, for agronomists using the tool with clients.

Once a new plan is started, a harvest year is selected followed by what crops are being grown that season. The tool then navigates through a series of screens starting with general IPM practices, followed by weeds, diseases and pests.

"For each IPM action you can say whether it's currently in use, planning to be used in future seasons, or not suitable for your farming system," explains Philip.

In the weed section, plants are separated into ones that would cause general problems across the rotation, such as creeping thistle, volunteer potatoes and common couch, and others which are separated between wide row and narrow row crops.

"We did this because there are some IPM actions which would work on wide row crops but not necessarily narrow row crops."

For the problem weed, pest and disease, you can also select the level of risk for each on the farm. Once selected, the next page navigates to all of the various IPM interventions the ADAS crops team have identified as effective strategies, from which users can select whether they are using in the current season or plan to in future seasons, or whether it isn't suitable for the farm or they have no intention of implementing.

"The idea is it can be used as a continuous review programme," says Philip. While last year's planned actions won't show in a new plan yet, ADAS intends to add that functionality in a future



There was little visual difference between treatments in the trial comparing biofortification (left) with a full fungicide programme (right).

compared the use of companion crops in OSR. The trial was primarily set up because of cabbage stem flea beetle concerns, but ultimately, they mostly didn't materialise.

Establishment was slightly better in the OSR with companion crops at 33 plants/m² compared with 22 plants/m² without. "We also found a 62% reduction in leaf loss in the OSR with companion crop." ►



Philip Walker and colleagues from ADAS have been involved with developing the IPM Planning Tool which supports SFI applications.

iteration and throughout the tool there are links to various sources of independent information about the weed, pest or disease, or the IPM control tactic, he adds.

Once complete, a summary page is produced for each crop with which weeds, pests and diseases have been selected as significant, moderate or slight risks, and the actions chosen to use this season, in the future or not applicable.

The document can be printed as a web page, and if evidenced it was completed with a BASIS-qualified adviser, it should be accepted for the criteria of IPM1 for producing an IPM plan.

IPM workshop



According to Mark Ramsden, only 5% of farmers are using decision support systems.

► Checks suggested final yields were similar in both systems, achieving averages of 4.4t/ha, but economically the companion crop use was cheaper as the more conventionally grown crop had starter fertiliser applied and a pre-emergence herbicide, which the companion crop didn't, says Andrew, leading to an overall saving of £155/ha.

"This was a success because we've reduced our inputs, had cost savings and maintained outputs. That's exactly what we're trying to achieve with the IPM Works hub, and even more crucially it's convinced some of our members it works in practice and they're now adopting it on their farms."

A second Horizon Europe funded project, IPM Decisions, runs alongside IPM Works. While reducing the requirement for pesticide use, for example, through cultural controls or improving plant health, it's also possible to reduce use through optimising applications, explains ADAS principal consultant Mark Ramsden. "That's where decision support systems can help."

The IPM Decisions support platform hosts

Alternative weed control project

Demonstrating and learning from other experiences using alternative weed control techniques are central to the Horizon Europe-funded project Oper8.

Seven countries and eight operational groups are involved in the work, which is being led by the University of Athens and involves ADAS and the Organic Research Centre in the UK.

"The network was brought together because there are lots of different groups looking at alternative weed control across Europe," explains ADAS' Lynn Tatnell.

While the project doesn't involve new trials, it's looking at how to bring shared existing

around 25 different decision support tools developed across Europe. "The idea is that a system that works well, for example, in Denmark, should work well in the UK or other countries. By working in collaboration, we can start sharing the knowledge and application across Europe more rapidly and move towards a better uptake of these systems."

He projects that currently, only around 5% of farmers are using decision support systems. "We've estimated that there could be a substantial reduction in pesticides across Europe if we could improve uptake."

Once registered, adding a farm's location to the platform will pull through local weather data from various open sources, which can be used in relevant decision support systems, explains Mark.

These include tools to help predict diseases such as septoria, potato blight and yellow rust, or pests such as aphids causing BYDV, slugs and carrot fly. There are fewer tools for weeds, but the Wageningen



IPM Decisions is a support platform which hosts around 25 different tools developed across Europe.

knowledge together, expand to other crops or locations, and then display best practice at on-farm demonstrations, she says.

A range of materials, such as fact sheets, videos and e-learning modules are also being planned to help farmers understand how alternative weed control practices can be used on farm.

Weed control practices being evaluated include camera-guided mechanical weeding, electrical weeding, robotics, self-seeding cover crops to provide competition in vines, development of novel bioherbicides based on essential oils, and the use of drone imagery to target herbicide use.

University developed IWMPRAISE tool is one of those hosted on the platform.

Understanding how farmers use IPM in practice and linking it to performance and profitability of crops on farm is behind the new IPM network (IPM NET) initiative ADAS is launching.

"At the moment there isn't a clear way of linking IPM activities with profitability and crop performance," says Mark. "The idea comes off the back of the test and trials work (see box) where we were talking to farmers to understand what's stopping people using IPM strategies, and a consistent response was a lack of understanding or knowledge of IPM and how to enact it on farm.

"There was also a concern that there was a financial risk starting off and farmers were unsure what the payback would be or what the risks were. So that's something we want to address in this network."

IPM NET is following a similar concept as ADAS has used in its Yield Enhancement Network (YEN) to share data to compare across farms. The starting point for network members will be filling out and agreeing to share data from the IPM Planning Tool, says Mark.

"We'll then ask further questions about what happened on farm and pull that together to not only understand what happened on that farm, but to also compare what happened on farms across the whole network.

"We're then going to link to the pest and disease survey we conduct for DEFRA to get a regional picture of pests and diseases that have been an issue that year. It would also be really useful if network farms took part in the pest and disease survey to help further link findings." IPM NET will be initially free to join, he concludes.

Energising soil health

BASE-UK conference

A PhD study conducted using Agrovista's Lamport AgX site is providing a scientific basis for why cover crops help to improve soil health. *CPM* heard more at the recent BASE-UK conference.

By Mike Abram

Agrovista's Lamport AgX (formerly Project Lamport) might be best known for its blackgrass research, but during the past six years it's also investigated improving soil health and function.

A key driving force for that work is a perhaps unlikely source in David Purdy. A territory business manager in East Anglia for John Deere, he also has a passion for soils which led him to undertake a PhD at Nottingham University investigating soil and plant interactions.

Lamport AgX is an important site for his research. Together with various partners, he's investigated cover and companion crops, varying depths and levels of soil disturbance, compaction, different cropping and rotations, and establishment methods, including drill type, residue management and dates.

Located in Northamptonshire on a

degraded silty clay loam soil by virtue of its 1:13 soil organic carbon to clay ratio, the fundamental challenge David is trying to address is getting energy into the soil, because he says this is what helps it to function.

Resilience

Functioning soils produce good cash and cover crops, cycle and manage water effectively, be resilient in both wet and dry seasons, cycle and store carbon and nutrients and be supportive and resilient to machinery, he explains.

"Another key function is effective gaseous exchange — I'm thinking particularly about oxygen and air, but also carbon dioxide and ethylene have to leave the soil," explains David.

Ethylene is a major plant hormone released from roots, he says. "If you don't allow it to move away from the roots, it backs up and the plant stops growing. Compaction isn't about mechanical constriction as much the build-up of ethylene."

A healthy functioning soil results from getting energy in the form of carbon into the system, he says. "That's about having plants living in the soil, with cover and catch crops providing an important route to maximising the length of time plants are living in the soil year-round."

Achieving that helps to overcome three of the major challenges to soil function — the loss of organic matter, soil compaction

66 What we want to create is a system that stores more than what leaves, and at the moment, most production systems do the opposite. 99

at depth and surface, and soil erosion. "To deal with those effects we've tried to build production systems at Lamport that



David Purdy has a passion for soils which has led him to undertake a PhD at Nottingham University investigating soil and plant interactions. Photo: Mike Abram.

BASE-UK conference



Soil structure comparison, from L-R: field margin; no tillage & cover crops; tillage & cover crops, tillage & no cover crops; no tillage and no cover crops.

 sequester and store carbon in the soil," he says.

In biological terms, carbon is delivered into soils through photosynthesis as exudates which leak out from plants, especially roots, and feed soil microbes. That's the process of sequestration — how carbon gets into the soil — but it doesn't necessarily equate to storage because carbon will also leave through microbial respiration. If more carbon is leaving than coming in, that's energy leaving the system.

"What we want to create is a system that stores more than what leaves, and at the moment, most production systems do the opposite."

Carbon flux readings, such as those carried out at Riseholme Farm by the University of Lincoln and Centre for Ecology and Hydrology, also highlight it's a dynamic system depending on management.

The readings taken during an 18-month



According to the research, cover crops aren't delivering the required construction at a soil surface level (close-up view of soil surface compaction).

period when sugar beet and spring barley crops were grown showed that during those crops' lifetimes, there were some periods where carbon was being sequestered into soils, but also particularly around establishment and harvest, and in between crops, more carbon was released from the field.

"Cash crops are critically important to this carbon story, but there are times in between when you perhaps have the opportunity to grow cover or catch crops to get carbon into our soils."

Combining that with reduced tillage intensity should increase net sequestration, ultimately leading to storage in our soils, he explains.

Cover crop trial

One of the long-term trials carried out at Lamport AgX is an eight-treatment trial comparing three cover crop mixes with plots grown without cover crops, with each option established using tillage, typically annual subsoiling to a depth of 25cm regardless of requirement, or no tillage.

"When we started this trial in 2018/19 we had low earthworm counts of around 180/m³ — approximately four per spade. We're now getting upwards of 22 per spade — around 600/m³ where we've grown the cover crops."

The increase in earthworms is driven by cover crop biomass with a clear correlation between higher peak biomass measured by NDVI within the cover crop plots and higher earthworm numbers, he explains.

Increased earthworm abundance drives nutrient cycling and therefore yield, according to recent research studies published in Nature. "The paper suggests earthworms make around a 6.5% contribution to global grain yields, rising to 8% in Europe; it's all about nutrient cycling." At Lamport, David's research has concentrated on infiltration rates which is another fundamental function earthworms deliver. Perhaps surprisingly, in the trial, where earthworm abundance with cover crops increased in year two, improved water infiltration rates took longer to demonstrate.

"It was only in year three when we started to see infiltration rates increase and from year four onwards we could see the soils handle water much better. We can see a huge difference in soil structure from year one to now."

The combination of different biology in soils from earthworms to bacteria and fungi, in simple terms, move soils, sew it together, glue and eat it, which helps to create soil structure, says David.

"What biology does, which nothing else does in soil, is create space in soils on a wide range of spatial scales — so you have big pores and lots of little pores. The big pores when it's very wet allow water to drain quickly, but the little pores when the soil is very dry hold onto moisture."

He says the combination of the two is crucial to moisture management, as is the connection between those spaces.

At Lamport, differences in soil structure between plots managed in different ways is stark after five years (see picture). Plots receiving the 25cm deep tillage operation without any cover crop are getting worse each season, says David. "If I picked up one of those big lumps and throw it on the ground it wouldn't shatter."

In comparison, the neighbouring plot has also never had any cover crops, but also no tillage. "It started looking really ugly," comments David. "But at the end of year three the soil started to break down. I wouldn't call it aggregated, but if you leave soils alone, they do a good job recovering."

A third plot has cover crops and tillage. "The cover crops are having some benefit at the top, but they haven't reached lower down. What we've lost in this soil is porosity."

In contrast, the plot with multi-species cover crops and no tillage had both a darker colour and better soil structure. "It's difficult soil at Lamport, but this now just crumbles in your hand."

By way of comparison, soil structure from the field margin was an even darker colour and better aggregated. "So we've seen a huge change to soils — cover crops accelerate the changes, bringing aggregation and the spatial pore spacing and porosity."

But establishment and termination date are crucial to getting the best results he says, with species less important. His advice

BASE-UK conference

is to avoid planting and terminating late.

This is because there's a significant drop off in dry matter from establishing cover crops even from mid-August to late-August, while some species, such as clovers, struggled to establish at all from a mid-September drilling date, he notes.

"Once you get into September, the day length is shutting down and you don't get the biomass from cover crops." And according to the Lamport trials, leaving cover crops to grow for longer in the spring results in significant yield penalties. "Our work suggests early termination is best by mid-January."

That could contradict Sustainable Farming Incentive scheme guidance for cover crop termination, he raises. "We like to have eight weeks between termination and planting, while SFI suggests six weeks, so it's a challenging decision."

But what has been the impact of using cover crops on carbon stocks in the soil, and how does that compare with using tillage? To answer, David measures soil organic matter and converts it to soil organic carbon, multiplies by depth of soil profile and bulk density at the same depth.

"At Lamport there's been no change in the top 15cm where cover crops are being grown, but carbon is increasing in the 15-30cm layer, storing 44t/ha compared with 36t/ha of carbon where cover crops haven't being grown. We've actually drawn down 27t CO_2e into that layer," explains David.

In comparison, tillage has released 17t/ha CO_2e into the atmosphere compared with no tillage in the 0-15cm subsection.

Those findings help to explain a key practical challenge highlighted by the Lamport trials — how cover crops contribute to very shallow compaction to around 80mm depth, and the effect on following crop establishment.

By measuring soil bulk density at different depths, David has shown that growing cover crops reduces bulk density to the same level as subsoiled plots at 15-30cm depths, but critically not at the soil surface. That's because the carbon has been built at depth and the two things are linked, he explains.

"But the cover crops aren't delivering the construction we want at the surface, so in our no-till systems when we get a very dry period in the spring, we have half the plant counts, regardless of growing cover crops, that we get out of our tillage system."

It only happens when soils dry and is partly related to how hard the soil is, with the compaction not necessarily visible at planting.

Further investigations by David suggest a

relationship to soil packing density which is the density of soil particles not including pore spacing, in comparison to bulk density which is the density of a volume of soil as it occurs naturally. It's calculated from bulk density using a weighting based on the amount of clay and silt in the sample.

"What I found is only a very small change in packing density is required to double plant counts. That means we don't have to pulverise soils, but just gently stretch them to counteract the surface compaction."

Subsoiler success

While David says he hasn't found the perfect machine, trials using a low disturbance grassland subsoiler with legs 450mm apart dropped in as shallow as possible to about 12cm, has worked well. He's hopeful that type of option will still qualify for no-till SFI payments in the future.

Carbon stock measurements can also be used to help calculate soil organic carbon to clay ratio to compare to the 1:10 benchmark Rothamsted research suggests is a good soil quality, with 1:13 being a degraded soil.

Comparing plots after five years suggests, despite the improvements cover crops and no-till have made to soil quality, there's still a way to go to reach the field margin benchmark at Lamport.

Using cover crops has improved the SOC:clay ratio to 1:16 from 1:19.3 at 15-30cm depth, which is still someway short of the 1:8 ratio of the field margin, notes David. Tillage has further degraded the top 15cm from 1:9.7 to 1:10.4.

And don't expect cover crops to improve yields, he warns. After 11 replicated trial harvests across five years with various tillage treatments, not one has shown a significant



The chances are cover crops aren't going to improve yields, but they'll improve the function of your soils, says David Purdy. Photo: Mike Abram.

yield improvement. "The chances are cover crops aren't going to improve yields, but you'll improve the function of your soils, which is really important.

"It will drive biology, improving soil structure; it's probably going to increase carbon storage, improve water management in soils, and reduce erosion. Growing cover crops should reduce the requirement for intensive tillage, while not eliminating it, should improve trafficability and overall sustainability and resilience.

"And there's a lot of opportunity, especially with SFI options, whether autumn or summer cover crops, or leaving a poor part of a field in a 12-month cover crop to get energy into the soil and bring a huge amount of function into it," he concludes.



Surface level compaction in no-till plots in May (a images) versus subsoiled plots (b images).

66 We're very aware that environmental requirements for farmers are becoming more prolific. **99**

Drills

Innovation never stands still and with focus moving towards environmentally conscious management, the drill and planter section of the machinery industry is no exception. *CPM* takes a look at some of the newest products and updates available to the market.

By Melanie Jenkins

Looking across the newest drill launches, it's clear to see that manufacturers are leaning towards producing drills aimed at low disturbance or direct drilling situations, with a conscious shift to machines that can be tasked with multiple purposes to help reduce passes, and thus compaction and cost. Here are some of the latest machines to hit the market.

Bednar

Two new additions to the Bednar stable

come in the form of the Directo No and the Matador Mo. "We're very aware that environmental requirements for farmers are becoming more prolific," explains the firm's Adrian Winnett. "Both of Bednar's new drills have been designed to reduce soil disturbance, erosion and overall carbon footprint."

Dynamic drills

Moving into the realms of direct seeding, Bednar introduced its Directo No at Agritechnica in November 2023. Equipped with a double-chamber pressurised hopper with a 5000-litre total capacity, it can be used for a single crop or dual application with fertiliser. When combined with the Alfa Drill seeding unit, up to three types of seed can be drilled or micro-granulate applied at the same time in a single pass.

"The Directo No is a direct drill that's been designed to place up to three different products in the soil at once," says Adrian. "This can help reduce the inherent cost of another pass to apply fertiliser and limit further compaction."

Seeding coulters are arranged in two rows, with the inter-row distance set at 16.7cm to allow for high throughput. Up to 250kg of downforce through the coulters should provide accurate seed placement even in heavy soils.

Bednar has also released its new

Matador Mo seed drill which is designed for strip seeding. "This has the capacity to place fertiliser deep in the soil and can be used to sow combinable crops with the Corsa CN seed rail, while a maize or sugar beet drill can be added to the tool frame to help users achieve the most from their investment," explains Adrian.

Featuring a double-chamber pressurised hopper with a 5000-litre combined capacity (40:60 ratio), the drill has been created to manage deep soil cultivation and seeding in one pass. It's equipped with Active-Mix tines for loosening up to a maximum depth of 35cm with the option of depositing fertiliser in the soil profile or on the soil surface. The tines are equipped with Auto-Reset hydraulic protection with a maximum release force of 870kg (maximum lift height of 30cm). The tines can be equipped with 40mm or 80mm chisels.

The disc working section operates behind the tines and is hydraulically adjustable. This can be set to level soil in front of the off-set tyre packer when drilling cereals or to create ridges for planting oilseed rape.

Horizon

Horizon has taken its increasingly popular DSX drill and produced a mounted version **>**





"We're now using the yield data to compare different drilling dates and varieties, to make decisions on what we do the following season."

Banial Crawford, Oxfordshire, 2023

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Drills



Bednar's Directo No is equipped with a double-chamber pressurised hopper with a 5000-litre total capacity and can be used for a single crop or dual application with fertiliser.

► in the form of the MDSX. "The DSX is our flagship product but we've designed the MDSX to be a lightweight, compact and cheaper version, suitable for smaller farms," explains the company's Charlie Eaton.

Because the MDSX is lighter, horsepower requirement is only 145hp for the 6m version, in comparison, the 6m trailed DSX would require 200hp or more on sloping ground.

The MDSX is available with two different row spacings — 22cm and 25cm, compared with 16cm, 18cm, 20cm and 25cm on the DSX.

According to Charlie, there are reservations related to mounted no-till disc drills and their capacity to force the disc into the soil without the weight of the trailed version. "This is something we tested on the prototypes of the MDSX in the spring, summer and autumn of 2023 and the drill was always able to achieve soil penetration. The undercut angle of the discs at 10° off vertical — like on a plough furrow or cultivation disc — means less downforce is required."

However, there's the option of adding weight blocks to either side of the drill and Horizon is currently developing a hydraulic weight transfer system which can be added to the three-point linkage.

The next step for the firm involves expanding the DSX range to include 8m and 9m versions. "To date, the 7.5m version is the largest drill we've made but in no-till systems, operations have to be done at the correct time meaning bigger farmers want higher output from their drills to get the work done."

The new versions will be available with the same row spacings as the smaller machines to produce high output but on narrow row spacings. "All other features are the same as the current DSX, including the row unit, row cleaners and multiple hoppers," explains Charlie.

Horsch

The new Avatar SL is the smallest and most manoeuvrable Avatar seed drill with a mounted three-point configuration



Horizon's mounted MDSX is designed to be a lightweight, compact and cheaper version of the DSX, suitable for smaller farms.

designed for precise sowing in mulch seed conditions. The depth control roller of the SingleDisc coulter is intended to ensure regular depth placement even in irregular conditions, while row spacings of 25cm or 30cm allow for mechanical weed control.

Used in combination with the Horsch Partner front tank, there'll also be the option of a solo version with an 800-litre seed tank in the rear. Hydraulic weight transfer achieves a coulter pressure of up to 240kg per coulter, which is especially useful in harder conditions.

"Looking at the direction of the market, with increasing environmental rules, direct drilling or very shallow cultivations are starting to prove more popular options," explains Horsch's Stephen Burcham. "At the moment, the primary way of direct drilling is often with a disc drill, but not everyone likes these as there can be issues with hair pinning, which is why we introduced the Avatar.

"What's completely new with the SL is it's now in mounted form, and the hope is that it'll open up a different market," says Stephen. "For those who perhaps don't want to go full speed into environmental measures it might be that a small, mounted drill suits them better than the trailed option. So the LS will complement and act as an alternative to the trailed Avatar."

Additionally, two new models join the popular Sprinter tine seed drill range; the Sprinter 6.25 SL and 12.25 SC. The models are aimed at reducing tillage to a minimum but can work well in high amounts of straw residue, as well as in harder soils. To ensure optimised seed-soil contact between the grain and seed furrow, the new Sprinters are equipped with a tine seed coulter that creates a residue-free seed furrow.

Three different interchangeable tine coulters (110mm WideEdge, 21mm ThinEdge and 12mm UltraThinEdge) enable the farmer to additionally react to various conditions.

The new 6m SL mounted model works in combination with a Partner FT front tank, while the 12m trailed SC model is equipped with a 6300-litre double hopper and is available with a triple tank and additional MiniDrill options. Both feature tines with a 25cm spacing and a 180kg release force.

The new Horsch Maestro TX is a compact, single grain seed drill with three-point linkage. It's equipped with a hydraulic telescopic slide frame on which ►

HORSCH

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Two new models join Horsch's popular Sprinter tine seed drill range – the Sprinter 6.25 SL and 12.25 SC. The models are aimed at reducing tillage to a minimum but can work well in high amounts of straw residue.

► the seeding units are mounted, allowing them to be expanded and contracted as required with working widths from 2.6m to 4.8m. It aims to offer precise placement of the grain and an optimum embedding at operational speeds of up to 15km/h.

It has common row spacings between 45cm and 80cm which can be set and adjusted in 5cm steps, explains Stephen. The Maestro 7 TX can also sow with a row spacing of 37.5cm or 40cm. If the middle row is deactivated, the operator can sow conventionally with six rows and a row spacing of 75cm or 80cm. The optional hydraulic weight transfer system guarantees higher coulter pressure while sowing. As an option, the Maestro TX line can be equipped with a 1300-litre fertiliser hopper and, as standard, is equipped with a fertiliser half-width shut-off. The fertiliser is applied with the Horsch metering devices at the single disc fertiliser coulter for underground fertilisation.

"Whenever we design anything we always start big first, so this marks the first time that we've produced for smaller famers or contractors in this market," adds Stephen.

KRM

Last year saw two developments to KRM's SM-P range of direct tine drills. "Firstly, we introduced a wider row spacing to the range," says the firm's Mike Britton. "The new version of the 6m drill has 24 rows spaced at 25cm



Weaving's new Lynx drill has been introduced to sit between its standard tine drill and Sabre tine drill.

(16cm is standard and still available). This was done in response to increasing demand for mechanical weeding. While it's possible to hoe a 16cm row it's a more practical proposition at a wider spacing, more soil can be moved providing a better result in the field."

Secondly, the firm introduced hydraulic depth setting. "The system replaces the traditional turnbuckles with hydraulic cylinders and spacers to set the depth. This uses the same oil supply as the folding circuit so no additional spools are required on the tractor and it can be retrofitted to existing drills. Simple precise adjustment can now be achieved quickly ensuring optimum results."

For the coming year, KRM will be introducing an 8m version of the mounted SM-P seed drills. This'll be on show for the first time at Cereals and will use the wider 25cm row spacing, providing growers with the opportunity to hoe should they wish.

"The drill will utilise the same pressurised hopper and Isobus controlled electric metering as the rest of the range. Tungsten carbide tipped coulters will create the seed slot and the same double row following arrow with a row of straight



Väderstad's new Seed Hawk 600-900C is a new machine which has been designed around the firm's Seed Hawk knife coulter system.

tines and a row of cranked tines ensure the seed is covered."

Väderstad

Väderstad's new Seed Hawk 600-900C is an entirely new machine which has been designed around the firm's Seed Hawk knife coulter system. With a large hopper split into three compartments with a 7000-litre capacity, it offers seed and fertiliser versatility.

The new machine has a Fenix III metering system to produce an even

product flow to the seed and fertiliser coulters, and is operated via the iPad-based control system Väderstad E-Control. To ensure field performance when seeding directly in heavy crop residues or after cover crops, the Seed Hawk knife coulter can be complemented with a front disc as an option.

Although a similar version of the machine has been on sale in Canada for a number of years, the new machine will be the first of its kind on offer for European markets. ►

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Drills



The benefits of the Claydon drill are enhanced by Astley Farms' 4.8m Claydon TerraBlade inter-row hoe, says Luke Rodway.

Weaving

Weaving's new Lynx drill has been introduced to sit between its standard tine drill and Sabre tine drill. "It's been designed for farmers who want a lower disturbance tine drill for use in low disturbance sub-soiled situations, or if conditions allow, a small proportion of direct drilling," explains the firm's Simon Weaving.

"The Lynx is considerably cheaper than the Sabre but has the same row spacing and high trash flow capacity, just simplified. The wings still pivot for better contour following, but it has smaller tyres and aluminium spacers instead of hydraulic rams."

It includes four rows of auto-reset



The Klinea is the latest innovation in cereals hoeing. It features central tine angle adjustment (without tools) to improve penetration in hard conditions and utilises the new Kipline camera system for automatic guidance. The shares are followed by harrow tines to remove soil from weed roots and prevent re-growth. Optional section control lifts each element independently at the headland for the ultimate in accuracy and efficiency.

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tungsten tipped tines with 'z' following harrows mounted to a frame set on wide flotation tyres. There are four depth wheels located in the centre of each wing that control depth and these can be adjusted by lifting the Lynx out of work and changing the aluminium spacers located on the wheel arm.

The 2000-litre hopper on the Lynx is the same as the Sabre, however as standard, it comes with the basic RDS Artemis Lite electric metering system with GPS forward speed monitoring which can be upgraded for Isobus connectivity.

As it's lighter on a more compact frame, the 6m Lynx requires 155hp, while 140hp is sufficient for the 4.8m version, he explains.

Claydon Opti-Till: farm perspective

The combination of direct drilling and inter-row hoeing has been transformational for Astley Farms. Since introducing the Claydon Opti-Till System timeliness has improved dramatically — staff and tractor requirements have fallen and diesel use has plummeted by 60% — yet soil structure has improved significantly.

An all-organic enterprise, Astley Farms comprises the 567ha in-hand portion of the Astley Estate near Fakenham. Owned by Delaval Astley, Lord Hastings, it's been farmed organically for over 20 years and received awards for its conservation work.

Farm manager Luke Rodway, who's been with the business for four years, having previously worked for one of the estate's tenanted farms, highlights that the owner of the East Anglian estate has a strong interest in regenerative farming.

"The crops we produce are either for seed or go into organic pig and poultry rations. Yields from crops grown on our



The Claydon Opti-Till System has produced numerous benefits at Astley Farms, including a dramatic increase in worm numbers.



The 4.8m Claydon Hydrid drill is used to establish a range of organic crops at Astley Farms.

primarily light soils will never be as high as those on better quality land and are 50% to 60% of what might be expected from a non-organic system under similar conditions. However, the organic premium compensates for that shortfall and, with much lower costs, gross margins are comparable to those of crops produced conventionally."

Luke says their previous plough-based establishment system was slow and expensive with cultivations taking one man most of the winter and drilling a further six weeks. "Claydon Opti-Till really has revolutionised the way we farm because now one man can do virtually everything in two and a half weeks. It's a cheap, simple system which is highly effective, works well and delivers great results.

"Timeliness is a key factor here, even though the soil is mostly light and rainfall averages 650mm per year, but the last two autumns and springs have been wet. Had conventional methods still been used to establish crops we wouldn't have been able to complete all our planned drilling because the results from fields sown in adverse conditions wouldn't have been good enough to justify the investment," he adds.

When Luke joined the business in 2018 it also employed two full-time staff on the livestock side and two men on the arable team. While the system 'worked', the onset of the pandemic in March 2020 and subsequent lockdown resulted in the elder member of the arable team going into isolation, while the other employee decided to retire.

Things had to change, so during what was an extremely challenging period Luke decided to review the farm's entire system and consider how it could operate more efficiently and reliably.

"Like everyone else we're looking to reduce our cost base and improve our soils so we could get on earlier and benefit from improved timeliness. One of the biggest difficulties in moving away from a system where 162ha were ploughed and pressed each year was finding a drill which would successfully sow crops directly into min-tilled land that couldn't be sprayed off with glyphosate because of our organic approach, and which would work on ploughed land equally well.

"Simplicity was one of the Claydon's key advantages compared with other drills I looked at. Some were too expensive, others too complicated, while some seemed likely to block even in slightly damp conditions. What we wanted was a drill which was well priced, simple, practical, and reliable, yet could cope with a wide range of soil types, conditions, and crops," he explains.

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Drills

► Luke was certain it would work well. In 2020, when the opportunity arose to purchase a lightly used 4.8m model, he decided to move forward with his plan to reconfigure the business.

Now, the area previously ploughed and pressed by the farm's labour and machinery has been reduced to just 40ha of two-year leys and the job is done by a contractor, part of a raft of changes which has reduced the number of full-time staff from five to just three. In addition to dramatic savings in labour costs, the number of tractors has been reduced from four to two.

"We used to operate two tractors on the arable side of the business — a 210hp New Holland T7.210 and 165hp New Holland T6.180, plus two smaller livestock tractors. I part-exchanged the T7.210 against a new 270hp new Holland T7.270 which works alongside the T6.180, so now

both tractors are fully utilised throughout the year," outlines Luke.

In excellent condition, the Claydon Hybrid had previously covered just 1112ha on a farm in Cambridgeshire and came with a stack of wearing metal. Since then, it's completed over 405ha in three seasons, although annual use will increase to around 202-243ha when 81ha of formerly tenanted land is taken back in hand.

Organic rotation

Fully organic, Astley Farms operates a five-year rotation, comprising three years of arable crops followed by a clover ley which is then ploughed down after two years, the Claydon being ideal for drilling into land which has been inverted.

Cropping includes winter wheat, spring barley in the form of the old but dependable variety Westminster, together



with rye. The farm also grows spring oats, split 50/50 between the well-proven varieties Canyon from Saaten-Union and WPB Elyann, both for seed because the farm struggles to achieve milling quality from any cereal crop.

"All will be drilled with the Claydon Hybrid, which is simple to use and maintain," says Luke. "In addition to our own drilling we've used it for some contract work, mainly sowing beans for neighbouring farmers.

"They like the Claydon because it means that they only have to spray off any green material and then we direct drill the beans 7.5cm deep. With no cultivations required, it's a simple, fast and inexpensive way to establish crops," he says.

George Gill, who does most of the drilling using the farm's 270hp New Holland T7.270, has found the Claydon simpler to calibrate than their former drill. "Equipped with RTK guidance, the tractor would pull the drill much faster than the normal 9-12 km/h, but forward speed is maintained at this level to achieve optimum consistency and accuracy. The following harrow leaves weeds on the surface where they're left to dry out for a few days before rolling."

The 2022/23 season was the first in which Astley Farms grew winter milling wheat. Luke grew 25ha of KWS Zyatt largely because staff at KWS UK's head office were helpful in answering his questions about growing the crop under an organic system.

"With much less labour now available the aim was to further spread the workload and produce a tall crop which would help to smother weeds," explains Luke. "Zyatt developed strongly, looking so good throughout the season that it was impossible to tell it was organic, and yielded very well, producing an excellent gross margin."

The benefits of the Claydon drill have since been enhanced with the purchase of a new 4.8m Claydon TerraBlade inter-row hoe in 2021 from TNS at Fakenham. Two passes through the winter wheat are carried out during the autumn, followed by a further three in the spring, starting as soon as conditions allowed. The TerraBlade has been highly effective and covered about 486ha last season.

"There's no question that direct drilling and inter-row hoeing with the Claydon Opti-Till System has revolutionised the way we farm, and the benefits are increasingly evident the more that we use it," concludes Luke. ■





real-world conditions take place over the next few years.

"Karl shouldn't be considered a replacement for the tractor, but a different concept entirely, with the potential to run a fleet of Karl autonomous tools to adapt to different farm sizes and labour restrictions faced by farmers across the world," concludes Edd.

FarmDroid

Innovation isn't always about the development of a completely new

Thinking big

66 Field crop production is evolving significantly with farmers aiming to lower soil compaction and reduce chemical inputs, while maintaining food supply. 99

dea, sometimes it appears in the tweaking and gradual upgrading of existing products. One such innovation is the upgrading of the solar-powered FarmDroid to a four-wheeled version. Until now the autonomous seed-and-weed robot has only been available in three-wheeler format, limiting its

ability to operate in certain specialist applications such as with salads and herbs grown on narrow row-spacings.

The four-wheeler aims to change all that. With pairs of wheels running in the same tracks front and rear, the unit is able to straddle the rows of crop, enabling it to plant seed into flat beds and return subsequently to weed between the seedlings without running any crop down.

Ultra-precise RTK-corrected GPS guidance means the FarmDroid can work autonomously, returning to the same wheelings time and time again with less than 5mm deviation from the original line of work. This same technology is what makes it possible for the machine to record exactly where it plants each seed, enabling its knife-shares to weed to within 5mm of each seedling.

Having a wheel at each corner also means this latest version is more stable on sloping ground, according to the firm. By reducing the opportunity for a shift in weight distribution when the unit is traversing inclines, the extra wheel means traction is maintained and reduces the requirement for extra ballast to retain grip in tough going.

This latest development is the first of a number of innovations set to widen the FarmDroid's scope of operations in the UK.

The Danish firm is working on a range of new technology that'll give its machines even greater appeal to a wider audience, particularly those looking to reduce pesticide ►

Smart Farming

Smart technology in agriculture is progressing at a rate of knots with new innovations promising to optimise workflow, streamline processes and utilise every ounce of data available. *CPM* digs into some of these unfolding technologies.

By Melanie Jenkins

It could be argued that the future of agriculture is being forged in the form of smart agri-tech, with AI, multispectral satellite imagery and real-time ground sensors promising to open up a new world of productive farming.

Here's an insight into some of the latest innovations, developments and advancing technologies that could reshape the industry.

Kuhn

Following on from the innovative success of Kuhn's Aura, an autonomous self-propelled mixer, the firm unveiled its latest autonomous concept at Agritechnica in 2023, Karl. Designed to meet the requirements of progressive crop production systems, Karl is an ambitious step from Kuhn toward automated crop production. According to Kuhn's Edd Fanshawe, Karl is an autonomous solution dedicated to plant production

which the firm is convinced will offer many advantages to growers. "Field crop production is evolving significantly with farmers aiming to lower soil compaction and reduce chemical inputs, while maintaining food supply. This focus will likely increase the number of operations, and agricultural robotics can help in a big way."

Karl uses a hybrid diesel/electric power source with a 175hp Volvo engine running an electric generator. The drive of the tracks and implement is solely electric, which offers a smooth drive engagement along with the ability to make incremental adjustments to the implement.

The machine has a level of intelligence to detect errors, blockages and breakdowns by sending an alert signal to Karl if there are issues, something that isn't possible with a conventional implement with no communication method.

A 2.5m Kuhn HR 2520 e power harrow has been tested with Karl for several hundred field hours. The width was selected due to the ease at which it can be loaded on standard trailers for transporting between fields without requiring additional licences. Kuhn is currently exploring soil engaging and shredding implements, along with additional tools from the firm's portfolio that can be available for use with Karl in the future.

"Although Karl isn't ready for commercial production yet, we hope that a five-year timeframe is realistic as more field tests in

Smart Farming



Designed to meet the requirements of progressive crop production systems, Karl is an ambitious step from Kuhn toward automated crop production.

► use, move towards energy independence and automate certain operations.

Agrovista

It goes without saying that most people wish they could predict the weather, and it's

something the technological sector is constantly striving to achieve. In efforts to help farmers get ahead of this most unpredictable of challenges, Agrovista has launched a suite of new and updated on-screen features to its weather station services to help optimise crop management following an extensive overhaul of the company's data platform.

Several hundred weather stations provided by Agrovista are in use across the UK measuring a range of parameters including rainfall, air temperature, soil temperature, soil moisture, relative humidity, leaf wetness, solar radiation and wind speed, depending on which option growers choose.

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weather-based information that individual growers can access via their own online dashboard on a range of devices.

This information includes live weather data, weather forecasts, crop disease predictions and irrigation management (in combination with soil moisture sensors).

The most obvious change to the service is the new dashboard design which presents a wide range of data in a cleaner, more accessible format via an app that works across different devices, says James Martin of Agrovista Weather. "The modernised dashboard display will be especially useful for smartphone users, helping them to easily access all the information they require."

Weather and disease forecasting for all crops including arable, potatoes, vegetables and fruit, as well as a forecast for spraying conditions, are now included on the same platform, says James. "Before they were on a separate system – now we've embedded them, improving access."

Up-to-the-minute weather data helps growers to make immediate decisions, while detailed short- and medium-term weather forecasts aid planning. These forecasts, along with additional measurements such as leaf wetness, are also used to model accurate disease forecasts for precise integrated pest management planning.

In addition, access to rainfall measurements in the local area for the past 24 hours and previous seven days provides a valuable overview for growers who irrigate. "This is particularly useful for crops further away that are covered by a weather station," explains James. "Growers with moisture probes can also find out which areas require irrigation, and how much."

The update also includes an irrigation probe dashboard with a soil forecast, indicating where moisture might be after seven days without rain. Additionally, the dashboard shows rain amounts, soil moisture levels and temperature measurements, as well as EC measurements for soft fruit growers.

"We're also working on water monitoring for irrigation pumps so growers can record water usage and pressures within the dashboard," he says. "In addition, we provide a similar feature for polytunnel systems."

New crop development indicators have also been introduced — growing degree days for all types of crops, growing degree hours for soft fruit crops and cooling degree hours for crops like blackcurrants which require a certain amount of chill over the winter. "Using these, growers can obtain thresholds for key management decisions



A four-wheeled version of the FarmDroid has been launched to allow it to straddle rows of crop, enabling it to plant seed into flat beds and return subsequently to weed between the seedlings without running any crop down.

and inputs," says James.

The overall result is a more comprehensive tool that enables growers to connect swiftly and easily to their data, he says. "It pools relevant data from different sources and delivers a lot more value for money, putting real-time weather insights into growers' hands."

Hyperplan

From earth-bound weather stations to space-based satellites. Hyperplan, a French company operating in France, Germany and Spain, is looking to bring its predictive insight business to the UK. Targeted at agri-businesses and agricultural cooperatives, the firm's platform uses satellite data about the crop canopy, weather and soils and combines this with crop yield models to anticipate supply volatility.

This type of technology is aimed at improving reaction times to changing situations for commercial and marketing teams so that opportunities can be seized as early as possible.

According to the firm's Rémi Banquet, volatility in agriculture can make it difficult to gain an objective assessment of situations as they occur, such as crop area, performance and potential yield. "With Hyperplan, our clients can determine what's grown, where, the volume, and monitor the stage of maturity through the season."

Working with French company, Arvalis — an applied research

organisation that works with cooperatives and input firms, as well as feed, food and non-food industries – Hyperplan uses its own knowledge and statistical modelling to develop hybrid models and optimise information from its satellite imagery.

Using multispectral satellite imaging, Hyperplan identifies crop type and monitors development of the crop canopy and vegetation cover. It has access to Meteo weather data and Lucas Soil, Europe's largest topsoil database, with real-time information made available through a single, easy to use platform.

According to the firm, there's great potential to use this technology to offer greater insights at a field level, as this would enable it to offer farmers and growers more personalised services.

"Being able to provide a customised service is particularly important in the transition to regenerative farming, where there's a focus on effective rotations and improving productivity with fewer inputs," explains Rémi.

"For agribusinesses, it means that their reps aren't going in cold. They have a sufficient level of knowledge to start engagement with the farmer to have a proper discussion and fine-tune the response.

"They're trying to sell the most efficient products that'll help the farmer gain better performance and improved margin, for ►

"Spinning disc spreader"

FAN JET



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Smart Farming



Several hundred weather stations provided by Agrovista are in use across the UK, measuring a range of parameters including rainfall, air temperature, soil temperature and soil moisture.

► example, a particular variety that grows well in their soils. This includes using historical data on rotations to look ahead to the next season and advise on suitability of follow-on crops.

"We're helping our clients to anticipate the market for the year, and this is invaluable to

MULTICAST 20

allow them to plan their budgets and marketing operations very early."

PES Technologies

An electronic nose aimed at determining soil health through smell, with results delivered to a farmer's phone in five minutes, is being developed by PES Technologies. The company is able to create an aroma fingerprint from gas released by microbes in the soil. These organisms are essential for breaking down organic matter and making nutrients available to plants, but current biological lab tests are expensive and take 10 weeks to provide results.

"Our electronic nose could potentially be trained on more indicators than the ones that we'll offer on launch, and we're keen to explore what people are looking for," explains the firm's Jim Bailey.

Having secured £2.4M in funding, PES Technologies is looking to build on the successful commercial trials it carried out with large agronomy companies and farm businesses in 2022, according to the company's Andrej Porovic. "This enables PES Technologies to complete product development, power product launch in 2024 and hire the key commercial and administrative staff needed to turn our potential into a commercial success story."

Plenty Sense

Using sensors, PlentySense is able to provide real-time monitoring of soil nitrogen availability under growing crops.

Around 50% of nitrogen applied to crops isn't taken up and can leach into the environment, but sensors developed by PlentySense — a spinout from the John Innes Centre — can measure the amount of nitrate taken up by the growing crop and the reserve available in the soil, thereby optimising fertiliser usage.

The first sensors are designed to measure nitrate, but Dr Yi Chen and Professor Tony Miller are working on adjusting the sensor chemistry to quantify other nutrients, including potassium (K) and phosphate (P).

According to Yi, the sensors give early actionable insights. "If aerial or satellite imaging used to measure the health of the crop indicates a yellowing of the leaves, then it's too late — yield has already been affected.

"Our sensors enable action to be taken that'll ensure that the plant has the right amount of nutrition throughout the year without waste or yield penalty; this'll have a huge financial and environmental benefit."

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Moving with the On Farm Opinion

What's the result when combining a carbon removal specialist with a Scottish agricultural contractor, a fleet of Fendt tractors and a ready supply of volcanic rock? The answer is, a new way to create carbon credits. *CPM* finds out more.

AND AND A

By Melanie Jenkins

More than 90 percent of the world's volcanic rock is basalt, making it easy to find when mining in areas with current or historic volcanic activity. Rich seams of basalt exist in the UK and carbon removal company Undo has been collecting it from mines and quarries to use on farmland.

"Basalt is an existing aggregate product of many UK mining operations which has agronomic value because it contains potassium, calcium, magnesium, sodium and sulphur that act as a soil conditioner," explains Undo's Joe Ritchie.

A Sheffield University study has established that at least six nutrients in basalt are essential for plant growth. According to another 2020 study that tested the effect of crushed basalt on sorghum trial plots, it increases yields by up to 20% without the use of phosphate and potassium fertilisers.

Furthermore, Sheffield University and others worldwide agree that basalt has carbon-fixing properties. This has led Undo to partner with mines and agricultural contractors to apply basalt to fields in the UK through a process known as enhanced rock weathering (ERW).

"ERW is a carbon dioxide removal technique which is already removing tens of thousands of tonnes of CO₂ from the world's atmosphere," says Joe.

Trusted relationships

For the farmer, Undo supplies the basalt free of charge by working with local, trusted contractors, which has the added benefit of creating jobs in rural communities. "This gives the farm the nutrient value of the basalt and the contractor an income for spreading it. When the operational data is harvested it's used to create carbon credits," he adds.

Undo then sells these credits to clients such as Microsoft, British Airways and McLaren, which helps to offset the carbon generated by these businesses' operations and enables each to move closer to net zero.

By using ERW, Undo removes 1t/CO₂ for every 4t of basalt applied to agricultural land at a concentration of 20t/ha. "This geological process has happened naturally for millions of years. However, mining basalt from the ground, grinding it to almost a powder less than 4mm in diameter to be precise, and applying large quantities to agricultural ► **66** With millions of hectares of land and millions of tonnes of basalt, there's seemingly no limit. **?**?



Robert Hamilton was approached by Undo to apply basalt in Scotland from his base just south of Glasgow.

On Farm Opinion



A study has shown that at least six nutrients in basalt are essential for plant growth.

► land, has simply accelerated this process," explains Joe.

Undo collects a lot of data to generate carbon credits. A custom-built data platform named Newton houses rock mineralogy data tied to the location of each spreading job. This allows for a single tonne of CO_2 removed to be tracked back to a specific rock type spread on a specific field, providing 100% traceability.

Crucially, Fendt's FendtOne system tracks the tractors' fuel use for each spreading task, allowing Undo to subtract the carbon emitted during the collection and spreading of the basalt.

Contractor Robert Hamilton was approached by Undo to apply basalt in Scotland from his base just south of Glasgow. The firm supplied the basalt and he was willing to invest in the AgriSpread machines required to spread it with his incumbent fleet of Fendt 700 series tractors. The partnership had the hardware, but as with most endeavours,



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the devil was in the detail.

"Spreading the basalt was a relatively easy task, no more difficult than lime and recording how much had been spread was equally easy. However, equating that data to the distance travelled, combined with how much fuel was used and the quantity of basalt being applied, was harder," explains Robert.

Data sharing

Fendt launched FendtOne as a new way for tractors to share data. Although in its relative infancy, it has the capacity to share fuel, time, quantity of product applied by an Isobus implement, and the

FendtOne focus

Robert Hamilton started contracting in 2001, initially spreading lime and fertiliser. He bought his first Fendt in 2006 and moved into silage contracting ten years ago. The business has further diversified away from agriculture to offer a gritting service to roads around Glasgow.

"We keep the Fendts for about 6000 hours and always under warranty, I don't like surprises. However, the tractors and support from McNae [dealership] has been good, and finding out we could update the older tractors to run FendtOne has saved significant amounts of time and money," says Robert.

With seven Fendt 700 series tractors, a 930 Vario and an older 718 in the fleet, Robert is able to operate two sets of Claas triple mowers, two McHale Fusion combi balers, a Pottinger rake and Lely tedders. He also runs a further seven tractors on light work, a Claas Jaguar 870, two JCB 320s, a 420 and a 434.

Working closely with local dealer McNae, Robert began to explore how the relationship with Undo could work and what investment was required to make his Fendt fleet fit the task. Drew McNae spearheaded the move to update the fleet to operate on FendtOne and worked with Fendt's precision farming manager, Ben Williams, during the process.

Robert now runs three AgriSpread AS285 spreaders which connect to the Fendt tractors, using Isobus to transmit data. Prior to using FendtOne, operators and members of the team from Undo would have to manually extract data from the AgriSpread's Isocam control box.

"It was stressful, time consuming and almost impossible to get accurate data for variable rate work. Using FendtOne is ideal because neither me nor my operators have to get involved. The data is communicated in real time by the tractor, all we have to do is set up the jobs," says Robert. Taking a deeper dive, FendtOne is an

On Farm Opinion

size of area that received it.

"It can record everything in real time without additional software or hardware like memory sticks. It provides everything Undo requires to create a carbon credit, so all we have to do is set up the job for the tractor and FendtOne records the job," he says.

Questions may arise regarding whether this is possible with any tractor. Robert says possibly, but data is a fickle thing and often difficult to share and interpret accurately. Fendt was not only able to offer Undo the data it required from Robert's exploits across Scotland, but it also found a way to enable his whole fleet.



Using FendtOne is ideal because neither me nor my operators have to get involved, says Robert Hamilton.

onboard/offboard system that enables data to be shared from the tractor. The system transmits task time, fuel used, distance, area, and data transmitted from implements such as the AgriSpreader used for applying basalt. It does this in real time and in a format that can be shared easily, says Fendt's Ben Williams.

"FendtOne is available to any Fendt operator with a tractor that was factory fitted with the system. It can also be provided to other tractors in the fleet so long as each has the 10.4-inch screen which features VarioDoc technology that can be updated to FendtOne," he explains.

An offboard phone, tablet, or computer-based application is used to communicate tasks to the tractor(s) and harvest data about the task. This can be shared with other farm management software such as Gatekeeper or Omnia.

"Soon tractors won't be judged solely on practical capabilities such as horsepower ---data is becoming as important. The work with Undo has shown the importance of machines making data easy to use. From now on we expect machinery decisions to be made based on how efficiently machinery operates in conjunction with how accurately it transmits operational data," concludes Ben.

"Any Fendt 500 series, or larger tractor fitted with the 10.4-inch screen and Fendt's VarioDoc system, can be upgraded to provide the same information, in the same way as a new tractor operating with FendtOne. I have updated S4 generation 700 series ProfiPlus tractors that had the optional screen factory-fitted and are compatible with the new software," says Robert.

The tractors were all fitted with a sim card, the same as those used for a sim-only phone contract, and instantly became data sharers. Fendt also required a software license fee of approximately £100 per unit to enable the older tractors to be added to FendtOne and become capable of performing the same job.

"At least one Fendt in the fleet must be a newer model manufactured with

FendtOne inbuilt in order for the owner to have an account, but I already had two Gen 6 724 ProfiPlus models so one of them became the lead tractor," he explains.

By converting four older 724 S4 models he was able to commit tractors with higher hours and less power to the spreading work, which reduced his cost per hour and freed up his newer tractors for more demanding work.

In year one (2022), a mere 10,000t of basalt was spread by Undo, at which time it was possible for the firm's team to grapple with memory sticks and various different file types to record the data they required to prove carbon credits were being created.

In 2023, this rose to 128,000t. This increase was, in part, due to having more >



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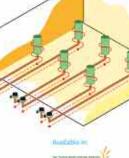




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Robert Hamilton invested in AgriSpread machines so he could spread basalt with his fleet of Fendt 700 series tractors.

 tractors on the ground that could share data faster using FendtOne.

"Downloading files from USB sticks and uploading BIN files, variable rate maps and spread rates, was clunky and inefficient. Now, all the data is sent in real time from the tractor using FendtOne, and Fendt will soon offer CSV files that can be downloaded from the system to enable immediate data export to other applications," says Joe.

No limits

"With millions of hectares of land and millions of tonnes of basalt, there's seemingly no limit to the technique Undo has created and no feasible reason not to max out the application of basalt worldwide," he adds.

However, it's important to note that the mineralogical composition of the basalt has to be established before it's ground and spread. Undo tests the feedstocks from each of its sources every 3000t to ensure the safety of the material and provide valuable data to determine how fast the rock will weather.

This sampling has the added agricultural benefit of offering the farmer or agronomist the amount of potassium, calcium, magnesium, sodium and sulphur present in the basalt being spread.

"The calculation of how much carbon is being sequestered from the process is an equally complex process. Grinding the rock makes it

more effective at capturing carbon as its increased surface area catalyses the chemical reactions between it and the CO₂ in rainfall.

"It's ground to 1-4mm and geological makeup is analysed and correlated with global climate, weather and rainfall. This is then used in conjunction with spreading data to supply the necessary information for our carbon credits," explains Joe.

And because the process isn't simple, Undo developed the Newton data platform to manage operational and scientific data. FendtOne is then required to provide Newton with data for every second a tractor is operating and the quantity of basalt it's applied.

A unique inventory management system (IMS) is subsequently used to generate the projected carbon credits based on the pooling of all the information relating to each tonne of basalt. This includes information about the quarry, the rock sample, haulage, spreading location, hours, fuel use and more.

"Only by using this can we provide the data in a cost-effective and time efficient way. And this is crucial to scaling the model. Automating the entire process has been business-critical and now we have the capacity to process millions of tonnes of basalt accurately using our own software and FendtOne," concludes Joe.



Knowledge is power

Unsurprisingly, I have no field work activities to report this month — the nearest we've been is making a muck heap in one of our driest undrained fields three times bigger than is required for the 3.5ha field it sits on.

For the first time in my memory we haven't been able to tip muck in winter where it's to be spread, so it will be to move again. Hey-ho, I'm not on my own with that, I'm sure. We haven't been able to lift beet either, but going by the factory outputs, that's a widespread issue too.

So wet day jobs have been the order of the day here. They take many forms — from recruiting a member of staff to fill a vacancy in our little team to making some ventilated doors for our pig sheds, as well as servicing spring machinery, catching up on some training and having a few days holiday.

I've been fortunate to benefit from the advice of many wise people over the years, but one that always sticks in my mind was given to me at a time when I was being a particularly irksome know-all teenager

(engage Yorkshire accent for this!).

"You want t'gerr out ot farm gate an larn summat lad, or y'll the gentleman was trying to point out to me that there was life outside of our little patch, and I hadn't been on the earth long enough to know everything yet.

How wise he was. Here we are 30 odd years down the line, and I find that I've barely scratched the surface of what's out there to learn about even just growing potatoes, never mind the wide-ranging subjects that agriculture encompasses.

I have a broad YFC heritage and sit as a founder member of a group called the Future Farmers of Yorkshire, in addition to playing an active part in the AHDB SPot, Strategic and Monitor farms over the years. Levy isn't avoidable, but becomes no more than a tax if one doesn't engage in the services available --- where else could I benefit from the minds of inspirational people like Philip Wright, Neil Fuller, Joel Williams, Hannah Fraser, or Tim Isaac for no cost beyond my time?

This principle applies to many things including farm walks, discussion groups and industry body meetings like GB potatoes - the more people that turn up the better the discussion and knowledge transfer is possible - I've never come away from such a meeting and not learned something.

Back on the farm we've just finished loading our February contracted potatoes, with nearly half of them going through our washer due mostly to dry rot in

store. Soils for potato growing in 2024 are sampled and fertiliser planned, along with an inevitably larger and ever edited programme of spring drilling for the rest of the farm.

Cover crops this season were once again a struggle to establish, but even the poorer ones have showed their worth in protecting the ground from the blasting that heavy rainfall can deliver, along with capturing nutrients, sequestering carbon, reducing cultivation requirements, and keeping nematodes in check. They'll be desiccated and most of them topped in the coming weeks as ground conditions allow.

I won't say too much about the impending loss of our industry's oldest multi-site blight protection product here because it's covered elsewhere in this publication, but just to say the real loss is in the associated consequences such a ban brings via co-formulations.

Mancozeb has been around for many years, yet sadly it's to go the same way as Diguat, CIPC and others. A cynic would say its demise is more driven by money than any safety issue, but I'll leave you to decide that yourselves!

Having put myself through the annual CPD that is the NROSO update. I also learned of the newest big stick to our industry, that of Pesticide Enforcement Officers. I have to say I prefer a carrot to a stick, but we have little say in the matter. I urge you all to carry out a self-audit of your chemical stores and procedures while we can't get on the land.

Even given all that doom, I somehow remain optimistic for a decent 2024 potato season. Next

Andrew Wilson is a fourthgeneration 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

week will see seed potatoes arrive to potentially be dressed with fludioxonil before going into Blackburn crates for chitting ready for planting. Machinery is at least part serviced and plans are mostly made. It will dry up soon, I'm sure.

In the meantime, I'd better go and do that self-audit.



One of our cover crops doing its thing.

HELIODOR 9 VERSATILE AND COMPACT



A strain on the future

Forward-thinking farmers

Seed shortages, mancozeb uncertainty and more resistant blight strains are set to compound the difficulties caused by one of the wettest autumn and winter periods on record. *CPM* reports.

By Rob Jones

Potato growers are facing more than the usual array of challenges this season. Of greatest concern is the spread of late blight strains with multiple resistance to two widely used fungicide groups and the difficulties these will create in delivering season-long protection.

Virus too is set to present an unseasonably high risk to crops. The area of Scottish seed crops infected with potato leaf roll virus (PLRV) has been steadily increasing. It's now the dominant aphid-borne virus found in symptomatic leaves by inspectors at 55.5% of cases, while the relative incidence of Potato Virus Y (PVY) has fallen to 36.3% in 2023 from 51.8% the previous year.

Seed certification schemes have done much to reduce the chances of infected seed being sold to commercial growers, but the greater issue is that the peach-potato aphid, the principal virus vector, is widely resistant to pyrethroids and there are constraints on the timing and application of systemic insecticides. In the place of early season pyrethroids, regular applications of mineral oil, typically in the form of Crop Spray 11E are commonly practiced, though fluazinam-containing products and the oil dispersion (OD) formulation of certain fungicides has been found to react adversely with this product, increasing the risk of phytotoxic symptoms.

Integrated approach

To reduce reliance on insecticides, growers have been encouraged to use straw mulch, purge and wildflower strips within early seed generation fields. Where these measures have been deployed separately, success has been variable. But deployed in combination, the evidence suggests these actions have been sufficient to deliver the high level protection required.

The emergence of 43_A1, a late blight strain demonstrating resistance to CAA fungicides such as mandipropamid, benthiavalicarb and dimethomorph, as well as the OSBPI fungicide oxathiapiprolin, has raised concern across the industry.

A second strain 46_A1, is also believed to be resistant to the OSBPI fungicide oxathiapiprolin, as in Zorvec Endavia (benthiavalicarb+ oxathiapiprolin), though this is yet to be publicly confirmed.

The development of more resistant strains raises questions. Not least, how should fungicide programmes be adapted and what about the cost? For the 2024 season and most likely the 2025 campaign, the threat these new strains pose is partly covered by the continued availability of mancozeb.

How protection will be achieved without this fungicide however, is a question to be

66 We're in an uncomfortable position with late blight; it's only through the judicious use of active substances that we've avoided the fate of growers in Europe. **99**

answered. On their own, such growing challenges could be sustained, but all at once? The danger to farm profitability and business confidence is painfully apparent,



Eric Anderson says the threat to crops posed by 43_A1 and 46_A1 is what currently concerns him the most.

Forward-thinking farmers

believes Eric Anderson, senior agronomist at Scottish Agronomy.

"Across Scotland, England and continental Europe, seed availability is greatly reduced. Belpotato.be, the trade association for Belgian potato sector, reports that the seed area across Belgium, Denmark, France, Germany and the Netherlands was down 7% in 2023 compared with 2022 volumes. The crop has also suffered from poor yield and quality issues which will further exacerbate supply issues," he says.

"As a result, any available seed is likely to be planted regardless of size, while there are some who are preparing to re-plant progeny from ware crops because they either can't source the required seed, or can't afford the cost."

Eric says undoubtedly, this will raise the environmental virus inoculum this season but it's the threat to crops posed by 43_A1 and 46_A1 that concerns him the most. Specifically, he fears the high incidence of foliar and tuber blight in continental seed and a likely shortfall in British seed means there's a real risk of importing 43_A1 into England via latent infection.

This raises concern that if anti-resistance strategies aren't followed from the outset, where infected seed is planted, it could allow the genotype to gain a foothold, he stresses.

"The tolerance for tuber blight in Basic seed potatoes and Certified seed potatoes produced in England is 0.5%, and about one in 200 blighted tubers will typically still emerge after planting," explains Eric. "At average planting densities, that could result in one or two blight foci per hectare.

"The damage inflicted to crops across Europe last season should worry growers. The Netherlands recorded the highest blight pressure for 30 years in 2023 where populations were dominated by 43_A1. Although overall it comprised 25% of the 2023 samples in Europe, to date it's locally higher — for example, 55% (n = 467) in The Netherlands, 52% (n = 115) in Germany and 36% (n = 250) in Belgium.

"Conversely, it fell from over 64% in 2022 to 24% (n = 113) in Denmark last year after new application guidance was adopted, and it wasn't reported at all in the UK. A single sample was, however, found in Ireland which may be a cause for concern and is under investigation," he says.

EU 46 A1 is related but is sufficiently different from 43 A1 to be given its own name, explains Eric. Since 46_A1 wasn't annotated by EuroBlight before 2023 and it accounted for about 10% of the Netherland's population last season, its rapid spread is likely to be related to inappropriate fungicide selection pressure.

Crop losses

He says 46_A1 was widely reported in the starch producing areas of northern Netherlands — poor late blight control alone is reckoned to account for at least 10% of the overall crop losses in the Netherlands during 2023 and the impact of 46 A1 has also been felt in northwest Germany.

It's understood that the issue caused by these new genotypes relates to the use of CAA fungicides (FRAC mode of action group 40) and OSBPI fungicides (FRAC mode of action group 49) - see table. CAA fungicides typically make up the bulk of most blight programmes, so the emergence of a strain resistant to this group of products will leave a gap in protection.

FRAC guidelines in regions with reported cases of resistance states that CAA fungicides must be used in mixtures, with no more than two consecutive applications.

OSBPI fungicides, of which there is currently one approved active substance in oxathiapiprolin, are used extensively during rapid canopy. Zorvec Endavia contains both CAA and OSBPI active substances.

Whereas new best practice guidelines from Corteva suggest sprays containing Zorvec shouldn't exceed 20% of the total number of sprays to a crop and should be

FRAC code	Active substance	Fungicide name (example)	Resistance risk	Maximum no. of applications
49	oxathiapiprolin	Zorvec Endavia	Medium to high	3 (2 for seed crops)
40	dimethomorph benthiavalicarb mandipropamid valifenalate	in Diprospero in Hubble Versilus Revus In Valis M	Medium to high	50% of the programme or six in total



According to Nick Winmill, potassium phosphonates has shown the greatest potential to contribute to blight programmes.

tank-mixed with mancozeb to add a third mode of action, if 43_A1 or 46_A1 are at risk of being present.

The FRAC OSBPI working group is expected to publish revised guidelines on the use of OSBPI fungicides in time for the 2024 season. In previous years, new season recommendations have been published in April, so monitoring the FRAC website (frac.info) will advise of changes in application guidance.

Although testing of blight samples submitted to the Fight Against Blight (FAB) campaign in 2023 found no evidence that either 43_A1 or 46_A1 are present in Great Britain, this shouldn't be seen as proof of their absence, stresses Eric.

"The industry has to work on the hypothesis that these strains may already be here, so adapt programmes accordingly. It's plausible that our proactive action, supported largely by mancozeb, has helped to keep them at bay," he says.

Nick Winmill, head of potato R&D at Agrii, shares the sentiment and endorses the importance of heeding the warnings.

"We're in an uncomfortable position with late blight. It's only through the judicious use of active substances that we've avoided the fate of growers in Europe, but that can't last.

"We urgently require new modes of action to reduce the pressure on the active substances we have, but until such a time occurs, we have to be mindful of the risks to crops and the importance of protecting the products that we have," says Nick.

Of the products in Agrii trials, potassium phosphonates has shown the greatest potential to contribute to blight programmes, but it's not without its own issues, he says.

"Performance is formulation dependant, but it should be a good mixing partner as

Forward-thinking farmers



Kuras was one of the most blight resistant varieties available, but its resistance has collapsed in the face of these new aggressive genotypes, says Eric Anderson.

► long as you have the right product. It has the added benefit of multi-site activity and is systemic in nature, but is currently only approved as a co-formulation with ametoctradin," explains Nick.

Aside from insensitivity to certain modes of action, little else is known about either 43_A1 or the related strain, 46_A1.

"Assay tests will give us detailed information to understand these strains, but the speed at which 43_A1 and 46_A1 have established themselves in the Netherlands is startling. The spread of 43_A1 has outpaced that seen with 36_A2 – the dominant strain in England and Wales. Were the same to happen in Great Britain, it would create significant difficulties, especially in seeking to protect new crop growth," says Eric.

He likens the situation to playing a game of chess with only 12 pieces, but with an infinite number of moves. "We can't afford to drop those fungicides with known resistance issues. Instead, we have to use them strategically and ensure they're partnered with an active substance belonging to an alternative mode of action."

He says achieving this in practice, however, is a complex task but one worth pursuing. "We should heed the lessons of both the Dutch and Danish experience of 2023. The latest strains to emerge in the Netherlands are most likely independent events, but the result of poor management practice. Guidelines were ignored, now the rest of the industry will suffer the cost of this short-term behaviour," stresses Eric.

Mode of action diversity

The first course of action is to protect the efficacy of oxathiapiprolin. In practice, this will mean adding a third mode of action to the sprayer tank. "All Zorvec products will have to be tank-mixed with mancozeb as a minimum," says Eric.

"We also have to protect cyazofamid, as in Ranman Top, and amisulbrom, as in Shinkon, both of which are Qil fungicides. These too have single-site modes of action and should be mixed with mancozeb or alternatively, Enervin SC (ametoctradin)," he adds.

If there's one positive from this situation, it's that Infinito (fluopicolide (FRAC group 43)+ propamocarb (FRAC group 28)) remains unaffected. "Infinito contains two modes of action for which there are no known resistance issues. With a maximum of four applications per crop it's a useful complement to the other modes of action in the programme," says Eric.

"Infinito remains a valued anti-sporulant for use in alternation with Ranman Top when the risk of tuber blight becomes a concern, but it also has a valuable role to play in delivering a balanced programme that follows best practice," he adds.

In recognition of the ongoing difficulties

Forward-thinking farmers

With robotics, gene mapping and molecular markers, digital technology and bio-chemistry, it is a dynamic time for anyone involved in agriculture.

Challenges lie ahead for UK agriculture, such as improving productivity while minimising its environmental footprint. But farmers have always had to deal with change and adopt new practices and technology.

Bayer is at the core of these agricultural advances, working with farmers throughout the UK and further afield to trial and develop new diagnostic tools and explore different production methods, coupled with exciting plant breeding and product development programmes. Adopting new technologies will help growers to improve performance while reducing environmental impact.

Despite the challenges facing UK agriculture there is much to look forward to. This series of articles focuses on how innovation and partnership between farmer and industry will help us face the future together.





Guidelines suggest sprays containing Zorvec shouldn't exceed 20% of the total number of sprays to a crop and should be tank-mixed with mancozeb to add a third mode of action.

facing growers, processor Albert Bartlett has relaxed its restrictions on the use of propamocarb. As a result, mixes containing the active appear set to be approved until the end of July.

"If you accept that resistance to OSBPI fungicides is likely to be confirmed at some point in the near future in mainland GB, then there's little choice but to accept that propamocarb is the only reliable anti-sporulant available. In practice, this means tank mixing either Axidor or Proxanil (cymoxanil+ propamocarb), or using Infinito as a co-formulated product. The better persistence of Infinito gives it the edge," says Eric.

The emergence of 43_A1 and 46_A1 may also have implications for cultivar resistance ratings. As an example of the aggressiveness these strains possess, Eric cites the impact on Kuras, a popular starch variety with previously strong late blight resistance.

"Kuras was one of the most blight resistant varieties available, but its resistance has collapsed in the face of these new aggressive genotypes," he says.

The published variety resistance ratings predate the newer strains of recent seasons so can be considered of little value to growers and advisers when seeking to develop a truly holistic approach to IPM, he warns.

"Reliance on published foliar or tuber blight resistance is a high-risk strategy in relation to the value of the potato crop. In view of the speed of disease development and its devastating impact on crop output, using effective fungicides which focus on disease prevention is a preferable course of action," concludes Eric. ■

BBRO BeetTech

Growers learned about progress being made to find solutions to virus yellows in sugar beet at the recent BBRO BeetTech 24 event. *CPM* joined delegates to hear the latest updates.

By Mike Abram

The yield penalty from sugar beet varieties with virus yellows tolerance is closing rapidly, as indicated by the latest results from BBRO trials. A total of 24 varieties were tested in 2023 against all three key virus yellow strains, explained Dr Alistair Wright at BBRO's Beet Tech 24 event at Newmarket Racecourse.

"We've seen some really promising results, with virtually all of the breeders putting forward promising candidates," he said. Candidate varieties were compared in the inoculated trials against five control varieties, including BTS1915, Daphna and Lacewing. The work also included plots without any virus yellows infection.

In the trial, BTS1915, the highest yielding variety on the current BBRO

Yield lag closing

Recommended List, yielded nearly 100t/ha adjusted in the absence of virus yellows infection and had around a 35% yield loss in plots inoculated with Beet Virus Yellows — the most yield robbing of the virus yellows complex. "That's not as high as the 50% yield loss we typically see from Beet Yellows Virus," noted Alistair.

The work showed that Daphna is more susceptible to beet yellows with a 45% yield loss – which aligned to previous years' results, said Alistair, while having a similar yield to BTS1915 in the absence of virus yellows.

"We also use Lacewing as we know that's a good indicator variety, which shows severe yield loss (60%) and 95t/ha adjusted without virus infection."

Varietal tolerance

In comparison, the yield loss from the first commercial variety with a level of virus yellows tolerance, Maruscha KWS, is less severe but comes with a near 15% yield penalty in the absence of virus. That yield lag has been virtually eliminated in some of the newer candidate varieties.

For example, a variety coded G11, which is in its second year of BBRO trials, has a yield performance in the absence of virus of 98t/ha adj., virtually on par with BTS1915, while a second variety, G21 from a different breeder wasn't far behind.

Yield loss to beet yellows virus for the two candidates was between 28-32%, with

66 It's encouraging this new material is showing yield tolerance to all three of the yellowing viruses. **99**

lower yield losses for the other two virus yellows diseases. "It's encouraging this new material is showing yield tolerance ►



IPM approaches are still valid until we have truly immune varieties which may come from gene editing approaches, says Dr Alistair Wright.

BBRO BeetTech



Good on-farm hygiene minimises initial virus pressure.

► to all three of the yellowing viruses," said Alistair.

By plotting the yields for each variety in the absence of virus to where each plant had been inoculated with virus, it's possible to calculate an approximation of the level of virus infection where it becomes beneficial to switch to a tolerant variety where the lines intercept.

Novel genetics

While for Maruscha KWS, beet yellows virus infections levels had to be somewhere between 25% (Lacewing), 60% (Daphna) and 100% for BTS1915, for the G11 variety it was only 10-20% for those three control varieties.

"It's going to become a good choice to start using these novel genetics as there won't be too much of a yield penalty, if any," explained Alistair. "That doesn't

Beet moth research continues

While 2023 saw nowhere near the same issues with beet moth as 2022, BBRO's Professor Mark Stevens believes the pest is here to stay. "It may be patchy and sporadic, but unfortunately because of climate change it's quite easy for it to overwinter," he said.

Beet moth larvae were found in plant samples recently sent into BBRO's plant clinic with black hearts that were able to survive -15°C temperatures, he explained.

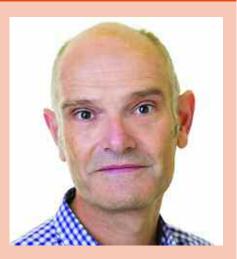
Drought and crop stress – anything that exposes the crowns — and growing beet on lighter soils will increase risk, while heavy rainfall or irrigation will suppress adult moths.

BBRO employed pheromone traps at 12 locations to obtain baseline data in 2022, said Mark. "The good news is that beet moth wasn't a major problem with weather patterns, meaning the crop wasn't under the same stress as in 2022.

"There was an early invasion at several sites in late June into early July, and at one site where there was some drought we started to see some damage which enabled us to do a trial to limit the impact of moth larvae."

mean we won't see loss of yield to virus, so the rest of the IPM approaches are still valid until we have truly immune varieties which may come from gene editing approaches."

He reminded growers of the requirement for good on-farm hygiene to minimise initial virus pressure. "I'm sure you've all cleaned up your spoil heaps because they're a very good source of



Professor Mark Stevens believes beet moth is here to stay.

Various treatments were tested, but with low moth pressure, there were no significant differences, said Mark. However, with beet moth larvae easy to rear, BBRO is carrying out further trials in controlled environments at their facilities in Norwich.

virus to carry over into future crops. Do pick up the beet that dropped out of the cleaner loader or were left behind the Maus or any groundkeepers coming in the field."

Other BBRO research is investigating the use of companion crops to camouflage the sugar beet with barley. Those trials have highlighted how it's crucial for the barley destruction timing to be spot on, ►

Cercospora strains threat

Comments from growers finding cercospora symptoms in sugar beet crops developing in October and November suggest the disease might be adapting to UK conditions, explained Professor Mark Stevens.

"It's something we have to keep an eye on because the last thing you want having invested so much money in the crop, is to lose the canopy, lose sugar and lose frost protection." Cercospora isolates collected by BBRO are being used to test that theory, he said.

BBRO is also looking at the impact of leaf wetness on cercospora infection levels. "We're aware of research suggesting that it might be more important than temperature and humidity.

"We had three monitoring sites based at the locations of our field events, where we had

cercospora levels of 26%, 37% and 7%, and the key factor that was driving this seemed to be leaf wetness.

"It's something we'll research more because we believe those conditions are probably more important than temperature, as well as also looking at what temperature do we require in the UK to make infection happen."

In fungicide trials in Lincolnshire, two and three spray programmes were more effective than the one or no spray treatments, he added. "In October, we were seeing nearly 60% rust infections in those plots," said Mark.

The benefit in holding onto canopy biomass late was also evident in January in the two and three-spray programmes, which gave a yield lift of up to 20t/ha adj. over the untreated and 10t/ha



Professor Mark Stevens says BBRO is looking at the impact of leaf wetness on cercospora infection levels.

adj. versus a single treatment. "There's a clear benefit in using those tools," Mark concluded.



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Regen beet premium?

Could farmers employing regenerative farming practices to grow sugar beet potentially receive premiums? That was what Slavoljub Eric, Nestlé sucrose procurement manager, appeared to suggest during a video presentation to beet growers at BBRO BeetTech 24.

The firm has set a target to be net zero by 2050, with earlier goals to reduce greenhouse gas emissions by 20% by 2025 and 50% by 2030. Sourcing food ingredients from regenerative agriculture is a key pillar in its strategy to meet those targets.

More than 75% of Nestlé's total CO_2e emissions came in the ingredients it sources, he said. "That's why it's important we join, talk and take action. We can put actions into our manufacturing and energy that we use but it's not enough. Without farmers and the sugar producers being on the same page, we won't be able to deliver most of the targets we've committed to."

Across its business, Nestlé is committed to sourcing a minimum of 20% of its key ingredients through farms using regenerative agriculture practices by 2025, increasing to 50% by 2030.

For sugar, there's a slightly higher target of 25% by 2025 because the firm believes that farmers growing the crop can move faster along a regenerative journey. "Regenerative agriculture is going to be mandatory," said Slavoljub. "We're currently talking about projects to work on and implement with our suppliers and farmers.

"Tomorrow, this is expected to become standard, and together with 100% traceability and

▶ said Alistair. "It's not a silver bullet and

can have a negative impact, so watch it

as you see fit."

carefully and consider destroying as soon

Rye windbreaks have proved effective at stopping virus spread in the inoculated

variety trials, so could be viable options

for infield strips, he added. "We're also

zero deforestation, we're sharing a fair revenue and conditions for all the people working in the sugar industry."

Regenerative agriculture plays a critical role in improving soil health, restoring water cycles and increasing biodiversity, he said. "This is why Nestlé is investing more than CHF1.2bn (£1.1Bn) by the end of 2025 to spark regenerative agriculture across our supply chain."

In the UK, Nestlé is speaking to British Sugar and the NFU on project ideas to decrease emissions from beet production, he said. For example, he was hopeful that a project around nitrogen application reduction would be approved and implemented soon. Other areas of focus for Nestlé included reduction in tillage, use of cover crops, integrated pest management and digitalisation of agriculture.

"You're going to ask me what are the benefits for you, as we expect you to do a lot of things," he added. "First, you're going to have lower costs because applying less nitrogen or any fertiliser whenever it isn't required is going to reduce your costs, therefore your profitability should improve.

"You'll have fewer hours in the field with a heavy mechanisation, which should improve soil quality while reducing fuel consumption, again with a cost improvement.

"And hopefully all of these practices should lead to higher yields, and if we are able to sell these kinds of projects as a good opportunity for Nestlé, you can participate in the better premium scheme for sustainability income from Nestlé or

planning to plant some brassica strips through commercial crops to see if that reduces virus incidents."

BBRO hasn't seen ongoing benefits from rotational flowering strips hosting beneficial insects and aphid predators in neighbouring beet crops. "If you can put them in permanently the literature



Nestlé believes that farmers growing sugar beet specifically can move faster along a regenerative journey.

any other customer interested in this topic," he suggested.

That last point was met with scepticism by East Anglian sugar beet grower David Hoyles in the following Q&A session, which Slavoljub wasn't present for. "I was interested in hearing Slavoljub say you'll get better premiums for regenerative agriculture," said David.

"I'm wondering why I'm missing out because I've been offering LEAF marque accredited sugar beet for a number of years and I've been told it's not going to be rewarded. So I'd like to know what effective premiums might be available?"

With BBRO not involved in commercial operations, this was a question addressed to any British Sugar delegates attending. However, while likely a subject of ongoing discussion, no one at the event was able or willing to answer David's question.

suggests they'll do a better job, and that could now be possible through SFI."

Growing endophyte grasses which produce natural aphid toxins, is the subject of a one-year masters project funded by BBRO and The Morley Agricultural Foundation. Research in New Zealand has suggested the



BBRO BeetTech

beneficial impact of the endophyte can be transferred into the sugar beet.

"We do think there's hope," said Alistair. "But it's not going to be straightforward as there's interaction between the grass and beet competing for resources."

There are also some positive results from dyeing the soil to camouflage the beet crop, which has reduced aphid levels. "While aphids still went over threshold levels, whatever colour we used there was a reduction compared with the untreated, so there's definitely something about manipulating the sensing of plants by aphids."

Furthermore, a French company, AgriOdor, is researching using volatiles from perfumes to manipulate aphid sensing. "It looks like it can delay the point at which the crop reaches threshold by up to two weeks, giving beneficials more time to build up," said Alistair, noting that BBRO would continue to follow the research closely.

With better varietal tolerance and different IPM practices, BBRO has identified a requirement to review current insecticide threshold levels and whether they should be dynamic rather than the black and white current



BBRO trials in 2023 tested a total of 24 varieties against all three key virus yellow strains.

system, said Alistair.

In response, BBRO has commissioned ADAS senior research entomologist Dr Sacha White to review the robustness of current thresholds. "The project will carry out a literature review to see if there are any grounds for change, and if so, whether the thresholds should be more dynamic," explained Sacha during a video presentation.

"Should they shift depending on the crop conditions? For example, taking account of weather on aphid population growth, the proportion of aphids carrying the virus, crop economics could all be important."

Another part of the project will review various models for virus epidemiology, aphid population dynamics and sugar beet growth. "We're looking for useful parameter values that we can use to build a decision support model. For instance, the rate at which a plant is infected by an aphid or the effect temperature has on the reproduction rate."

Ultimately, ADAS hopes to build a decision support system for virus yellows control, similar to the Acrobat BYDV assessment tool recently launched, he concluded. ■



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Innovation Insight

Although it's been a while since the loss of desmedipham, finding a similar level of annual broadleaf weed control in sugar beet has proven quite the head-scratcher. However, the answer could lie in a specific type of adjuvant. **CPM** reveals more.

By Janine Adamson

Done well, sugar beet provides much value within a rotation, breaking the cycle of many weeds, pests and diseases while helping to build soil organic matter. However, the crop isn't immune to its own challenges, particularly when it comes to annual broadleaf weed control.

As with most UK crops, sugar beet's plant protection product toolbox is diminishing, with one of the most significant losses being desmedipham in 2020. Since then, focus has been on finding alternative methods to achieve a similar level of control to what 'des' offered.

British Sugar's Pam Chambers says this has meant more attention to detail when it comes to all aspects of herbicide application. "With only 11 active ingredients registered for annual broadleaf weed control in

sugar beet, of which nine are for use on conventional varieties, we have no choice but to get the best from those limited options to optimise performance.

"There's also a high risk regarding the future of triflusulfuron-methyl. as within Europe 2024 it's the final year of use for this active, although a decision still has to be made within Great Britain," she explains.

Adjuvants

For Pam, central to improving performance is refining understanding of a sometimes neglected piece of the tank mix puzzle ---the adjuvant. "Adjuvants are so important for sugar beet — in every mix for annual broadleaf weed control, an adjuvant will be used.

"My colleague Andy Wing once said that using products such as Debut/Shiro (triflusulfuron-methyl) without an adjuvant, is like a gin without the tonic. However, the importance of adjuvants does vary depending on weed species and size, active being used, and climatic conditions."

In some years, for species such as cleavers, correct use of an adjuvant can lead to a 50% uplift in weed control efficacy, she says. Equally, 'hairy' weeds such as small nettle and poppies, respond particularly well to the inclusion of an adjuvant.

Hutchinsons' Darryl Shailes concurs that adjuvants perform a variety of tasks and should be considered a vital component in most herbicide programmes. "A correctly selected adjuvant can help the adhesion and penetration of herbicide actives to target

66 This will be the most economically-savvy way to achieve control. 99

weeds and importantly boost herbicide activity on larger weeds, especially in cool dry conditions," he says.

But when faced with a year like 2023 where sugar beet was drilled a month late



The importance of adjuvants varies depending on weed species and size, active being used, and climatic conditions, says Pam Chambers.

Innovation Insight

with mixed conditions, significant crop damage was reported across the board. "It's likely this was due to applying too strong a tank mix without the correct adjuvant at the correct rate, which stresses the importance of paying close attention," explains Pam.

Rhodri Morris, commercial director for De Sangosse, agrees that using mineral oil-based adjuvants in sub-optimal conditions can induce phytotoxic effects on the crop, particularly if used when atmospheric temperatures are high or plant vigour is compromised.

"This is the case for a product such as Newman Cropspray 11E (mineral/paraffinic oil), although very effective, its use in temperatures above 21°C can increase the risk of crop phytotoxicity," he explains.

"However, adjuvants based on methylated seed oil (MSO) such as Phase-II are much safer to apply in high temperatures. This is because MSOs increase the interface area between the spray droplet and the target surface, reducing concentration levels at the site of adhesion.

"In comparison, droplets containing mineral oil contract, increasing the concentration and consequently the risk of crop phyto. Another benefit of MSO-based adjuvants such as Phase II is they're normally used at lower rates than mineral oils," says Rhodri. MSO adjuvants were first introduced to the UK market around 30 years ago and according to Rhodri, De Sangosse's Phase-II adjuvant is the most widely used MSO in the UK. Despite this, like Pam, he believes more can be done to improve understanding of their benefits.

"Progress continues to take place in MSO product development, for example, around 10 years ago De Sangosse released Drill — an activated MSO co-formulated with a non-ionic surfactant. This co-formulation can be particularly beneficial for weeds with cuticles of poor wettability such as cleavers," he explains.

Spray drift

"It also contains tall oil [paper mill by-product] which can help to mitigate drift. From an environmental perspective, it's essential that spray practices reduce the risk of pesticides reaching non-target organisms, and adjuvants can play an important role in reducing spray drift."

Work carried out in 2021 by Silsoe Spray Applications Unit (SSAU) for De Sangosse and UPL demonstrated the benefits of including Drill with phenmedipham (Betasana SC) when controlling Chenopodium species (for example, fat hen and fig-leaved goosefoot).

The inclusion of Drill at 0.5 l/ha with



Rhodri Morris says adjuvants based on methylated seed oil (MSO) are much safer to apply in high temperatures.

Betasana SC at 3.0 l/ha when applied with flat fan nozzles or Teejet AIXR nozzles at 100 and 200 l/ha of water, resulted in a significant improvement on plant surface area covered (see graph 1).

Furthermore, Rhodri says growers should also consider that any pesticide not reaching its target is a wasted investment. And of course, from an agronomic point of view, the more active on the target, the better it should perform, he explains.

"Without desmedipham there's a glaring gap in terms of product performance but we believe that adjuvants such as Drill can help to plug that gap." ►

Formulation considerations

According to British Sugar's Pam Chambers, the majority of beet herbicides used for annual broadleaf weed control are suspension concentrate (SC) formulations which are much kinder to the crop and weed than what was formerly available.

"Historically, we used to have emulsifiable concentrate (EC) formulations which were much harsher and didn't rely on adjuvant use so much; we had to be much more cautious when using adjuvants with ECs," she says. "Now, all liquids apart from clopyralid which is a soluble liquid (SL), are SCs."

Hutchinsons' sugar beet crop protection specialist Darryl Shailes agrees that the loss of ECs and oily flowable formulations means adjuvants are essential to make current herbicides work more effectively. "With the older formulations the use of an adjuvant wasn't always required as the products were already well supplied with adjuvants and worked very effectively on their own in most conditions.

"While being a little more aggressive on the sugar beet, ECs had more impact on the weeds

because the adjuvant and solvents within the products broke down the leaf wax and enabled the herbicide to work more effectively.

"We only really had to add something extra when the weeds were larger and the weather conditions were dry and the plants had become very waxy and hard to kill. With the formulations we have available now, adjuvants are required with nearly every herbicide application," Darryl explains.

Equally, greater attention should be given to whether an adjuvant is based on methylated seed oil (MSO) or mineral oil.

When comparing the two, the following points should be considered:

- Protracted crops can be prone to more damage from harsher penetrants, adjuvant choice is key to mitigating this risk
- If plant vigour is slow, trials have shown MSO adjuvants are preferred in this situation



With the formulations we have available now, adjuvants are required with nearly every herbicide application, says Darryl Shailes.

 Monitor temperatures – BBRO guidance should be followed in terms of rates; avoid mineral oils in extreme temperature scenarios (high or low)

Ambient temperature	Rate of Newman Cropspray adjuvant
Up to 18°C	0.75 l/ha
18-21ºC	0.5 I/ha (normal rate)
Above 21°C	Not recommended, switch to MSO-based adjuvant

Innovation Insight



Antonia Walker says straights are the building blocks of sugar beet weed control because not only are they tried and tested, but they're a cost effective way to achieve results.

► Darryl agrees that adjuvants don't just enhance the efficacy of herbicides, they also increase spray coverage and help with rainfastness. "Spray drift can be an issue too — identifying spring spray days when targeting sugar beet weeds can be difficult, so something that reduces drift while targeting more of the product where it's required really helps.

"And it's not just with herbicides that adjuvants are useful, they can also help with many fungicides, insecticides and trace elements," he explains.

To demonstrate the value of adjuvants further, work has been taking place in conjunction with UPL to help growers to maximise the effectiveness of herbicide straights. Antonia Walker stresses that actives such as phenmedipham have become more critical in recent years, especially when margins are tight.

"This season in particular is challenging

and growers will be carefully considering their spend across both sugar beet and the rotation as a whole in hope of avoiding wastage.

"Straights are the building blocks of sugar beet weed control because not only are they tried and tested but they're a cost effective way to achieve results," she says. "Although newer co-formulated products are available, straights have never been as important as they are now."

Tailored approach

According to Antonia, another benefit of using straight active ingredients is the ability to tailor mixes and rates according to the specific broadleaf weed pressure. "As well as applying at the optimum timing, this is enhanced further through the use of the correct adjuvant at the correct rate. This will be the most economically-savvy way to achieve control."

Her advice to growers and agronomists is to know exactly which weeds are in abundance and to target difficult species such as fat hen early doors. And although she acknowledges the benefits of the Conviso Smart system (Smart hybrid varieties in combination with Conviso One (thiencarbazone-methyl+ foramsulfuron)), Antonia believes growers may be some way off fully buying into the concept.

Equally, Pam says conventional chemistry is increasingly being used in sequence with the Conviso system. "Conviso One chemistry is very effective against weed beet but the single spray option often means that annual broadleaf weeds have to be controlled or sensitised before the optimum timing for Conviso One.

"Using straights such as ethofumesate, metamitron and phenmedipham at the early

60.8 plant surface area covered 49.9 47.6 50 46.6 34.9 34.1 24.7 25 % 0 100 l/ha 100 l/ha 200 l/ha 200 l/ha 100 l/ha 100 l/ha 200 l/ha FF + Drill AIXR AIXR + Drill AIXR AIXR + Drill

Effect of application techniques on phenmedipham

post-emergence timings in conjunction with an adjuvant oil will help to ensure the best results are obtained from Conviso One, especially where fat hen and other Chenopodium are present," she explains.

According to Pam, adjuvants are also regularly used with Conviso One chemistry on the continent and she believes inclusion within GB programmes should be evaluated more closely.

But overall, Rhodri believes adjuvants suffer from simply not being interesting enough. "Adjuvants just aren't overly 'sexy' when it comes to crop production so we have to convince agronomists and then farmers of their importance. They can be a secondary thought, so the technical messages and benefits should be made clear.

"Whether that's balancing input costs or preserving active ingredients, adjuvants, in particular MSOs, have a clear place within the sugar beet portfolio," he says.

And the collaboration between De Sangosse and UPL continues, this time with the development of a new emulsified adjuvant where one use is with post-emergence graminicide, clethodim. Current stewardship guidance in the UK outlines that the clethodim shouldn't be tank mixed with an adjuvant, although inclusion of a water conditioner is recommended.

The new product is currently approved in France and branded as In-Tech Exsentia. According to Rhodri Morris, this development shows a continued commitment to adjuvant R&D. ■

Innovation Insight

De Sangosse is a European leader in complementary chemistry and molluscicides providing growers with innovative new approaches to protecting crops against disease, pests and the effects of adverse weather from seed to harvest.

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CPM would like to thank De Sangosse for kindly sponsoring this feature, and for its assistance in providing access to the relevant experts and contacts required to produce it.



Silsoe Spray Applications Unit, 2021



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overcoming loneliness. But

Networking – does it put the

never mind, I'll press on.

fear of God into you? I think

me out in a cold sweat. And

given my profession, I ought

to take out shares in

antiperspirant.

some people are simply better

equipped to walk into a hubbub

of folk, whereas for me, it brings

I try my best to disguise this

shortcoming but it never seems

to grow any easier. I'm the type

out a job to take on at a party or

event, simply to keep my hands

busy and to avoid looking

despondent in a corner.

Weddings especially! But

of girl who immediately seeks

lastword by Janine Adamson

overall, it makes my toes curl more than sandwiches drying out on a buffet table.

Why is it so difficult to strike up a conversation with someone new? If I think back, as an only child, this is something which has literally plagued my entire life. I recall my step father receiving very funny looks during a family holiday when he approached a young girl to ask: "Will you be friends with my daughter?"

I mean, you have to laugh. Thank goodness it was the 1990s or the outcome could have been very different. Luckily, said little girl did speak to me and my parents were free to enjoy their sunbed holiday without me clinging on like a limpet.

It's not that I don't want to speak to people, I very much do. In fact, it's what lured me into journalism — a natural curiosity for the perspectives of others. I love nothing more than hearing about people's lives and presenting it accordingly; investigative documentaries are my favourite type of television especially a 'Louis' (Theroux).

But in a busy room or unknown territory I seem to freeze. I start over-thinking my opening gambit, I scan the horizon for the most welcoming, friendly face, an outfit I can complement, pray there's someone's dog I can pet. At conferences I awkwardly clutch the agenda, hover relentlessly by the refreshment station and make a point of proudly displaying my lanyard, in hope someone might recognise my name.

Despite rinsing and repeating this for the past 15 years or so (someone once said the more networking you do, the easier it becomes), I'm still a complete melt. I think I'm better one-to-one or in small groups, and that's okay, isn't it?

Actually, wait a minute, is this why I'm lonely?! Okay I jest; as my mother once proclaimed — I'm just not very good at mixing. She often regales when the ladies at the nursery school pulled her aside to say they were gravely concerned because I'd only play in the Wendy house when no one else was there. Guilty as charged.

From a professional level, being more of a thinker means I don't always offer the best bang for the buck at conferences, press launches and alike. I prefer to muse things over and thoroughly consider my questions and responses rather than speak off the cuff. I don't feel as though I can compete for the air space because by nature I'm a quieter person, albeit with a honey badger inside (that's another story). Yet ask me to present to a room full of delegates and I thrive — I can adequately prepare and there's an element of performance involved. At the ripe old age of 25 I was lecturing students at Harper Adams University, admittedly it was in one of the grave yard slots.

The reason why I excel in this type of environment which others might fear, is because in mother's quest to help me to mix better, she enrolled me in childhood dance lessons. I soon learned to love the stage and the individuals on it.

'On with the show' coupled with a deep intake of breath and I feel as though I can take on anything. Although worryingly, am I almost pretending to be someone else? In short, I don't think so. Maybe it's enacting my alter ego — a shiny sociable being who can converse with anyone.

But yes, back to networking. It's not my favourite if I'm truly honest. Conferences are bread and butter for journalists and here I am, cringing at the thought. I'm hoping in my new role as *CPM*s editor people might look favourably on me and proactively entice me from my isolated lair.

If not, at least you know I can write a good story, with or without the small talk.

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