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Editor's pick

There's plenty of food for thought inside this month's magazine. At a time when planning has become nigh on impossible — as both the price and availability of fertiliser for this and the next crop remains uncertain, and the grain markets volatile — decisions become all about managing risk and cash flow.

Nutrient-use efficiency has long been earmarked as having 'room for improvement' and we look at some of the technologies that could have a bigger role if fertiliser inputs are pegged back. This month Real Results covers a Scottish grower's thoughts about current agronomy and future cropping as he deals with the impacts of market instability.

Oilseed rape comes under the spotlight in a new series looking at de-risking the growing of a crop that is renowned to test the nerve of the most steely of growers. The Inside Traits series makes a reappearance this month and focuses on stem-based diseases, which are perhaps underestimated as potential yield robbers towards the end of the season. In Tech Talk we're reminded about the intricacies of clubroot and how best to manage it.

Always a favourite to write is our annual Crop Doctor roundup from trial sites at the Callow and Long Sutton, with a disease update from farms in Oxfordshire and Yorkshire. The first round of visits took place towards the end of March, when wheat crops hadn't quite gone into stem extension. We'll follow up in the May issue to see how disease has developed, with visits planned for around the time T1s go on in a 'normal' season.

The disease theme continues in the last of the 'Mastering spring barley' series, where barley diseases are unpicked, and fungicide choices considered.

We pick up weeds in the technical section and again in Roots, where sugar beet herbicides come under the spotlight. The theme across three very different articles is broadly about enhancing control from existing chemistry.

Our journey into sustainable farming continues with a slightly different Climate Change Champion whose aim is to make recycling more accessible to farmers. As always, it's an interesting read from Tom Allen-Stevens.

Recognising that 'sustainable' has very different meaning to different people, new series 'Green Horizons' visits two growers to find out how they're reshaping their farming practices. Fit for the Future also looks at sustainability and gathers an industry-wide view on the impact of changing attitudes and how these can be put into practice.

One of the criticisms often levelled at regenerative and agroecological approaches is a lack of scientific evidence and this is a gap Hutchinsons intends to plug with the launch of a new Helix farm. We cover the detail of the launch, which is intended to bolster advice to clients who wish to adopt a more agroecological approach with hard data as it puts different practices under the microscope.

My personal favourite this month is a departure into ecology, where we look at bumblebees and find out some simple ways to keep the buzz in pollination. I found this fascinating to write and found out I actually knew precious little about an insect we perhaps take for granted. A lot can be done to provide for bumblebees and other pollinating insects once their needs are understood and the measures that can make a difference are very simple ones.

The Machinery section delves into the latest in sprayer technology, and we find an On Farm Opinion on the Fendt Rogator 645. Staying with the hands-on approach, a mizzly day in Yorkshire saw a range of direct drills put through their paces during a demo day — if you're looking for a new piece of kit, this report may give a few pointers.

Last but by no means least, our four farmer columnists have been perusing what's uppermost in everyone's minds — the impacts of Putin's war on their businesses. Each takes a very different path as they think through the enormous issues they're facing as individuals, as well as the bigger picture of food security in general.

I hope you enjoy reading the April issue of *CPM* as much as I enjoyed putting it together.

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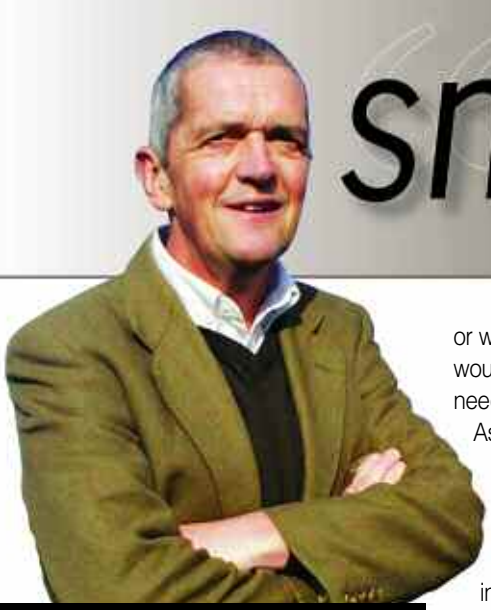
by Guy Smith



Such times as these

Lead times, that being the time gap between an article being written and it being read, are the bane of the farmer columnist. It used to be the weather or maybe markets that made a sound observation written two weeks previously subsequently look rather foolish.

But never in my wildest dreams or worst nightmares did I think it would be war in Europe that would need second guessing.

As I write I can only pray that by the time you read this there has been a de-escalation of conflict and a sense of decent humanity starting to influence what is happening in Ukraine.

While the challenges of running a farm business in the face of turbulent markets are as nothing when compared to the horrors being endured by millions of Ukrainians, the fact remains that for farmers, the impacts on our businesses from this war are like nothing we've seen before.

I'll admit in the past on hearing news that other parts of the world were facing poor or indifferent harvests, my reaction hasn't always been a charitable or a sympathetic one. The brutal fact is bad harvests elsewhere in the world are good at gingering upwards the grain market, thereby improving business prospects.

But now in the spring of 2022 a new sobering reality has dawned. As I look at off-the-combine wheat prices for harvest 22, the reaction is no longer one of encouragement but rather a chilling feeling of being disconcerted. The world is already a dangerous and unstable enough place, the prospect of poor world harvests fuelling very high food prices only adds to the worry.

While the evening news makes for a very tough watch, that makes COVID seem like yesterday's trivial concern, I tend to look back in history to see if there are any lessons for today.I will quickly put 1914 and 1939 to one side, but rather concentrate on 1973.

At this time another proxy Cold War was coming to an end as the US withdrew from Vietnam after 20 years of fighting the Soviet-backed Vietcong. Back in the UK, in 1973 farmers were struggling with a lot of unprecedented financial turbulence.

Firstly, there was the destabilising process of a radically changing agricultural policy. In 1973 the UK joined the EEC and from then on, the CAP hatched in Brussels would rule farming fortunes. Interestingly, one outcome of this was to significantly increase the cereal area in the UK. The question now is are we seeing a fundamental reversal of this and is this wise at this time?

Then there was inflation at over 10%. My father told me that it wasn't uncommon in the 1970s to sell farm machinery for more than you had bought it for a few years previously. Bank interest rates were at an eyewatering 15% and as farmland prices approached £1000 an acre, anyone who had borrowed was under pressure.

Another struggle in 1973 was a sharply escalating oil price that was driving up energy prices to unprecedented levels, including a doubling of the fertiliser price. On the other side of the coin, the wheat price was also in orbit because one major global player had clandestinely bought up another major country's wheat stocks. The seller was the US and the buyer was Russia, who in 1972 suffered a major harvest failure due to drought in the Volga basin which bizarrely the Americans were unaware of. At the time it was dubbed 'the great grain robbery'.

Despite all this disturbance and turbulence, most of the old men I know who ran farm businesses in the 1970s now remember them as good times for arable farming.

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

Sakura peas going into good seed beds in late March. The old farming lore used to be 'a peck of dust in March is worth a kings ransom'. Now it seems to be 'a peck of dust in March is a portent of drought'.

> *“There’s less septoria in the Extase but more than in previous years.”*

Crop Doctor

Full of promise

After two springs which followed extremely wet winters, crops in 2022 are looking promising coming out of a much kinder winter. *CPM* joins the Bayer Crop Doctor team to get a feel for likely disease pressures before fungicide programmes get underway.

By Lucy de la Pasture

In a world that’s currently topsy turvy, the sight of wheat plants basking in early spring sunshine and rippling in the breeze, readying themselves for an imminent switch into stem extension, is somewhat reassuring. Even so, the exact beat of the rhythm of the 2022 season isn’t yet set and that will dictate disease pressure — crops look full of promise but it’s in the hands of Mother Nature.

Nearing the end of March, the Crop Doctors took their annual tour, taking in Bayer trial sites in Herefordshire and Lincolnshire and farms in Oxfordshire and Yorkshire. The aim is to get a measure of how different varieties are faring in the different regions and to establish the baseline for disease just before fungicides programmes kick off.

Great Tew Estate, Oxfordshire

First stop was Great Tew Estate, where Colin Woodward welcomes ADAS’ Jonathan Blake and Bayer’s Ben Giles for a whistle stop tour. Standing in a field of SY Insitor, a Group 4 winter wheat, Colin says that yellow rust has begun to appear in the past few days but it’s still pretty hard to find. But it’s a different matter for septoria which is commonplace on the lower leaves — including on the third last to emerge, he says.

Jonathan notes that the yellow rust he’s found looks very brown. “It’s hanging in there and with a warm week forecast it’ll be perfect conditions for yellow rust — so it may explode,” he says ominously.

Colin reckons the recent overnight frosts have helped hold infection back, but a rust treatment is looking increasingly justified at the T0 timing, he says.

So how close to T0 is the crop? On closer inspection the consensus seems to be that stem extension is likely to be underway in about a week’s time (last week of March/beginning April) but it proves impossible to determine the exact growth stage by trying to dissect the stem.

“The ear is firmly rooted to the base of the stem, so it’s not at GS30 yet,” adds Ben.

Compared with the October-drilled Skyscraper and KWS Extase Colin showed the group earlier, Jonathan notes the Insitor appears behind. “The Skyscraper is very upright and leafy, with the septoria clearly on the second last leaf to emerge,” he says.

The two fields of Extase are first and second wheats, drilled in mid-October. “There’s less septoria in the Extase but more than in previous years,” adds Jonathan.

Ben points out that its septoria resistance rating has fallen to 7.2 in the AHDB Recommended List’s one-year figures.

That’s perhaps not unexpected, comments Jonathan. “Extase is now widely grown which means we’re selecting for the septoria isolates which are most virulent on that variety.”

Last season, Extase proved responsive to fungicide programmes in spite of its high septoria resistance, says Ben. “We had appalling levels of sunlight during grain fill, so fungicides helped keep the crop greener for longer which equates to higher yields.”

Colin plans to look after his crops this year, a decision made easier by the keen market for wheat. “Any spend on fungicide should be easily recouped,” he adds.

One crop where plenty of fungicide ▸

Colin Woodward and Jonathan Blake take a closer look at SY Insitor at the Great Tew Estate.

Hybrid winter barley SY Kingsbarn is exhibiting a mixed infection of net blotch, rhynchosporium and brown rust.

▸ may well be needed is his SY Kingbarn hybrid winter barley. Jonathan says it has to be one of the most disease susceptible varieties grown and calling in Colin's field, he quickly finds leaves with a combined infection of net blotch, rhynchosporium and brown rust.

Colin winks at Ben, saying, "At lease we have Ascra (bixafen+ fluopyram+ prothioconazole) now," alluding to its recent approval for barley crops. Jonathan pips in to add that Ascra seems to bring more on net blotch, whereas Siltra (bixafen+ prothioconazole) is still good on rhyncho and rusts.

September-drilled and ahead of the wheat, the winter barley's ready for a T0 of tebuconazole plus a PGR, says Colin. He'll be keeping a close eye on the disease levels in the winter wheat but plans to use tebuconazole, with the addition of azoxystrobin where yellow rust is active, and for the remainder it'll be standard PGR and trace elements. "I may try some Iodus (laminarin) on some fields this spring," he adds.

As far as fertiliser plans go, Colin is planning to apply 180kgN/ha to most of his wheat, which is a drop of 30kgN/ha compared with the rate he'd normally apply. Part of the reason for knocking back is so he can carry some fertiliser stocks to next season, he says.

Callow, Herefordshire

Plots at the Callow trial site were drilled 16 October and the stand isn't as thick as at Great Tew, observes Jonathan Blake. "Plants are too small for dissection and are tillering profusely. If anything it's a little bit behind," he says.

A more thorough look at the plots reveals disease levels at the Herefordshire site are low, with no yellow rust to be found. "The outstanding impression I have after looking at the plots is that septoria is unusually low for this site, which is the furthest west the Crop Doctor team visits."

It's the usual suspects that top the list for disease on the lower leaves, with the more susceptible KWS Barrel, Elicit and Skyscraper all having septoria visible on the most recent leaves to emerge. Extase and Graham have septoria lesions at the base of the canopy. Theodore stands out as being particularly healthy, says Jonathan. "Though septoria is present enough to be a threat," he comments.

Local independent agronomist and AICC member David Lines adds that it's early days yet for Callow. "September drilled crops in the area have more septoria than we're seeing here, and that's in varieties with relatively high septoria resistance, such as Extase, Graham and Siskin," he says.

Bayer's Gareth Bubb adds that at least there's a fighting chance of keeping the septoria down on the lower leaves. "Where susceptible varieties are sown early in the West then it's putting too much pressure on the chemistry to try and reliably control septoria," he says.

The conversation moves on to discuss T0 and Gareth says some crops of Extase in the region have just received a T0 and PGR because it's more forward than the majority of varieties. David says that he's going through his Extase with a PGR but isn't applying an early fungicide, though he says he would have put some CTL on if it was still available. He is however looking to apply some Iodus at T0 on some early direct-drilled crops.

Yellow rust is widely considered to be the justification for a T0 fungicide these days and Gareth highlights that the AHDB rating can't be used as a guide when plants are still in the juvenile stage. "You can't predict exactly when adult plant resistance will kick in so if yellow rust is present then tebuconazole is required at T0. When we lose teb, like with CTL, it'll become a much more difficult decision whether to put a fungicide in the tank at T0 as a preventative," he says.

Mildew is very common out in the field, says David. "The frosts we're having will take care of it and I'm not planning on applying a mildewicide. With early drilled Wolverine and Extase then eyespot is something to look out for, though ever since we've had prothioconazole, it hasn't really been something to worry much about."

Long Sutton, Lincolnshire

Two days later the Crop Doctor team headed to Long Sutton in Lincolnshire to view the Bayer trial site at David Hoyles' farm. Jonathan's immediate reaction was that the plots looked 10 days more forward than the Callow and he didn't have to walk far to find higher levels of septoria than at its sister site in the West.

It's not unusual for David's crops to look leafy and well, in part because he has a policy to get nitrogen on early. "We can travel on the silts here relatively early without risk of leaching. We applied 25kgN/ha with some sulphur in the first week of February, followed by 70kgN/ha with a further dose of sulphur in the first week of March."

David plans his final split of N for early April, which will make a total of 180kgN/ha. "This field follows potatoes and the soil mineral nitrogen wasn't as high as I thought it may be. But we're not cutting back on N this year."

In contrast, the heavier silty clay soils in Herefordshire have only just dried out enough to travel on, says Jonathan, with the Callow trials site receiving its first N application the week of the Crop Doctor visit.

"It may be why the Callow looks backwards compared with the field we're in now and also why we're seeing more septoria here at the moment," he adds.

Comparing different varieties, it comes apparent that the growth habit also plays a significant part in the amount of septoria present at this time in the crop's growth. ▸

Varieties at the Callow trial site are looking 7-10 days behind the other sites visited, though it's probably due to ground conditions only just allowing N to be applied.

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The Crop Doctor team at David Hoyles' farm at Long Sutton in Lincolnshire – (from left to right) James Wilkins, David Hoyles, Henry Richardson and Fiona Burnett.

▸ SRUC's Prof Fiona Burnett inspects a plot of Extase, rated 7.3 for septoria resistance on the RL — based on the one-year data — a drop from 7.8 on the three-year figure. "It's really vigorous but there are loads of pycnidia."

Stepping into the much 'dirtier' variety Barrel, it looks a lot cleaner than expected, she notes. So what's going on? Fiona reckons that the amount of septoria in the Extase doesn't mean there's an issue with its resistance.

"I put it down to the fact that the Extase is so forward early in the season — it's akin to getting more septoria when a variety is drilled early — so it has more to do with its development stage. On the flip side, Barrel is much more prostrate and plants are more sparse, leaving the crop open so there's less septoria right now."

James adds that because Extase is quite upright, the lower leaves are rubbing on the higher leaves, helping to spread septoria up the leaf layers.

Mildew is also a common sight at Long Sutton. "It's a disease that goes with a mild winter and thick crops," says Fiona.

David agrees. "Even with our later drilled fields last autumn, a mild December meant crops emerged within three weeks. All the crops look really well and are showing potential in what was a more normal autumn/winter than we've experienced for a couple of years."

Yellow rust is somewhat conspicuous by its absence, says Bayer's James Wilkins. "There was some yellow rust in early February but it's disappeared and low night temperatures are helping to subdue any pressure at the moment."

Fiona's eagle eye found yellow rust in Skyfall but James says it's pretty hard to find at the moment. Fiona adds: "But it has that humid feel of a yellow rust infection that's about to take off."

Jonathan also spotted yellow rust in KWS Zyatt, not an unexpected find, and some brown rust in Crusoe — which was something he hadn't anticipated seeing this early in the season.

David's all geared up to start T0 applications on his more forward commercial crops this week (penultimate week in March), with more likely to follow next week.

"If yellow rust is active then we'll add some tebuconazole but our T0 strategy will be based on either Firefly (prothioconazole+ fluoxastrobin) or straight folpet — depending on drilling date, variety and disease pressure — all plus micronutrients and PGR.

"All our fungicide applications are prescriptive and tailored to the variety's strengths and weaknesses. But I think there's scope to cut back our fungicide input on some varieties," he adds.

That's an approach James is on board with. "You have to assess the crop and treat for what you see."

Skyscraper has been one of the standout varieties in David's commercial cropping — both for its yield and its disease ratings. It also came out well in Bayer trials, adds James.

At this stage in the day, it's Theodore that looks a cut above in terms of disease resistance at both the Bayer trials site. "It makes Extase look a little dirty," comments Jonathan.

Another eyecatcher is KWS Dawsum, which Jonathan describes as another Costello but with an improved yield. David grew the variety commercially last year and reports it was his second-best yielder at 11t/ha, just behind Graham at 11.5t/ha.

"Even in the low sunlight we had during grain fill last year, Dawsum had a specific weight of 78 where most varieties were around 72 on this farm. It certainly does what it says on the tin," he says.

Sowerby, Yorkshire

The Crop Doctor tour also stopped off at Bayer's Tom Sowerby family farm, Cocked Hat Farm at Sowerby near Thirsk. Tony Sowerby is part of Bayer's National Snapshot initiative and is tracking septoria and yellow rust infection through the season in Graham and Gleam.

Both were drilled in mid-October and inspections by Tom and Fiona held a few surprises.

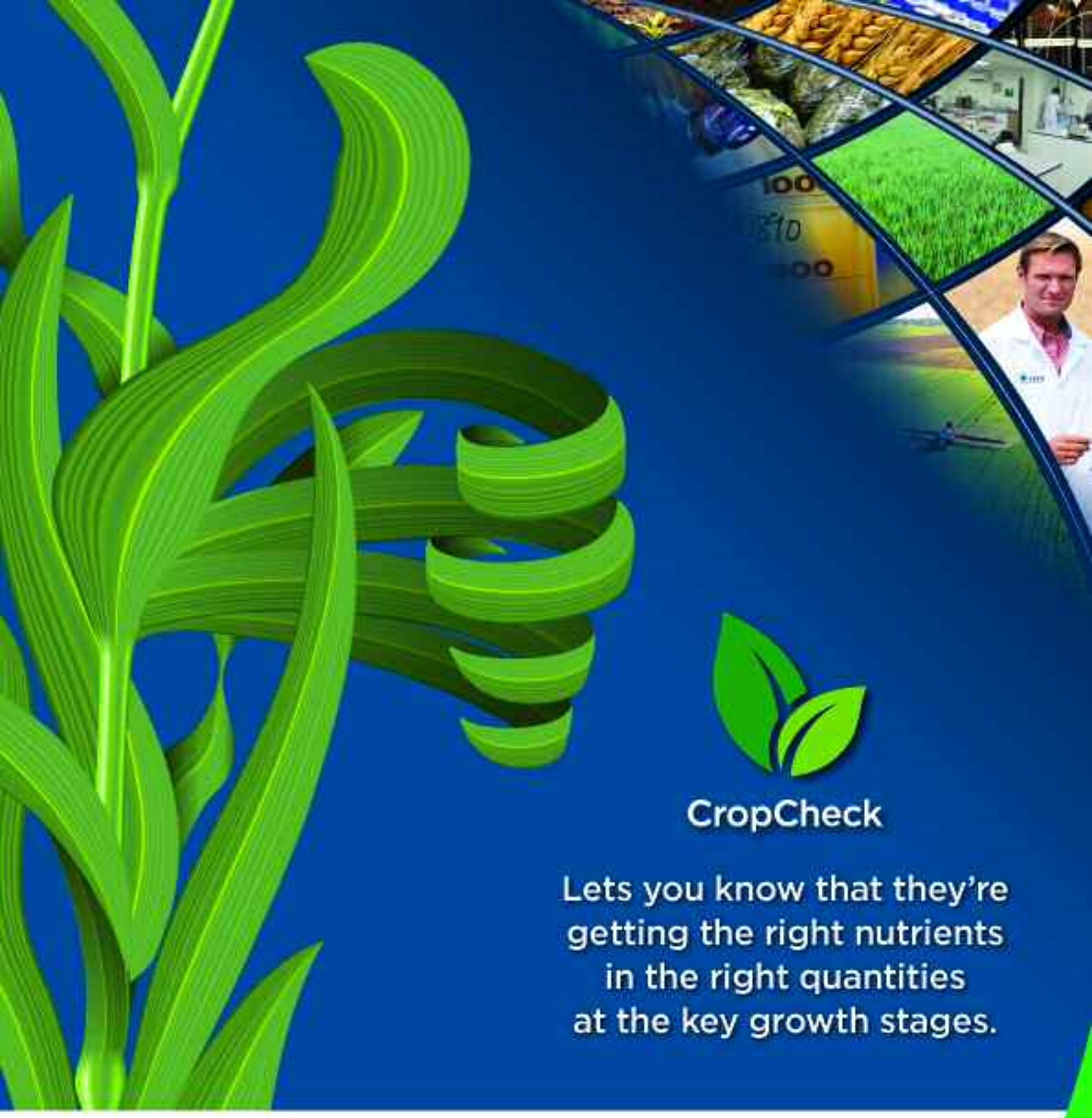
Despite its better rating, Graham is carrying a bit more septoria than Gleam which was something of a surprise as the Graham is on lighter ground.

Like the other sites, both crops were still to 'lift away', notes Fiona, and she attributes the higher septoria levels in Graham to its development in spring, in a similar way to the Extase at Long Sutton. "Septoria is more visible in the Graham, but it's one to get going quickly in the spring which might explain this."

It's reflected in the CropCheck scores — the newest leaf of Gleam carried DNA/mg of 0.400, a little way below that of Graham at 1.470, giving them CropCheck scores of 93 and 96 respectively, late-stage infection.

Fiona expects varietal resilience to reveal itself later in the season and reiterates that disease severity ahead of GS32 is more down to drilling date and crop development. ■

Even KWS Extase has easy to find septoria on the lower leaves of the canopy at both Bayer trial sites and at Great Tew (pictured).



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War implications profound

Repercussions from the war in Ukraine are changing plans on a Scottish farm. *CPM* joins Scott Campbell to discuss the future cropping and agronomy at his Aberdeenshire farm.

By Mike Abram

Scott Campbell never once utters the name Vladimir Putin during our conversation, but it's clear his decision to invade Ukraine is likely to have big implications for Scott's farm over the next few years.

Take the Agri-Environment Climate Scheme (AECS), for example, which is the Scottish version of Countryside Stewardship. Before the war in Ukraine it was highly likely Scott would enter his 415ha Aberdeenshire farm — which he farms in partnership with his father, Iain and uncle, Neil — into the scheme by the end of April deadline. Now, he's not so sure.

"It's a hard decision — one part of me is saying I should, and the other that I shouldn't."

The impact on world grain supplies off the back of war in a country often dubbed as the breadbasket of Europe is the obvious reason behind his reticence. Others are worried too. The EU Commission was due to consider a proposal in late March to allow cultivations on 'set-aside' land to boost production in 2022, while there were reports in Ireland that farmers might be asked to grow more grain crops.

Cropping conundrums

"We have benefitted our soils by applying farmyard manures and growing green manure crops, so I'm thinking we should grow maximum cereals for the next four or five years without entering a scheme," says Scott.

Autumn cover crops and grass margins would meet his greening requirements without the need for any fallow. But there's increased risk from maximising cropped area, especially through the availability and higher costs of inputs, he recognises.

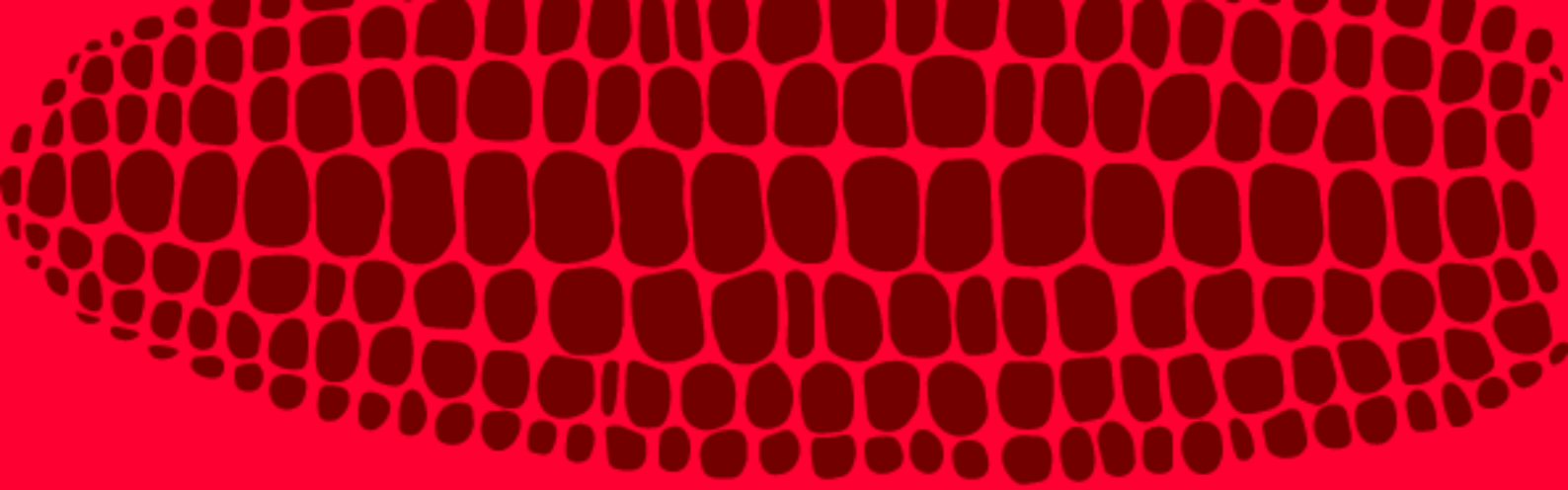
"But does that extra risk make sense for a long-established family business? We have grain storage on the farm, we're not paying rent on the land, grain prices could rise but input costs are also rising — it's a difficult one, but currently I'm likely to maximise cereal output and hold off on the scheme."

The farm is split into three roughly similar sized holdings, with the main hub at Kirkton of Kinellar, just north of Aberdeen. Three miles down the road is Aquherton, while Floors is 23 miles further north at Auchterless — fortunately near his main employee Grant Cameron's home, which helps with logistics in winter. Larger fields, which have much lower stone content than at the other two farms, helps cut labour costs and increase efficiency.

"One big advantage is we normally get all the spring barley cut at home before we travel up there to help spread risk and workload."

A further 40ha is contract farmed at Auchnagatt, near Ellon. Winter wheat and oilseed rape make up around a third of his total cropped area. Around 22ha of green manure is grown as part of his existing AECS scheme — which is sown in May and mulched in August, making a good entry for wheat, while 10-20ha is rented out for potatoes.

Winter barley has been dropped in favour of winter oats which, with its later harvest, gives around three weeks longer to ▸



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▸ concentrate on the family's other enterprise, an excavation business, at a peak time in the summer.

But spring barley is his main crop — around 200ha is grown each season for malting by Bairds Malt or Diageo — split between different varieties at each holding. That spreads risk, he says. Sassy was grown at Floors, Diablo at Kirkton and Aquherton, and Tungsten at Auchnagatt. "We've got storage buildings in each location so we can store separately."

With the rising malting barley commodity market, he's already traded some futures ranging from £216/t to £244/t, which is the highest price he's ever sold malting barley for. "But you have to watch greed doesn't kick in. It does feel wrong to profit when somebody else is having a terrible time in Ukraine, so I'm going to hold for the moment.

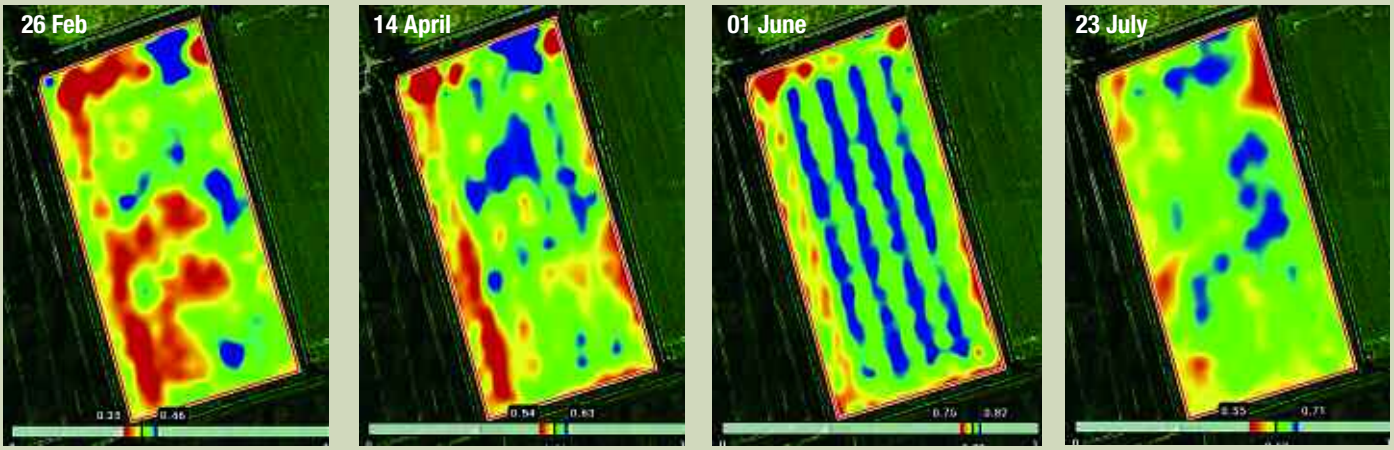
"Our costs are rocketing though, and we will need to feed the nation. I can see an upside to this market yet."

Having bought nitrogen fertiliser before the price exploded in the autumn, stocked up on diesel for spring drilling and some of the chemicals for spring barley and OSR, this harvest should be profitable, he says.

"But my concern is harvest 2023," he says, sighing. "Nitrogen is at £670/t, 16:16:16 at £680/t, fuel could be £1.10/L, although grains could be way up in price as well. It's just so difficult doing a budget."

He's trying to minimise his risk and exposure to high fertiliser prices by ▸

Extra investment in fungicide pays dividends



In late July, NDVI was visibly higher in the Agronomy Max tramline than in the rest of the field

A near 0.8t/ha improvement from the higher input 'Farm Agronomy Max' treatment in his KWS Lili Real Results trial means Scott will consider where using higher rates will pay. "I don't think you could make the colour of it any better," he says.

After a standard T0, each of the three following timings had either higher rates of Revystar, or additional pyraclostrobin on top of the standard Kestrel T3 treatment in the Agronomy Max treatment, explains Scottie.

The result was a 13.29t/ha yield compared with 12.51t/ha for his standard programme based on very similar actives at lower doses, and 12.79t/ha for the standard BASF programme.

ADAS analysis of the results concluded that while yield mapping data was not available from the trial, the size of the benefit from the Agronomy Max treatment gave confidence this was a real treatment difference. That conclusion was supported by a visible NDVI benefit from satellite imagery in late July.

"It cost an extra £52/ha in fungicide," says Scott. "But taking that 0.78t/ha extra yield and my average selling price of £190/t, that's worth an additional £96.20/ha in margin after taking off the fungicide costs."

Some caution has to be applied to the results because it's a tramline trial, he notes. "If you were treating the whole field, it's worth using a management process so you only use the higher spend on the better bits of the field that you know are going to perform."

That comes back to getting the foundations right, especially drainage, which is a speciality of his father and the excavation business, as well as maintaining correct soil pH and general soil health. "You probably wouldn't want to be spending that if the pH was 5.5, or there was a burst drain in the middle of the field, or parts of the field are on the thin side," he adds.

Fungicide spend in Scotland does tend to be higher than further south, while weed control costs are lower, says Scottie. "We're under more disease pressure given the varieties that perform well up here. The saving on blackgrass probably goes on drying costs."

The wheat varieties with excellent septoria resistance, such as KWS Extase, haven't suited Scotland, so he grows Skyscraper, KWS Lili and Elicit, with a small area this year of RGT Saki. None of them have septoria resistance ratings much above a five on the SRUC Recommended List, which makes timing crucial in a climate that produces around 800mm of rain a year.

"It seems to be more extreme weather now. The crop can be looking clean and then there's some rain splash and before you know it disease has come up the plant.

"That's why we try to have a spray policy of every three weeks to try and keep it clean. Timing is as equally important as product. Last season timings were spot on, and we had super yields."

Scott Campbell, Aberdeenshire – Real Results– Wilderness field

	Field treatment (l/ha)	BASF (l/ha)	Farm Agronomy Max (l/ha)
T0 (22 April)	Unizeb Gold (1.5)	Unizeb Gold (1.5)	Unizeb Gold (1.5)
T1 (15 May)	Revystar XE (0.75) + Phoenix (1.0)	Revystar XE (0.75) + Phoenix (1.0)	Revystar XE (1.0) + Phoenix (1.0)
T2 (14 Jun)	Lenvyor Duo (0.8) + Imperis (0.4)	Revystar XE (1.0)	Revystar XE (15)
T3 (30 Jun)	Kestrel (0.75)	Kestrel (0.75)	Kestrel (0.75) + Tucana (0.5)
Yield (t/ha)	12.51	12.79	13.29

Variety – KWS Lili; Previous crop – Oilseed rape
Wheat fungicide active ingredients – Imperis (fluxapyroxad); Lenvyor Duo (mefentrifluconazole); Kestrel (prothioconazole); Phoenix (folpet); Revystar XE (mefentrifluconazole+ fluxapyroxad); Tucana (pyraclostrobin); Unizeb Gold (mancozeb).

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Scott Campbell is weighing up his options in the light of world events and the impact on both input and commodity prices.

▸ purchasing anaerobic digestate from Sinclair Agricultural and Recycling Services in Ellon, alongside an existing 'straw for muck' deal.

"All our land at Kirkton and Aquherton gets muck or digestate at least once every four years. The green manure also saves us 20-25% on bagged fertiliser, and we're trying some backend cover crops to keep the nutrients in the soil," he explains.

These are grazed by sheep from local young farmers. Encouraging the next generation is important to Scott — he also hosts student visits, practical projects and trials from SRUC Craibstone.

On spring barley, the 105kg/ha of bought N is all applied by the time the crop is peeping through. "We do that to keep the nitrogen low for the malting market. We're finding with these newer varieties, which tiller more, we can push them a bit harder to get more yield, and the nitrogen is still quite a bit below 1.65%, which 10 years ago you'd never have managed."

That extra fertiliser can mean higher disease pressure, which he combats with a three-spray programme starting at GS30/31 rather than at T0. Early on, rhynchosporium and mildew are his main concerns, with the aim to keep as many tillers as possible viable and reduce stress to minimise ramularia risk.

He also uses that timing to control any weeds his pre-emergence spray has left behind, to adjust trace element requirements and to apply some growth regulator.

The flag leaf spray is used to control wild oats and also reduce the potential for brackling, as well as protecting against ramularia, while the ear spray at T3 is a bit of insurance, especially against skinning, he says.

In last season's BASF Real Results trial in a crop of LG Diablo spring barley, the field treatment of Propel Xpro (bixafen+ prothioconazole+ spiroxamine) at T1, followed by Imtrex (fluxapyroxad) plus Phoenix (folpet) at T2, was compared with a BASF programme of Priaxor (fluxapyroxad+ pyraclostrobin) plus Decoy (pyraclostrobin), followed by Revystar (mefentrifluconazole+ fluxapyroxad) plus Phoenix. Both programmes had Decoy as a common T3.

Scott Campbell, Aberdeenshire – Real Results LG Diablo spring barley trial

	Field treatment (l/ha)	BASF treatment (l/ha)
T1 (27 May)	Propel Xpro (1.5)	Priaxor (0.4) + Decoy (0.4)
T2 (16 June)	Imtrex (0.45) + Phoenix (1.0)	Revystar XE (0.75) + Phoenix (1.0)
T3 (5Jul)	Decoy (0.4)	Decoy (0.4)
Programme cost (£/ha)	41.05	63.70
Yield (t/ha)	8.99	9.42
Margin over fungicide cost* (£/ha)	1622.10	1679.00

*Barley fungicide active ingredients - Decoy (pyraclostrobin), Imtrex (fluxapyroxad), Phoenix (folpet), Priaxor (fluxapyroxad+ pyraclostrobin), Propel Xpro (bixafen+ prothioconazole+ spiroxamine). *Malting barley priced at £185/t*

The yield results showed over a 0.4t/ha advantage for the BASF programme, says Scottie Milne, a BASF agronomy manager for Scotland.

"Ramularia is a big concern in Scotland, and Revysol is now the best azole for reduction of ramularia," he claims. "It delays the onset of the disease coming into the crop.

"By going in at T1 with pyraclostrobin and fluxapyroxad you're also helping to reduce the stress on the crop, alongside getting the nutrition programme right through the tissue analysis Scott does."

He also describes fluxapyroxad as the best SDHI active against rhynchosporium, while pyraclostrobin is strong against net blotch.

ADAS analysis of the results were not able to confirm whether the difference was due to the treatments or underlying variation, with little other differences being observed in disease control, specific weights or thousand grain weight.

The results have encouraged Scott to use a bit more Revystar this season. "We might not have got those results over the whole farm but, especially on the good bits, we'll look to use it and push yield where we can," he concludes. ■

Combining at Kirkton, just north of Aberdeen, which is the main hub of the farming business.

The Real Results Circle

BASF's Real Results Circle farmer-led trials are now in their sixth year. The initiative is focused on working with 50 farmers to conduct field-scale trials on their own farms using their own kit and management systems. The trials are all assessed using ADAS' Agronomics tool which delivers statistical confidence to tramline, or field-wide treatment comparisons — an important part of Real Results.

In this series we follow the journey, thinking and results from farmers involved in the programme. The features also look at some in-depth related topics, such as SDHI performance and data capture and use.

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Keeping ahead of a changing disease

> *"Yellow rust pathotypes present at the beginning of the season could be very different those present at the end, even in the same area of the field."*

Yellow rust

Yellow rust has become the bane of both growers and plant breeders over the past decade. At last month's UK Cereal Pathogen Virulence Survey (UKCPVS) meeting, delegates heard why the disease has become so unpredictable when it comes to the robustness of varietal resistance. *CPM* reports.

By Lucy de la Pasture

There was a time when yellow rust was predictable. Every five to ten years a new variant would arise and then become dominant, often in response to the area of a particular wheat variety being grown at the time.

Disease outbreaks followed certain weather patterns and resistance bred into varieties was both dependable and durable, that is until there was a step-change in the yellow rust population and an adjustment in variety choice became necessary. But then everything changed with the arrival of the Warrior race.

The UK yellow rust population used to be clonal, with one dominant race at any given time, explains Rachel Goddard, cereal pathologist at Limagrain. "New variants would arise and over time become dominant and this gave step-wise changes in virulence every few years."

But in 2011, a new race was identified in the UK and Europe which led to a complete change in the yellow rust population, she says. "This was exceptional for a number of reasons. Unusually, the change was identified in a number of countries in the same year, and it also broke a number of effective resistance genes in UK wheat germplasm (not just one as used to occur previously).

"Compared with the old clonal population, this new Warrior race incursion came from sexually recombining populations outside Europe. Effectively yellow rust had become a different disease."

Diverse pathotype

Since 2011 yellow rust has remained very complex in the UK and a new naming system was derived to reflect this — with genotypes classifying the pathotypes within Red, Blue, Purple and Blue groups. While there have been some fluctuations in the yellow rust population over the past few years, the Red group has remained dominant — with Red 37, Red 36 and Red 41 pathotypes the most common in 2021, she explains.

"The Red group is also very diverse, with more than 50 pathotypes identified, and it's possible to see this diversity in the field. In work undertaken by Chris Judge at NIAB, he discovered that different pathotypes could be found in the same region of the field. He also noted that the frequency of different pathotypes could change throughout the growing season.

"That means that the yellow rust pathotypes present at the beginning of the season could be very different to those present at the end, even in the same area of the field. So it's quite difficult to predict pathogen population change because the situation is so fluid," says Rachel.

Back in the day, when a clonal population of yellow rust presided, the disease was more predictable as it preferred mild winters — which enabled it to overwinter — but frosts and cold weather would stop it in its tracks. In spring warmer weather was tolerated, but if it became too warm yellow rust would slow down, she explains.

"Since Warrior has become prevalent, yellow rust is more adaptable and able to withstand changes in the environment without being inconvenienced. It can tolerate a greater range of temperatures and this means it can keep going at 20°C and above, which is when older pathotypes would have given up."

Warrior-types are also much more aggressive, adds Rachel. "The Warrior group pathotypes have a shorter time from infection to sporulation, which gives the potential for the disease cycle to repeat several times within the season. They also produce more spores."

As well as acting differently, the disease can look very different in the field too. "We often see black telia on the leaves later in the season instead of the usual yellow pustules in stripes on the leaf. That's also an indication that these newer pathotypes evolved from a sexually recombinant population."

Because the disease has changed, the way breeders look for and incorporate resistance has also changed, says Rachel. To illustrate this, she highlights two complete ▸

Because the disease has changed, the way breeders look for and incorporate resistance has also changed, says Rachel Goddard.

SET SIGHTS ON GRASS WEEDS

FORWARD CEREAL CROPS AND ADVANCED GRASS WEEDS WILL MAKE SPRING HERBICIDE TIMING AND APPLICATION TECHNIQUES ESPECIALLY IMPORTANT THIS SEASON.

Left uncontrolled, it's those larger, well-established plants that will be far more competitive to the crop and produce a much greater viable seed return at harvest, warns **Syngenta Technical Manager, Georgina Young**.

- **Hit grass weeds whilst still small**
- **Use AXIAL® Pro first in the spring herbicide sequence**
- **Increase application rates on larger weeds**
- **Treat when growing conditions are good**
- **Adapt application technique to target weeds**

"It's more important, and very much more cost effective, to target the established grass weeds early," she advocated. "Even if some grass weeds were to still emerge later in the spring, they are likely to have a more limited yield effect on the crop and produce many fewer viable seeds."

Where overwintered wild oats can be targeted before they reach GS29, Mrs Young advised they can be effectively controlled with AXIAL Pro application rates of 0.6 l/ha.

"But if any grass weeds in the field are left to get larger, to wait for further spring emergence, then rates should increase, up to 0.82 l/ha," she added.

Best use advice would always be to increase application rates if spring growing conditions are poor, which might impede herbicide uptake and speed of effectiveness. Larger weeds could have the chance to recover - with associated risks of herbicide resistance developing.

Treating grass weeds early, before they are hidden by the growing crop, makes it easier for sprays to hit the target, according to **Syngenta Application Specialist, Harry Fordham**.

For early treatments, he advocated application using angled nozzles with a smaller droplet spectrum, best suited to targeting narrow grass weed leaves and hitting small plants under the crop canopy. Nozzles should be fitted to alternate facing forwards and backwards along the spray boom for all round coverage of the target, with a water volume of 100 l/ha.

If treatments are delayed and the crop has grown taller to cover the weeds, a switch to a more vertical spray pattern and a larger droplet spectrum, can achieve better spray penetration through the canopy and down to the weeds. An increase in water volume, to 200 l/ha, can achieve better coverage on the larger weed leaves, he added.

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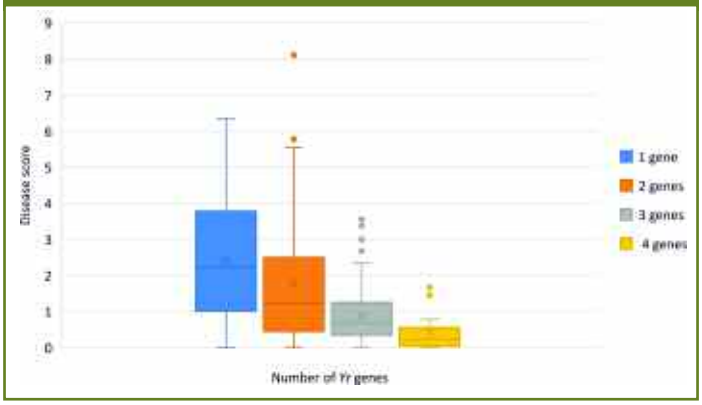
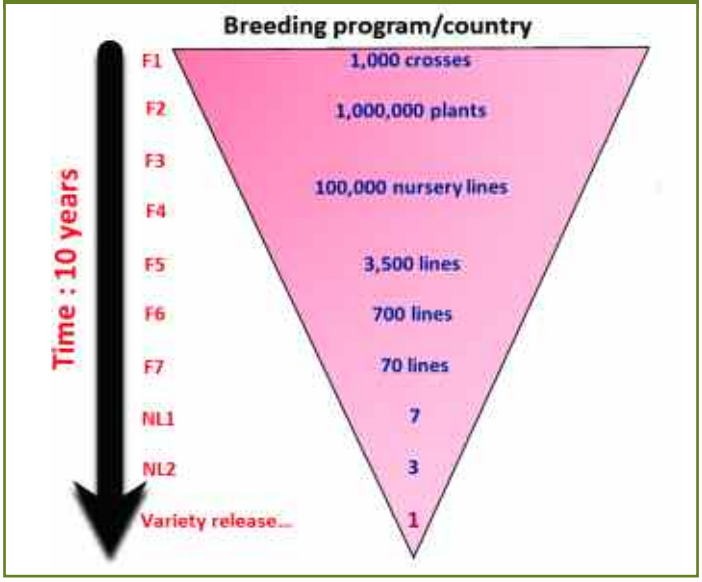
Syngenta Spray Assist provides a powerful tool to enhance spring grass weed control, as well as other application timings and crops throughout the season.

Stacking genes increases durability



Source: Limagrain, 2022

Time to produce a new variety



Source: Limagrain, 2022

▸ shifts in yellow rust resistance breeding in the UK.

"Following the breakdown of Brigadier in 1997, Claire was used extensively in breeding programmes. It had a single adult plant resistance gene — *YrClaire* — which provided complete protection against yellow rust.

"For ten years the *YrClaire* gene was very effective, however, following the appearance of Warrior in 2011 there was a marked increase in its susceptibility. In more recent years in the Limagrain nurseries (2019-2020), Claire has an infected leaf area of 60% or more, indicating it's still very susceptible to yellow rust."

But for Brigadier, which broke down in 1995-1996 before the ingress of Warrior, the story has a very different ending. "In the Limagrain nurseries, Brigadier was susceptible to yellow rust after its resistance broke, but from 2017 onwards it's become very resistant to the disease. This means Brigadier has *Yr* genes which were defeated by the old clonal lineage of yellow rust but now provide resistance against the Warrior population," she explains.

So, what's next for plant breeders? Breeding for durable resistance is the Holy Grail but the unpredictable nature of the yellow rust population makes it very difficult to anticipate which host resistances genes will continue to work long-term, says Rachel.

"We know single genes are unlikely to endure so we're looking at combinations of genes together, but it's difficult to forecast which combination will prove to have the most longevity."

Trying to breed for resistance post-Warrior means plant breeders have to use all the data available to try and make the best and most-informed choices, she believes. That's where the data collected by the UKCVPS comes in useful.

Significant changes

"As plant breeders we work with the wheat host genetics and not the pathogen, so the work of the UKCPVS helps us understand if there any significant changes in the yellow rust population — providing an early warning system to potential problems, as well as validating new races."

The survey work also identifies new pathotypes and provides breeders with information on the virulences these have and at what frequency they're present, she adds.

There are at least eight effective resistance genes for yellow rust present in the varieties currently on AHDB's Recommended List. Those that have three or four *Yr* genes have greater resistance than those with less, says Rachel.

But not all resistance genes are effective against Warrior. To establish which genes are working well together and which are losing efficacy, Limagrain closely monitors its nurseries. "By monitoring resistances year-on-year, we can see which gene combinations are shifting."

Pre-breeding also provides an added opportunity to introduce resistances, particularly because the elite wheat gene pool is fairly narrow, she says.

"If you cross an elite wheat with another elite wheat then you produce a limited number of *Yr* gene combinations. So, it may be necessary to introduce *Yr* genes from elsewhere."

Approximately 75% of yellow rust resistance genes are native to Triticum aestivum but others, such as *Yr5*, *Yr8*, *Yr9* and *Yr17*, are non-native.

"There are a number of additional resources we can exploit. Wheat has three gene pools, with the primary gene pool from elite wheats, landraces and genetic stocks; the secondary gene pool from wheat progenitors; and a tertiary gene pool made up of crop wild relatives. The secondary and tertiary sources can bring more diversity and new resistances."

But as always with plant breeding, there's no magic wand and new traits are often accompanied by unwanted ones. "Often these genetics produce plants that are very tall and prone to lodging, they can have lower yields and are difficult to cross, with sterility all too commonly encountered.

"Because of these problems, introduction of new resistances into breeding programmes takes 2-3 times as long compared with using elite sources."

And that isn't good news because traditional plant breeding already takes about ten years to progress from the initial cross to nursery stock selection, through to yield trials and eventually National List and RL trials.

"A further downside is that new breeding lines derived from crosses made 4-5 years ago may be less resistant by the time they reach NL trials due to the diversity and speed of change in the yellow rust population."

Rachel says that for these reasons breeders have to be selective with resistances and the use of DNA markers is essential to help pick those combinations they believe will be most useful, taking into account changes in the pathogen population and how quickly they're occurring.

"But it's no easy task! To protect resistance genes we have to stack them together as this provides more durability, but it requires 1000s of lines to be screened with markers in order to create effective gene stacks with four or more resistance genes." ■

> *"It's better to reduce rates rather than cut an application timing altogether."*

Protecting precious yield

Mastering spring barley

High cereal prices, forecasts for tight global supplies and eye watering nitrogen prices mean optimising spring barley yields are more important than ever this year. *CPM* explores how a robust fungicide programme can be worth every penny.

By Melanie Jenkins

The open autumn of 2021 means there's likely to be less spring barley in the ground than in previous years, with AHDB's early bird survey estimating that plantings are down 8% on 2021 at 687,000ha.

Though disease management is a fundamental aspect of any spring barley crop, this year's high prices and turmoil in the global markets means that protecting yield is more important than it's been for quite a long time, says James Southgate of Prime Agriculture.

"With commodity prices where they are and where they're looking likely to be going forward, all cereal grains are worth a lot of money — whether for feed or malting — so there's a greater justification for a higher spend on fungicides," he explains.

"Although applications should still be tailored to variety, drilling date and location, it could be remiss to take risks with fungicide applications when the return on investment is so good this year. There's a very small yield increase required to cover the cost of a robust fungicide programme compared with a weak one when prices are where they currently are."

Return on investment

Even in more stable times there's a good return on investment with fungicide applications, agrees Syngenta's Joe Bagshaw. "With a currently conservative grain price of £250/t, crops only need a 0.2t/ha yield response over untreated to cover a £50/ha spend on fungicides. And other than in 2018, most crops have achieved well above this over the past five years."

And as well as maximising yield, those growing for the malting market will want to ensure good grain quality, he adds.

So what diseases should be focused on? Net blotch can be an issue, particularly in earlier drilled spring barley and a fungicide spray at T0 may be required to tackle it, says James.

When it comes to mildew it's not always the early drilled crops that are worst affected, he says. "Weather can have a big impact as it can induce stress in the crop, making it more susceptible to mildew."

Wet weather can also result in outbreaks of rhynchosporium, with pressure usually higher in the West and North, more so than in the East, he continues.

Brown rust is another big consideration in spring barley and is more of an eastern disease, says James. "Though it can be an issue in western areas, it's less prevalent in Scotland."

Ramularia is probably the biggest potential yield robber of all and has caused the greatest losses in recent years, so should be taken seriously, he points out. "There's some regionality in infections — which tend to be worse in the North and Scotland — but that's not to say it can't rip through crops elsewhere.

"It's been about three years since we experienced really high pressure from ramularia," he says. "We've not had much over the past couple of seasons, but it's been there in the background and if we get levels like we had three years ago again, there could be pretty significant yield losses and problems with screenings."

One of the biggest issues with ramularia, other than that it can exist asymptomatically in crops, is the lack of effective curative chemistry to tackle it, continues James. "We only have protective chemistry, so it must be thought about early.

"Ramularia is one of the trickiest diseases as we don't really know when it ▸

Even in more stable times, fungicide applications offer good return on investment, says Joe Bagshaw.

Keep nitrogen out of the clouds by keeping it in the crop

DEFRA recently announced new standards to mitigate ammonia emissions. From 2024, farmers in England can only use unprotected urea from 15/01 to 31/03, and protected urea fertilisers throughout the rest of the year.

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Though disease management is a fundamental for any spring barley crop, this year's high prices mean protecting yield is more important than ever.

▸ will be triggered or when early or late infections are likely to become symptomatic. And we have no chemistry sets at all that will work in a curative situation."

Looking at the previous history of ramularia on farm can indicate the likelihood of it being present again, says Joe. "It's something to be careful of. You can DNA sample your crop but this is relatively expensive. So the best way to keep it out is to keep your crop stress-free and healthy, making sure it's not deficient in any micronutrients.

"Those targeting malting specification will want to make sure nitrogen doesn't become limited as any stress can increase ramularia levels," he warns.

But it's not just against ramularia that fungicides work better protectively. "All fungicides work better in a preventative rather than curative situation," explains James. "That's not to say you should always spray before you see any disease in a crop, and very few spring barley crops will receive a T0 application."

Joe advises being aware of the disease risks based on rotation and integrating cultural control methods as well as thinking about varietal susceptibility. "Generally, most spring barley varieties are rated as good against mildew and, because it has such a short growing season, it's not generally an issue. But controlling it should be considered if the crop has been drilled early and the disease is present.

"Products such as Talius (proquinazid) can be used against mildew, or if crops get net blotch early doors you can use Kayak (cyprodinil)," adds Joe.

Earlier drilled crops that have suffered unfavourable weather conditions are more likely to need targeted chemistry as these could be more susceptible to net blotch or carry higher levels of mildew infection, explains James. "If you see these in the crop and it's still a long way before the T1 timing, then a T0 fungicide is justified."

Historically, when spring barley has been drilled in late March and April, a lot of crops only get one fungicide application, he says. "But I don't see that being very likely this year, given the typically earlier drilling dates and the high value of the crop."

Fungicide strategy

Spring barley's short growing season and the way it can romp through its growth stages can make fungicide timings tricky, but Joe believes it's worth taking a programmed approach. "It's better to reduce rates rather than cut an application timing altogether — especially if you're aiming for a quality end-market. Then it's vital to do two fungicide applications."

At T1, growers should be looking to apply a preventative spray to make sure they don't let disease into their crop, advises James. "If you don't apply at T1 any infections will bubble along and once the canopy gets bigger removing disease is much trickier. This could mean you have to apply higher dose rates, spend more and you could still see reduced yields."

Typically, in low pressure situations an application of prothioconazole may be all that's required at T1, he explains. "But there's potential to add in a strobilurin or an SDHI in higher disease pressured situations depending on the combination of diseases present.

"With prothioconazole as a base, you're covering the main diseases — protecting from brown rust, mildew, net blotch and rhynchosporium. It'll also have some, if pretty limited, effect on ramularia."

Ramularia is triggered to become symptomatic by stress in the plant, which can be caused by cold and dry conditions, says James. "In these situations, there could be a benefit from adding folpet at T1 as it's been shown to give good levels of protection against ramularia."

Depending on when crops were drilled, the gap between T1 and T2 applications could be quite long. In situations where the time between fungicide applications is protracted and folpet is only planned at T2, then it could be too late to provide

Be aware of disease risks based on rotation and integrating cultural control methods as well as thinking about varietal susceptibility.

adequate protection, warns James.

He suggests that in these instances it's worth looking at applying folpet at a halfway timing, between T1 and T2 — GS37-39 — to boost protection against ramularia. "This will allow you to take T2 slightly later, from the start to the end of ear emergence, which gives the ears protection and will also help to cover fusarium if conditions turn wet."

In winter barley T1 is the more important fungicide spray, but in spring barley T2 has now become more important because it offers the best chance to control ramularia, says Joe. "It might be a case of using a reduced spray at T1 and using your better product at T2.

"And for those going for a one hit approach, ensure you do have a good SDHI, triazole and multi-site in there —

Spring barley's short growing season and the way it can romp through its growth stages can make fungicide timings tricky.

Net blotch can be an issue, particularly in earlier drilled spring barley, and a fungicide spray at T0 may be required to tackle it.

such as folpet — to hit ramularia. Ramularia needs a different approach to other diseases and a multi-site has proven to be a worthy addition," he advises.

"At T2 it's then a case of using a prothioconazole base with an SDHI to cover the main foliar diseases, while getting good persistency and keeping the crops green for as long as you can," says James.

A stacked programmed approach is best, believes Joe. "I'd advocate folpet at T2 in any programme to add insurance and Proline (prothioconazole) will still do something against ramularia.

"Generally, Elatus Era (benzovindiflupyr+ prothioconazole) at T2, applied with folpet, will cover the awns and protect the top leaves, stem and ear. Dose rates are flexible depending on disease pressure. Although Elatus Era can be a good fit at T1, it's usually better aimed at the T2 timing," he adds.

Later sown crops are also likely to need a good PGR programme as they try to compensate and catch up their growth, increasing biomass quickly with extending day length, explains James. "Some crops that are slightly more backwards may also need careful management as they can 'bounce back' with tall, weak stems and lodged crops cost yield.

Rhynchosporium is favoured by damp conditions and can be a yield robber in some seasons.

Preventing lodging

"Using chlormequat or trinexapac-ethyl at GS31 — T1 timing — combined with a fungicide will leave an option for Terpal (mepiquat chloride+ 2-chloroethylphosphonic acid) at GS37-GS39, which could be applied together with folpet," he adds.

"Look at varietal lodging ratings and adapt your programme to your local situation and the weather, as that'll play a big part in lodging risk."

A decent PGR can also help at harvest, says Joe. "It'll help strengthen the cell walls in the stem and prevent brackling. The ears hold up and off the ground so they can go through the combine header and don't just snap off."

Later and prolonged crop greening can also help to reduce brackling, which can be a particular issue if the crop has disease, says James. "Foliar disease leads to premature senescence, resulting in a weaker plant with more brackling."

That's where Elatus Era gives added value, he says. Trials have shown that Elatus Era can increase green leaf retention and help reduce brackling by improving plant health and upper stem strength when applied at T2, explains Joe.

Optimising nutrition can also play a significant role in crop health and its ability to deal with disease, says James. "With such a short growing period, spring barley has a requirement for nutrients very quickly. If the weather is nice and warm, plants will have good access to soil nutrients but in drier conditions, it's advisable to think about an early manganese application on some soil types."

Ramularia needs a different approach to other diseases and a multi-site has proven to be a worthy addition to fungicide programmes.

Along with this, it doesn't matter if spring barley is going for feed or malting, getting nitrogen on relatively early can mitigate issues from dry periods, he adds.

"On lighter land especially, access to required nutrients at early stages is important and having the healthiest plant possible will help use the plant's inherent genetics to reduce disease," explains James. "In turn this will mean lower pressure and potentially less requirements for chemistry." ■

Mastering spring barley

Spring barley is the UK's most popular spring combinable crop, with the intended area in 2022 far exceeding the area of winter barley already in the ground. It's hardly surprising because, get it right and spring barley can deliver a pretty decent gross margin. While there are masters of spring barley, who have learnt their art from years of experience, there are also apprentices — more recently acquainted with the crop and its intricacies.

To help navigate the potential pitfalls of spring barley growing, *CPM* has teamed with Syngenta to draw on its experience from varieties through to crop protection. Looking at the whole picture, this series of three articles will investigate growing for the market; early agronomy to set the crop up to make the best of its short growing season; and how best to keep diseases at bay.

With yield and quality well worth protecting this season, Syngenta fungicides allow multiple damaging barley diseases to be targeted. Combining the reassurance of prothioconazole with the long-lasting protection of the SDHI, benzovindiflupyr, Elatus Era has label approval against net blotch, brown rust and rhynchosporium. In ramularia trials, adding folpet to Elatus Era at T2 boosted yield by 0.28t/ha. Adding folpet at T1 and T2 gave an extra 0.45t/ha.

> *“Bairstow’s going to be one that will compete with its better-known Group 4 contemporaries.”*

Insiders View

Bairstow, howzat?

Whoever at RAGT is a fan of cricket, they seem determined to pull together a winning team. Soft Group 4 variety RGT Bairstow looks to be a winner and *CPM* has front row tickets to see how it performs.

By Melanie Jenkins

Joining the ranks at RAGT is RGT Bairstow, which has bowled its way to the top of the soft Group 4s on AHDB’s Recommended List (RL) and, like its cricketer counterpart, RAGT is likely hoping it can achieve notable success.

A consistently high yielder across all regions, with a strong all-round disease package — including OWBM resistance — and very high alcohol yields, Bairstow is suited to a wide range of growing systems, according to RAGT breeder, David Schafer.

The latest RL has seen two new soft Group 4s added this year, both coming from RAGT, says the firm’s Tom Dummett. “Previously we had RGT Saki — which is still a very useful variety — but Bairstow and RGT Stokes are the next generation on.

“Bairstow’s yield hardly deviates from its own yield mean,” he explains. “It goes from 102% to 104% in its spread of yield results — something few other varieties do. It can be grown further north and its alcohol yield/ha means it has good environmentally friendly credentials.”

Wynnstay has had an interest in Bairstow for a while now, according to the company’s Nigel Britland. “We watched it go through AHDB screening for a few years and it’s been at the forefront, showing a lot of promise. It’s pleasing it got on the RL as it looks such a versatile variety.”

Consistent performer

Bairstow’s agronomic package of disease resistance is what originally drew Frontier Agriculture to it, says Chris Piggott. “Not one disease element is a problem for it, which is reflected in its regional yield results in AHDB and our own trials. At most of our main sites, it’s been in the top third of varieties and nothing seems to pull it down.”

It’s a variety that has performed consistently across regions, soil types, geography and drilling dates, he adds. “I don’t think Bairstow has a particular affiliation for heavy or light land, north or south and this is reflected in AHDB’s data.”

Bairstow’s versatility will appeal to growers, says Nigel. “As a strong first or second wheat, with a good Hagberg and resistance to sprouting, Bairstow’s going to be one that will compete with its better-known Group 4 contemporaries.”

Another thing that became evident to Chris from Frontier’s trials was how strong Bairstow’s specific weight was moving northwards. “It was very strong the further north our trials went, and it remained so in untreated situations.”

Bairstow is a three-way cross of Revelation, Santiago and Cougar, explains David. “It was identified as a favourable combination in 2013 and accelerated through our breeding programme’s single seed descent systems.”

Revelation and Cougar provided a diverse septoria resistance base, with Cougar also conveying multigenic yellow rust resistances. Santiago was the heavy yield contributor, while Revelation also brought in the distilling quality of Bairstow, he explains.

But it can’t be omitted that some growers may be looking at the Cougar in Bairstow’s parentage and feeling concerned about the resilience of its septoria resistance, but RAGT assures growers that the variety came out of last year’s septoria nightmare strongly.

“It’s been a difficult story for a number of varieties with Cougar in their parentage,” says David. “Bairstow was tested in the same locations as varieties such as Firefly — which now have much weaker ratings — and it hasn’t seen the same ▸

RGT Bairstow is the next level up from RGT Saki, according to Tom Dummett.

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Chris Piggott believes that Bairstow is agronomically sound, with no single disease element causing it a problem

▸ susceptibilities. This was a very good result and encouraging to observe in a tough season."

Even after last year's horrendously bad septoria year, where varieties known for their septoria resistance — with and without Cougar in their parentage — lost half a point from their resistance scores, Bairstow fluctuated little, confirms Tom.

Because of its relatively strong septoria and yellow rust scores, there isn't really anything other than its eyespot score that could potentially pull the average yield down, says Chris. "It's not anything we're hugely concerned about though."

Nigel recommends a full growth regulator programme for Bairstow. "It has a standing score of 6, which means the variety will require a full PGR programme in spring, with particular attention paid to that aspect," he suggests.

David is encouraged by Bairstow's regional stability and says it has done well in second wheat trials.

The new variety has a wide drilling window, but Tom advises not going too early with it, instead aiming for the main and later sowing dates, from 25 September through to the mid or end of February. "It has a fairly low vernalisation requirement, so drilling date is quite flexible."

Bairstow's likely to suit those growing a varied selection of varieties, explains Chris. "The slightly later maturity of Bairstow means it'll be a good fit for growers wanting to split maturity and there aren't a huge number of highly disease resistant varieties with later maturity."

He assures anyone concerned that later maturity may mean late harvesting that this isn't because it has a long growing season. "It's certainly not the latest harvesting or longest growing variety so doesn't need drilling early."

Once established, Bairstow has an intermediate growth habit, says David. It has a moderate to fast speed of development but isn't as fast as Skyscraper and doesn't fly through the winter. Instead, it slows itself and reaches GS32 at a reasonable time.

"But once that happens, the variety then accelerates and is a very high tillering type, with a leafy canopy and good-sized ears, reaching heading quite early — similar to Gleam and Skyscraper."

Whereas Cougar derived material can often produce club ears which stifle

Bairstow at a glance

Yield (% treated controls)	
UK treated	103.1
UK untreated	84.6
East region treated	103.3
West region treated	102.9
Disease	
Mildew	6
Yellow rust	7.1
Brown rust	6.3
Septoria	6.4
OWBM	R
Agronomy	
Lodging (% + PGR)	6.3
Height (cm)	91
Ripening days (+/- Skyfall)	+2
Specific weight (kg/hl)	75.6
Protein content (%)	11.2
Hagberg falling number	228

Source: AHDB Recommended List, winter wheat 2022/23

Bairstow test series

Growing Bairstow for the second year, Andrew Cawood likes varieties with good disease resistance, which are all-round yielders. Farming 250ha at Burley House Farm, Selby in North Yorkshire, his land includes both light and heavy soils on top of magnesium limestone. This has a high pH and high magnesium so he has to contend with lock-up of various nutrients.

Aiming for a seven-year rotation, he has wheat, winter and spring barley, oilseed rape, peas and potatoes and is trying grain rye for the first time this year. "It's always a toss-up if I go for a second wheat, a winter or spring barley or rye in the second cereal spot."

As part of RAGT's Growers Club, Andrew was offered seed in 2020 but he wasn't able to drill it until 24 November that autumn. "Bairstow went into the ground we had left, and we could only drill the middle of the field because of the conditions."

Although he drilled a high seed rate of 461 seeds/m^2 and applied 196kgN/ha, due to the late establishment and difficult conditions the crop only achieved 6.5t/ha. This was below the farm average of 10.25t/ha.

"It went in too late and wet, which is why I didn't drill the headland," he explains. "I don't think it was a fair reflection on the variety as the situation wasn't ideal."

He now has another crop of Bairstow in the ground and feels this year he'll get a proper answer about its capabilities. He has planted the variety in two fields following potatoes, which were drilled on 22 September 2021 at 325 seeds/m^2 and in another field in a second wheat position, which was drilled on 8 October at 397 seeds/m^2.

Andrew ploughed the second wheat field to get rid of volunteers and any disease inoculum and top-downed and rolled the potato fields, then drilled all of them with his Amazone combination.

"I'm not sure what I will do with my fertiliser regime this year — I've been taking soil samples and hopefully I can knock back on nitrogen a bit, but I can put N on normally as I bought stock last summer at £300/t," he says.

"All the crops are looking well this season and Bairstow has come out of winter looking very good."

Growing Bairstow for the second year in a row, Andrew Cawood is optimistic about its potential.

specific weight, Bairstow has a slightly laxer ear, likely aiding specific weight uplift, adds David. "It has a long grain fill window, which is very interesting as it's something we like to see to help build yield."

Looking at the soft wheat market at present, Skyscraper sits in third position for market share, taking around 10% of the market, according to Tom. "Bairstow is likely to take the same percentage share in time and there's enough in the ground at the moment to fulfil 3-5% in the coming season.

"We released some seed to our Growers Club members and the feedback was really strong. The seed crops yielded really well in what was a difficult season, where some crops underperformed," he says.

"If you want to get hold of some seed, book it early. There will be a nice amount for people to try and get their teeth into," adds Tom.

Nigel says that Wynnstay has had a few enquiries about Bairstow and thinks when growers see it at demo days and events, there will be more interest. "I suspect there'll be more demand than supply. A lot of growers will look to try it this year and see how it performs under their management schemes and because of its scoring on the RL, it will likely be here for a while," he adds.

Chris seconds this. "Although the soft wheat market is smaller than for other wheat groups, I think Bairstow has potential to take market share from some of the big varieties, especially as it offers opportunities in the distilling market, and maybe even in biscuit grist blends and export. Bairstow could have full UK-wide interest."

Bairstow has been proven to have a strong alcohol yield, according to Tom. This was backed up by the Scotch Whisky Research Institute (SWRI). The key requirements for grain distilling are that a variety has a high alcohol yield (measured as litres of alcohol/tonne) and that it will process efficiently, explains James Brosnan of SWRI.

James Brosnan has seen Bairstow since National List 1 trials, where its alcohol yield was above the control variety.

Working with the British Society of Plant Breeders, SWRI screens newer varieties as they come up through National List and AHDB trials. "We saw Bairstow at NL1 and could compare it with established control varieties."

Alcohol yield

Though grain distilleries use thousands of tonnes of wheat a week, SWRI has a small-scale testing method to determine a variety's suitability for distilling. Using a 50g sample at the same temperatures as would be used in a distillery, the method looks at breaking starch down to fermentable sugars.

"We cook the wheat, cool it and add high enzyme malted barley to break down the starch," says James. "Then we ferment this with a yeast strain for three days and, distil it in a lab to obtain the amount of alcohol it can produce."

Viscosity is another aspect that has to be tested, he explains. "To test this theresidue left from distilling — a brown syrup — is measured. If it has a high viscosity, then there are potential processing problems when used at scale," he explains. "High viscosity used to be a major problem in UK wheat varieties but it's rare to see now."

At NL1, Bairstow's alcohol yield was a bit above the control variety, says James. "At NL2, we analyse again and in Bairstow's case, it did a little better. So with two years of limited data, we saw consistency and a promising alcohol yield."

SWRI then follows varieties as they go into RL trials. "In 2021, Bairstow showed it was at the top end for alcohol yield of 13 varieties in the sample set, across six trial sites. It was in the top five at every site and in the top three at four sites," explains James.

"With my distiller's hat on, I could rate it as good for distilling, similar to varieties such as Swallow, Elation and Elicit," he adds.

Because of Bairstow's distilling potential and its wide sowing window, it has a niche akin to that of Skyscraper and is suitable in northern environments, says David. "Growers selecting these Group 4 soft wheats ought to be looking at Bairstow. We see it as a Saki-plus — with a maintained septoria resistance."

According to Nigel Britland, Bairstow will go on to compete with its better-known Group 4 contemporaries.

Because of the past few difficult seasons, more growers are open to having different types of varieties on farm, says Chris. "We've certainly seen more interest in newer varieties. To see a variety outyielding Skyscraper, with disease resistance too, is very impressive and great progress from the plant breeder." ■

Bairstow is a three-way cross of Revelation, Santiago and Cougar.

Bairstow has shown regional stability and has done well in second wheat trials.

Partners in success

> *"To have a solution which works well on its own – and even better with a partner – is invaluable."*

Research Briefing

The latest trials by Nufarm have shown that the scope of weed control by its sulfonylurea herbicide, Paramount Max, can be extended to 'off-label' species when paired with partner products — helping growers to tackle some of the most challenging weeds. *CPM* finds out more.

By Charlotte Cunningham

For as long as chemistry has existed, farmers and agronomists alike have experimented with various mixtures and combinations to try and get the best from weed control.

Iain Allan — account manager at Nufarm — is no exception, having worked as an agronomist for over 20 years.

Over this time, Iain says he identified trends and 'tricks of the trade' when it came to optimising the control of some of the most troublesome weeds which were not on the label, which ultimately led to Nufarm's latest research into the efficacy of its sulfonylurea herbicide, Paramount Max (florasulam+ tribenuron-methyl).

"Based in the north of Scotland, spring barley was my main crop and one of the SU herbicides I used to use frequently was a product called Inka (thifensulfuron-methyl+ tribenuron-methyl)."

Iain explains that he learnt very quickly that if an adjuvant was used with Inka, it appeared to control weeds which weren't on the label. "It dawned on me that in some ways, Inka was quite similar to Nufarm's product, Paramount Max, in that they both contain tribenuron-methyl and are co-formulated with another SU.

"So when I joined Nufarm — which had recently just purchased Paramount Max — I had a suspicion that I could make the product work in a similar kind of way, which has essentially been the driver behind these latest trials."

Problems with fumitory

The trials were carried out in Scotland where there are a number of weeds which are very troublesome for spring barley growers, says Iain. "The most problematic is probably fumitory — it robs yield and can be difficult to control — and it's very expensive to do so.

"But the biggest challenge with the weed comes at harvest time as it wraps itself around combine headers, causing real hardship for farmers at what can already be a busy, time-sensitive period of the year."

As such, he decided to establish two years of trials to put Paramount Max to the test and see if it was possible to bolster control of weeds not on the label.

Year one

The first year of the trials saw Nufarm use Paramount Max with three different partners — mecoprop-P, its own product High Load Mircam (mecoprop-P+ dicamba) and Corteva's product, Pixxaro (halauxifen-methyl+ fluroxypyr).

"We got extremely good results and the weed control across the board was fantastic," recalls Iain.

Pleased with what he saw, Iain says he then wanted to take the results and develop them further to get a deeper understanding of how exactly Paramount Max worked in a working situation and how it could be manipulated to maximise weed control.

"I put my agronomist cap back on here, and decided I wanted to look at the ▸

Trials were carried out using 'realistic' dose rates of Paramount Max to provide more representative results, explains Iain Allan.

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All the trials were carried out in spring barley, on 12m strips down a 10ha field.

▸ performance of the product at realistic working rates — not just a manufacturer's recommendation. You can make anything work at full rates, but let's be honest, no agronomist uses these," he laughs.

Year two

To study realistic rates, Iain wanted to carry out the trials on a working, commercial site. "I spoke to James Hardie — an agronomist I know well — who managed to find me a suitable site belonging to a livestock farmer, who produced a lot of grain crops for his cattle.

"He was working a 12m sprayer, which made it ideal for the trial. Here, we trialled four treatments — Paramount Max on its own, Paramount Max with an adjuvant, Paramount Max with Duplosan KV (mecoprop-p) and Paramount Max with Duplosan KV and fluroxypyr.

"With regards to the adjuvant, I decided to choose just a methylated rapeseed oil as we knew every distributor would have access to this."

All of the trials were carried out on spring barley, on 12m strips down a 10ha field. In terms of rates, Paramount Max was kept at 15g within each treatment (compared with the full rate recommendation of 25g).

Fumitory in spring barley can be very difficult and very expensive to control.

The trial strips were also compared with the farmer's usual treatment of a Harmony M (metsulfuron-methyl+ thifensulfuronmethyl) plus Duplosan tank-mix on the rest of the field.

Looking to the results, Iain says that it was no great surprise that Paramount Max on its own killed the weeds the label stated. "It didn't, however, kill off any species that weren't listed on the label — including the problematic fumitory. Effectively, this was a benchmark trial to see what Paramount Max wouldn't kill, which would allow us to compare how we could boost this with various other partners."

To his delight, the Paramount Max with the methylated rapeseed oil (at a rate of 0.5 l/ha) delivered a much more promising result. "It worked exactly the way I thought it would after seeing the capabilities of Inka when used with an adjuvant," he explains.

"It provided control against fumitory, but it killed the weed in a different sort of way than perhaps we'd been used to. Effectively, this combination of products causes the youngest growing point of the fumitory to start to blacken and that blackening starts to spread throughout the plant — enabling growers to take out weeds up to 10-12cm, which is quite a mature plant.

"And this was still only using Paramount Max at just over a half rate of 15g. We were also bolstering the control of other key weeds — namely polygonums like knotgrass and redshank. We also saw improved control of chickweed and even saw activity on pansies.

"Pansies can be quite difficult for an SU to control if they get to any size. In the good old days, we had products in the armoury which were able to provide control, but these have since been withdrawn, so to have something which provides an effect on difficult weeds was great to see.

"Methylated rapeseed oil isn't a fancy adjuvant and there are much better, more effective options out there, but the comparative difference in control just by adding a bit of this was really interesting."

When used with 1.25 l/ha of Duplosan, Paramount Max performed well and quickly — speeding up the kill of key weeds like chickweed, explains Iain. "One of the best results we saw was with the final treatment (Paramount Max, 1 l/ha of Duplosan and 0.4 l/ha of a 200g/litre fluroxypyr).

"The results were absolutely fantastic — I call it a 'scorched earth' policy where absolutely nothing survived," he laughs. "There was no evidence of any weeds at all, and there are certain scenarios where we'd recommend this mix to agronomists."

Iain says this includes where growers have ALS-resistant chickweed, for example. "This is incredibly common in the north of Scotland, but with this mix

Agronomist's view

James Hardie, agronomist at Agri Solutions, was responsible for finding the trial site used in the second year of research into Paramount Max.

The farm belonged to one of his clients who was struggling significantly with weed control in his barley, making it a perfect site, he explains. "The farmer grows around 40ha of spring barley and a small amount of spring oats, and has historically had severe issues with chickweed, docks and thistles, to name a few. He has also had some issues with resistance in some of the chemistry he was using."

Going forward, James says he'll be using and recommending more Paramount Max — with a suitable partner. "These weeds have caused issues for growers for a long time, and unfortunately, the same course of treatment has been prescribed which has led to increased rates and issues with resistance in some cases.

"But to have a solution which works well on its own — and even better with a partner — is invaluable."

Year two treatments and results summary

Treatment and rates/ha	Result
Paramount Max only (15g)	Killed on-label weeds, but no activity on off-label species
Paramount Max (15g) with 0.5 l of methylated rapeseed oil adjuvant	On-label weed kill plus control of fumitory. Also improved the control of other key weeds like knotgrass, redshanks, chickweed and even saw activity on pansies
Paramount Max (15g) with Duplosan KV (1.25 l)	Good control of on/off-label weeds, speeding up the kill of weeds like chickweed
Paramount Max (15g) with Duplosan KV (1.0 l) and fluroxypyr (0.4 l of a 200g/lproduct)	'Scorched earth' result where absolutely nothing survived. Particularly useful in cases of ALS-resistant chickweed. This is where the best results were seen

you've got both the mecoprop-p and fluroxypyr attacking the chickweed while the florasulam within Paramount Max is helpful if its SU resistant.

"Arguably, the tribenuron-methyl does nothing in this situation and this is something we've just got to accept when you've got SU or ALS-resistant chickweed."

Iain says they'd also recommend the treatment in oats, or on ground with very heavy weed burdens. "Oats are a very sensitive crop compared with barley. However, they became quite a common part of rotations for a while as growers sought a third crop for the three-crop rule and the prices were fairly reasonable, so having good weed control options is paramount."

The benefit of carrying out the trials in a real-life setting, compared with replicated plot trials for example, is that it allowed the team to see the 'warts and all' of the treatments, he adds. "I believe this gives a much more realistic picture of what farmers are likely to actually see in the field."

Though Iain says his agronomists' 'nose' and previous experience with similar products meant there weren't too many surprises within the trial, it did reveal the limit of pansy control. "If pansies are any size — once they start to get 8-10 leaves on them — then control does become a bit more of a challenge, but I think this is more to do with the nature of the weed rather than a failure of the product," he adds.

In contrast, what he was most pleased to see was the fumitory control. "Anyone who grows spring barley in this region knows just how severe fumitory problems can be — but we've now been able to prove there is another way to control it. It's always great to have a different way to kill something."

So what's next? Iain says the firm is currently working on another SU, which is currently going through the registration process. "The trials so far are looking very promising when compared with a 'standard' treatment — so watch this space for more information…" ■

Spring barley is one of the main crops in Scotland, but success can be hampered by weeds.

Repeatedly prescribing the same weed control treatment causes issues with resistance, says James Hardie.

Paramount Max – everything you need to know

Paramount Max is a co-formulation of florasulam+ tribenuron-methyl and is designed to help growers control a range of broadleaf weeds including chickweed, groundsel, poppies, mayweed and cleavers, explains Iain.

A full rate dose is 25g/ha, and Iain explains that Nufarm is the only manufacturer to have this specific co-formulation available.

"How to get the best from Paramount Max all depends on what you partner it with," he adds. "It also has an extremely short half-life, so if agronomists are needing to clear up mayweeds or late flushing volunteer OSR, for example, it can be used right up until flag leaf in winter cereals.

"After nine weeks, that product is completely gone and there's no chance for residual activity on cover crops, or OSR."

It partners very well with phenoxies too, adding another element of flexibility into the strategy, he concludes.

Research Briefing

To help growers get the best out of technology used in the field, manufacturers continue to invest in R&D at every level, from the lab to extensive field trials. *CPM* Research Briefings provide not only the findings of recent research, but also an insight into the technology, to ensure a full understanding of how to optimise its use.

CPM would like to thank Nufarm for sponsoring this Research Briefing and for providing privileged access to staff and material used to help bring it together.

Scorecard reconnects farmers with soil

AHDB

from theory to field

> *"The apparent disconnect between farmers and their soils had eroded confidence in their ability to assess soil health."*

A five-year project has just come to an end and will have a significant impact on how soil health is measured and managed in the UK. *CPM* takes a look at one of its most useful outputs — the Soil Health Scorecard.

By Adam Clarke

With UK crop yields and margins plateauing, interest in soil health has been reinvigorated and AHDB has invested significantly in soils research over recent years.

One of the early outputs of a recently completed five-year project was the Soil Health Scorecard and this simple, practical tool for use by farmers has now been tested and validated in multiple trials.

Its creators hope it will help restore the connection between farmers and their soils, which has, on some farms, been lost because of increased mechanisation and reliance on artificial inputs.

The Soil Biology and Soil Health Partnership started back in 2017 and researchers have been trying to work out the best way of helping farmers reconnect with, and improve, the health of their soils.

All known indicators of soil health had to be identified and expert inputs were used to distil these down into a shortlist, with the plan to use those indicators to produce a traffic light do-it-yourself scorecard system.

This would see green-amber-red represent low-moderate-high risk of reduced crop yield and sub-optimal soil conditions, or an increased risk to the environment, especially for available soil phosphate, according to the project's research lead, NIAB's Elizabeth Stockdale.

She says the initial indicator list was 45 strong and these were reduced to just eight, which include one physical, four chemical, two biological and a microbial where additional detail on soil biology is considered useful.

Co-development process

"The apparent disconnect between farmers and their soils had eroded confidence in their ability to assess soil health. The scorecard we've produced can help regain that confidence and put them in control, without bamboozling them with complicated tests or datasets.

"In the end, what we have is an apparently simple thing, and that comes from the co-development process. Farmers have been part of the journey the whole way," she explains.

Initially, when the concept was first pitched to farmers at discussion groups, the Soil Health Scorecard was met with scepticism and, in some cases, bemusement because assessments have to be carried out in the busy autumn or spring periods, says Elizabeth.

"However, its simplicity means it takes a mere 30 minutes or so to carry out each assessment and once tested, they became very enthusiastic about its value as a management tool," she adds.

"There's a sound understanding now of why it matters, so people are making time to work through the assessments, even when they're busy."

The information collected using the scorecard is essentially a GP check-up for soil, with observations on soil structure and earthworm numbers made, and samples for laboratory analysis collected at the same time, with the location georeferenced.

This allows the farmer to come back to the same place each time to benchmark progress on a rotational basis. To that end, assessments should be done in similar conditions each time, she explains.

Elizabeth stresses that the scorecard doesn't always indicate the interventions or management tweaks required but acts as a signpost to where more investigation ▸

It takes a mere 30 minutes or so to carry out each assessment for the scorecard and once tested, growers are enthused about its value as a management tool, says Elizabeth Stockdale.

Studies indicate that those growing roots or other field vegetables can improve soil health by doing the right things in between crops like potatoes and sugar beet.

▸ is required.

"In the same way that a doctor would refer you on to a specialist, it might say your pH is a bit low and prompt you to go and have a look at your liming plan and test a wider area. It could be that one patch is low, but equally it might be the whole field," she explains.

Once the Soil Health Scorecard was conceived, it was tested to prove the indicators provide the correct information to help improve soil management. As the wider project was mainly focussed on soil biology — the least known aspect of soil science — it also aimed to improve understanding in this area.

To achieve these goals, ADAS principal research scientist Anne Bhogal used the scorecard in trials on seven sites already hosting long-term experimental work, including two in Scotland looking at pH and rotation.

A site at Game and Wildlife Conservancy Trust's Loddington experimental farm was used to assess the impact of cultivation on soil health and ADAS Boxworth in Cambridgeshire hosted work on the impact of mole draining.

Finally, the impact of typical farm rates of organic matter additions, such as green waste compost, farmyard manure and slurry, was assessed using the scorecard at three long-term trial sites around England.

One of the key messages from the testing is that site is very important when considering soil management, says Anne.

While the effects of treatments

Soil Health Scorecard

Attribute	Control	FYM (23 years)	Green compost (13 years)
Soil organic matter (%LOI)	3.0	4.1	4.0
pH	6.4	7.0	7.0
Ext. phopshorus(mg/L)	56	73	60
Ext. potassium (mg/L)	80	311	187
Ext. magnesium (mg/L)	44	87	63
VESS score	2	2	1
Earthworms (number/pit)	11	13	11
Potentially mineralisable nitrogen (mg/kg)	23	90	43
CO_2-carbon (mg/kg)	198	228	222

Source: AHDB, 2021

Soil Health Scorecard indicators

- Soil organic matter (%)
- pH
- Phosphate
- Potassium
- Magnesium
- Earthworm numbers
- Visual Evaluation of Soil Structure (VESS test)
- Microbial activity (Solvita CO_2 burst)

gave similar responses (increasing soil organic matter with repeated organic material additions, for example), the actual values of the soil health indicators varied considerably depending on location, she comments.

This is due to differences in soil texture, rainfall and other climatic factors, plus rotational history, explains Anne. "It showed us that you can't rely on generalised information — getting measurements and interpretation of what they mean for a particular site is key. The scorecard helps growers do that."

Encouragingly, testing showed all indicators chosen for the Soil Health Scorecard gave a strong baseline for soil health at a site-specific scale. It picked up positive effects of organic matter amendments, grass leys and reduced tillage intensity, with pH seen to be one of the most important basic elements to get right, says Anne.

"You can do all sorts of other elaborate tests, but if you haven't tested your pH, then you are in the wrong starting place. The key is to get these basics right first," she adds.

One of the surprises from the work were the cultivation results at Loddington, where a long-term no-till field was ploughed, and the scorecard used to assess its impact.

Doing the right thing

Anne says she expected a much more dramatic effect: although the plough did reduce earthworm numbers, it wasn't devastating, and the impact on soil organic matter after one year was negligible.

This hints that growers moving to a no-till system should not feel guilty about using targeted cultivations, she highlights, providing it's agronomically justified and they return to no-till as soon as possible.

Similarly, those growing roots or other field vegetables can improve soil health by doing the right things in between crops like potatoes and sugar beet, without the fear of going back to square one when those crops are planted.

"By bringing in cover crops and only tracking on land when conditions are right, it can be manageable. However, that can be tricky with increasingly unpredictable seasons," notes Anne.

The design of the Soil Health Scorecard has been inclusive of growers from the outset.

Elizabeth adds that cultivation decisions shouldn't be made solely on soil health grounds, with targeted operations helping to control problem weeds like brome or blackgrass.

"Tillage may help reduce herbicide use or control a weed that you might not be able to control without that intervention. The same as any other input, ask yourself: do I need to do it? Can I do it more gently? The advice remains the same — only move soil when you need to," she says. ▶

Tool for the masses will help improve soil health

After being involved in the development of the Soil Health Scorecard, Yorkshire grower and contractor David Blacker sees it as a simple and valuable tool for any farmer looking to improve soil health.

Farming about 200ha in hand and a further 600ha on contract agreements, he's been paying much more attention to soil health since 2012, an extremely wet year that exposed soil structural problems across the UK arable area.

His soil types are mostly clay loams and being in a wetter part of the country in North Yorkshire, land can lay saturated over winter and anaerobic conditions do not favour soil biology.

Just prior to 2012, David had started doing his own research in soil science and whether his land would be suitable for direct drilling, rather than the plough or min-till system that he employed at the time.

He started to experiment with cover crops and immediately saw a benefit from different roots to open structure and capture carbon. The farm then moved to a Mzuri strip-till system to establish crops in his wheat-oilseed rape-wheat-spring beans rotation.

More recently, he invested in a Shelton CT150 trencher, with the aim of renewing 8ha of land drains a year to improve drainage and avoid such conditions in wet winters.

Through most of the process, David had used a spade and gut feel to monitor progress but since he became involved in the development of AHDB's Soil Health Scorecard, he now has a more structured way of assessing and recording changes, he says.

His assessment sites are recorded on the What3Words app for repeatability, and he carries out the VESS test and worm count concurrently, so can finish the whole process in a rapid 15mins. Samples are then taken and sent to the lab.

"I think the VESS is a subjective thing, so it's very important that the same person is doing the assessments each time.

"The scorecard looks at organic matter levels and I can see from testing that it's a slow process building it up. I'm using cover crops and chopping residues and my results over five years show levels haven't increased much, but they certainly aren't going down," he says.

David does caution that the scorecard only gives information on set criteria, so in addition to doing the assessments, it's important to step back and look at the big picture, too.

David Blacker believes the scorecard's simplicity allows any farmer to gather valuable site-specific information on soil health and make positive changes to its management.

"When I was a monitor farmer, one of the best fields on the Soil Health Scorecard was the worst performing field for yield because of an underlying drainage problem. There could be a lot of factors outside of the scorecard criteria that might be limiting yield," he adds.

Even though the scorecard has its limitations, David believes its uncomplicated process allows any farmer to gather valuable site-specific information on soil health and make positive changes to its management.

"It is a great baseline to help you see if you're going backwards or forwards, which we didn't have before, and if it gets people out with a spade, then it can only be a good thing," he says.

Amanda Bennett says farmers at the beginning of a soil health improvement journey are better placed focussing on the basics, rather than investing in more complex tests.

▸ A bonus of the Soil Health Scorecard is that parts of it align with Defra's Sustainable Farming Incentive (SFI) arable and horticultural Soils Standards.

This currently requires entrants to measure organic matter levels across all land entered in the scheme. Soils should also be assessed, and a soil management plan produced, she notes.

"Farmers adopting the Soils Standard is a no brainer for me. It's sensible soil management that will benefit the farm — it's not just about a box ticking exercise for Defra payment," says Elizabeth.

In addition to producing and testing the Soil Health Scorecard, the project also aimed to plug gaps in knowledge of soil biology — a complex area to study and understand.

One area explored was the value of two laboratory tests used to assess microbial activity in the UK, including potentially mineralisable N (PMN) and the CO_2 burst, as part of the Soil Health Scorecard process.

The former measures the amount of nitrogen readily decomposed under anaerobic conditions; the latter measures the amount of carbon released as carbon dioxide when a dried soil is rewetted.

Both processes are dependent on the size and activity of the microbial biomass in the soil, so the greater the final value the higher the microbial activity, she explains.

AHDB's senior environment manager Amanda Bennett says the main issue with the two analyses is that interpretation frameworks were based on data from the United States.

The project aimed to benchmark guideline values relevant to UK soils and to some extent, that has been achieved, but more work and data gathering is required to extract full value out of the tests for UK growers, she believes.

Amanda says farmers at the beginning of a soil health improvement journey are better placed focussing on the basics, rather than investing in more complex tests.

"With all soil biology reliant on having a food source for survival, namely organic matter, looking to improve that on mineral arable and horticultural soils is a good starting point.

"The Solvita CO_2 burst and PMN tests are potentially ones for consideration where a grower has a good grasp of the basics, is technically much further forward and wants to take their understanding of their soils to the next step," says Amanda. ■

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 staff and others involved in helping put these articles together.

For further info:

AHDB Project 91140002: Soil Biology and Soil Health Partnership was project managed by NIAB, with scientific partners including ADAS, FERA, GWCT, ORC, SRUC, Natural England and University of Lincoln. Industry partners included BASF, Frontier, Innovation for Agriculture, LEAF, NRM and Wye & Usk Foundation. The project cost AHDB and BBRO £999,807.

> *“The Government must ensure new ways for farmers and growers to manage their risk and volatility.”*

Crisis in crop nutrition

Food security

As fertiliser prices soared, confidence both in food security and crop returns have broken from their tethers and the muck has begun to fly. *CPM* tracks the policy exchanges and current resolve around the need to feed.

By Tom Allen-Stevens

After months of uncertainty, during which prices for inorganic fertiliser have more than tripled, Defra has finally published the steps it will be taking to support farmers in the coming growing season.

Applications of slurry and farmyard manure can be made during autumn and winter, provided growers take “reasonable precautions”, Defra announced as *CPM* went to press. Planned changes to the use of urea fertiliser will also be delayed by at least a year and an industry fertiliser roundtable, chaired by farming minister Victoria Prentis, has been convened. This will continue to work on these issues, identify solutions and better understand the impact of current pressures on farmers, says Defra.

It was at the NFU conference in February that farmer exasperation over difficulties with dealing with organic manure and soaring fertiliser prices came to a head. Merseyside grower and NFU North West combinable crops chairman Olly Harrison voiced the concerns of many arable farmers, who without access to ammonium nitrate fertiliser would face a 60% reduction in yields, he said.

“That obviously isn’t good for food security. We all know what’s happening in the Ukraine and Russia. Have you got a plan for fertiliser security?” he asked Defra secretary of state George Eustice.

Farmyard manure

“I think that this spike in fertiliser prices will cause more farmers to think carefully about where they get their fertilisers from. We could see more people looking at different technologies to use organic fertilisers and farmyard manures,” responded the Minister.

This drew jeers of disapproval from farmer delegates. “It needs a little more than a fairy tale that we can use more cow muck. It’s not being wasted, it’s simply not available,” said Olly.

NFU president Minette Batters backed this up. “The Farming Rules for Water effectively bans spreading all manures in the autumn on the growing crop. This is where a lot of the frustration in this room is coming from,” she said.

George blamed “ambiguous” EU litigation. “As soon as you put this into regulation, it becomes problematic. What we need to do now is issue very clear guidance to the Environment Agency about how they should interpret it. That’s what we’ll do.”

This new guidance was published on 30 March and there are four key elements to the criteria that will be taken into account by the EA in its enforcement of the regulations:

Planning — you should be able to demonstrate that you’ve planned applications in line with the Farming Rules for Water. This would include a nutrient management plan, for example, that takes into account crop need and shows a qualified source was referenced for the information. The nutrient content of organic manures should be assessed and taken into account.

Soil levels – you should consider N requirement based on an annual crop cycle. You should avoid applying organic manures that raise the soil P index above level 3, although there are specific exceptions here. ▸

Without access to ammonium nitrate fertiliser, farmers would face a 60% reduction in yields said Olly Harrison.

▸ **Risk of pollution** – Different approaches should be taken depending on readily available nitrogen (RAN) content of organic manures. A low RAN is no more than 30% for which there's no statutory application rate limit provided you're taking "reasonable precautions" to mitigate against risk of pollution (which includes criteria above). For a RAN above 30%, for autumn and winter applications there's a limit of 30m³/ha for general organic manures and 8t/ha for poultry manures, and no repeat applications for at least 21 days during the restricted time periods. For most soils on tilled land, that window runs from 1 October to the end of February. For sandy and shallow soils, restrictions start on 1 August.

Reasonable precautions — You should have established green cover by 15 October, which includes both commercial and cover crops. You are allowed an appropriate justification, such as delaying drilling for blackgrass and leaving medium and heavy soils to weather before a spring root crop. You should incorporate organic manure unless there's a good agronomic reason not to. This would include when it's applied to a growing crop or grassland or a precision

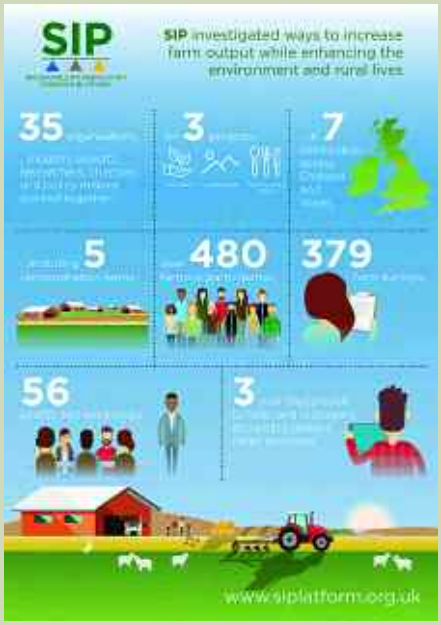
Concerns grow for food security as policy dithers

Defra came under fire, both at the conference and at Westminster, for what's seen as a lack of policy on food security. A group of influential MPs and peers has warned the Government may be "sleepwalking into its own food crisis".

At the NFU conference, Minette Batters used her opening address to challenge the Government on its approach to food security. "Do we want and expect different things from our land than the rest of the world? A pretty park at home while we tuck into imported food produced in extremely intensive ways with huge environmental impact somewhere else?" she asked.

"We have completely contradictory government policies: raising the bar for environmental standards at home but pursuing trade deals which support lower standards overseas."

Meanwhile, in a Westminster Hall debate, the Government was called on to put greater scientific rigour and evidence into UK food-policy development. MP for York Outer Julian Sturdy, who chairs the All-Party Parliamentary Group on Science and Technology in Agriculture (APPGSTA), requested "robust and meaningful metrics" for sustainable agriculture.



The outputs, recommendations and advice generated through SIP appear to have been quietly shelved and forgotten.

The debate sought to highlight the objective of "sustainable intensification". This was identified a decade ago by Defra chief scientist Sir John Beddington as a route for the world to increase food production and availability by 70% by 2050. It was adopted into policy by Defra to help keep pace with the food needs of a rapidly expanding global population, in the face of climate change and increasing pressure on the world's finite natural resources. Examples include the £4.5M invested in the sustainable intensification research platform (SIP).

But Julian indicated there were grave concerns about the current direction of travel of the Government's future vision for agriculture and about where future policy is going. "We cannot afford to be complacent with something as fundamental as food security," he said. "Without clear vision and a definition of what is meant by 'sustainable agriculture', the UK is at risk of sleepwalking into its own food crisis."

He said that leading UK experts in crop science, agricultural economics, rural policy and conservation science had brought to the APPGSTA their concerns that current farm policy development lacks scientific rigour, and that policy focus on sustainable intensification had diminished.

"The outputs, recommendations and advice generated through the Defra SIP appear to have been quietly shelved and forgotten," he stated.

Julian highlighted concern that the Global Farm Metric, promoted by the Sustainable Food Trust, "is firmly embedded in the Government's thinking". This measures the sustainability of food production on a per farm or per unit area basis, while a number of scientists have indicated the metric should be assessed per kg, or calorie equivalent, a food system yields.

"Will the Minister agree to submit the Global Farm Metric model to a process of independent scientific scrutiny and validation with leading academic experts in the field? Secondly, will she commit to facilitating a joint roundtable with our all-party group to take forward discussions on the development of robust and meaningful metrics for sustainable agriculture?" he asked.

The UK is at risk of sleepwalking into its own food crisis, warned Julian Sturdy.

"Everything I do in Defra is science-led," responded Defra environment minister Rebecca Pow. "Our work has to be science-focused; we have to have evidence for what we do and how we make policy."

She said that SIP hadn't been forgotten and that Defra is gathering a "huge amount" of data and evidence as part of Test and Trials as well as its £75M R&D package, currently being implemented. "I think we are singing from the same hymn sheet," she added.

Nevertheless, Defra appears to be singing out of tune with NFU. When asked by *CPM* at the conference whether Defra had lost direction when it comes to sustainable intensification, George Eustice pointed to the support it's offering to the horticulture sector to boost production of fresh produce and displace Dutch imports.

"People often talk about things like vertical farming, but the real opportunities are in a whole new generation of heated glasshouses. That's where the big opportunities lie when it comes to sustainable intensification," he said.

Minette Batters told *CPM* she doesn't "see any approach to innovation" in the way Defra is currently addressing food security. "I do think there's going to be a lot more of that [glasshouse production]. But this is about focusing on the optimisation of every sector and we have got to get that right. If we just focus on agri-environment schemes [on arable land], we are not going to change the way we are producing our food and the way we are increasing our soil health."

application method is used.

Further details of the Sustainable Farming Incentive have also been published with flexible start dates on offer. SFI options include measures designed to help build the health and fertility of soil and to reduce erosion, such as payments to sow nitrogen-fixing plants and green manures in standing crops or before the cash crop is established.

Defra has also stated priorities to "pioneer new technologies to manufacture more organic-based fertiliser products, and rediscover techniques such as using nitrogen-fixing legumes and clovers as an alternative to fertiliser".

Farming Innovation Programme

A further £20.5M of grants has also been announced as part of the Government's Farming Innovation Programme, launched last October to boost R&D and increase productivity. Projects could include tackling a crop pest or disease that is affecting productivity or a business may work in partnership with researchers to breed new crop species which are more resilient to a changing climate.

The NFU has given the announcement a cautious welcome. Minette noted that farmers are experiencing unprecedented costs when buying fertiliser, alongside tightening supplies. "The updated guidance on the Farming Rules for Water which will allow autumn manure spreading are positive for farmers," she said.

"The move to a rolling application window for SFI will offer flexibility to farmers and growers to apply at a time that suits their business. This also needs to be matched by certainty over when agreements will start once an application has been submitted.

Contradictory government policies raise the bar for standards at home but pursue trade deals which support lower standards overseas.

There were tense moments on stage at the NFU conference as Minette Batters challenged George Eustice on the Farming Rules for Water.

"While the offer available now will be suitable for some farms, it's clear there are still not viable options for all. It's essential for all farmers who wish to enter these new schemes that payment rates properly recognise the public goods they will be delivering. Farmers in England are facing a very different approach to the rest of the UK. The Government must ensure new ways for farmers and growers to manage their risk and volatility."

NFU Deputy President Tom Bradshaw noted there will be a farming industry self-regulation approach to the use of urea. "Working alongside other farming organisations, such as AIC, we put forward a strong case to Defra for a robust and pragmatic industry-led approach, without which there would have been a ban on the use of solid urea fertilisers." ■

Coalition coercion leaves UK on its own

The UK Government has received renewed calls to join the US-led global Coalition on Sustainable Productivity Growth for Food Security and Resource Conservation (SPG).

This was launched by the by US Department of Agriculture secretary of state Tom Vilsack at the United Nations Food Systems Summit last September. More than 80 countries and organisations have officially declared their support for the coalition, including Australia, Brazil, Canada, Israel and New Zealand.

APPGSTA chairman Julian Sturdy wrote to the Prime Minister at the time, urging him to include the global coalition for agricultural productivity growth in the UK's collaborative work programmes with the US. The MP for York Outer repeated his request during the Westminster Hall Debate in February.

Now the European Commission has indicated it will also be joining the coalition, in a statement released a month after the debate. The move, made to address EU food security in the light of the war in Ukraine, is being seen as something of a U-turn by the EU. Tom Vilsack had reportedly started the coalition to "counter" the EU's Farm to Fork (F2F) strategy, indicating that F2F "sacrifices productivity in order to reach a sustainability goal".

Tom Vilsack reportedly started the coalition to counter the EU's Farm to Fork strategy.

But the UK has yet to make its position on the coalition clear. During the debate, Rebecca Pow responded that Defra was "looking at it". When George Eustice was asked about the coalition at NFU conference by *CPM* he said he hadn't heard of it. "We're involved in many of these different dialogues, there are a multitude of them, and we often attend them and take part," he added.

techtalk

Managing clubroot in OSR

Clubroot is on the rise across the UK, particularly in Scotland, the Borders, and western regions where there is more mixed farming and higher rainfall. Climate change is bringing warmer, wetter winters nationally – meaning disease pressure will increase. Resistant varieties, along with sensible rotations, are key to combat clubroot.

LSPB COMBINING EXCELLENCE

The resilient invader

Clubroot may be lurking in your fields, and once you have it, it's almost impossible to shake off. *CPM* gathers expert advice on how to manage its spread and limit its damage.

By Tom Allen-Stevens

There may be many reasons for a stunted oilseed rape crop. Clubroot is one that's often overlooked until it becomes a serious issue.

An acute problem in the northeast of Scotland, it's a disease that's now found in many soils and locations across the UK, notes Prof Fiona Burnett, who warns that a changing climate and tight rotations have made it worse. A recent AHDB-funded project shed light on the pathogen population and how to manage it sustainably.

And this is the positive side of the issue, notes oilseed and pulse breeder with LSPB Craig Padley. Armed with awareness and understanding of club root, growers should keep in mind the three Rs — rotate, review, resist — to defend against it, he advises.

What is club root?

Clubroot is caused by a soil-borne fungal pathogen Plasmodiophora brassicae that produces thick-walled resting spores. These are highly resilient, helping it survive for up to 15 years in the soil and aiding its transfer from field to field or within fields on machinery, transplants, water flows or even muddy footwear. The spores can also pass unharmed through an animal gut, which can be an issue if using infected forage, such as turnips, as feed stuffs. Even OSR straw as bedding is a possible source of spread when it goes back out to be spread on land.

Many brassica species are host plants, including vegetable crops as well as OSR, and just a small amount of spores will cause new foci for clubroot. Chemicals, released by the roots of these plants, cause spores to germinate and release new zoospores that move through soil water. Flooding can also spread the disease and the UK's recent milder and wetter winters favour zoospore movement.

The zoospores infect host plants, via the root hairs, and develop into plasmodia. These structures form secondary zoospores that invade the root cortex, causing the cortical cells to enlarge and increasing the rate of cell division, forming the characteristic galls. These reduce nutrient and water uptake in roots, leading to lower yields, then release large numbers of resting spores as they decay.

How do you detect it?

The first sign is often stunted plants and it's common to find these first in field gateways,

> *"A good rotation forms the bedrock of a sustainable management plan."*

which then spread to distinct patches in the field. These tend to elongate with the passage of cultivations. Dig up the roots and you'll find the characteristic gall that gives clubroot its name. The smaller fibrous plant roots tend to wither, and in really bad cases, the entire root will rot away

There is no quick in-field test, but suspect samples can be sent to labs for analysis, and many horticultural growers do this as a matter of course, especially

A changing climate and tight rotations have made clubroot worse, warns Fiona Burnett.

Zoospores invade the root cortex, causing the cortical cells to enlarge and increasing the rate of cell division, forming the characteristic galls.

before taking on rented land. PGRO and SRUC both offer testing services.

Don't underestimate how easily clubroot is spread, though. Good field hygiene can help enormously, keeping machinery cleaned between fields — up to half a tonne of soil can be carried on some equipment. But just a small amount can bring the pathogen onto your farm, and this could be via fencing or electricity pylon contractors for whom field hygiene is not a priority.

How do you control it?

A good rotation — the first of the three R's — forms the bedrock of a sustainable management plan. The clubroot pathogen has a half-life of 3.5 years, so bumping OSR out to once every five or ideally seven years will do most to keep it contained.

Bear in mind that some cover crops have brassicae in the mix, which will help multiply the spores. Note also that clubroot cycles more than once in a season, and keeping volunteers greening up after harvest, which can be a way to trap cabbage stem flea beetle and capture excess nutrients, can generate another cycle.

Which brings in the second key part of the strategy — to review it. Mid-April is an ideal time of year to inspect crops and note any suspect patches. Pull up plants and inspect the roots, and if necessary, take samples for testing.

Part of the AHDB-funded project involved using precision farming techniques to map known clubroot patches, which can then be treated differently, forming an effective part of the plan. Just putting the area around the gateway into grass can squash a problem before it starts. But once you've identified where clubroot is, it's important to do all you can to limit its spread.

Another key consideration is that clubroot likes an acidic soil, which is again a reason why the disease is common in Scotland, where soil pH can naturally drop to around 5-5.5. Monitoring arable soils and keeping them regularly limed to maintain higher pH levels will help. The disease is suppressed at pH7-8 but this ideal may only be achievable for horticultural crops so not a cure-all for the disease in most arable situations.

How can genetics help?

Using varietal resistance forms the third key aspect of a sustainable management plan, but again it's important to note that OSR genetics on their own won't solve a clubroot problem.

The resistant gene was originally isolated in Brassica rapa and introgressed into B. napus (OSR) in the late 1980s, as part of an industry-wide research project. European breeder NPZ, the parent company of LSPB, was involved in the project and

Mid-April is an ideal time of year to inspect crops and note any suspect patches, advises Craig Padley.

brought the first OSR variety with resistance, Mendel, to the market.

Varieties with the Mendel gene provide very effective resistance to clubroot, especially in situations where they haven't been used before. But the genetics shouldn't be relied on too heavily. One of the aspects highlighted by the AHDB-funded project was that clubroot populations found in the UK are very diverse — more so than across Europe. This may be a reflection of historical ▸

Crome consistently keeps the shine across OSR area

You sense a note of trepidation as Sandy Norrie leans onto the spade and prises up the OSR plant. "I hope this isn't one with clubroot," he says.

Fortunately it isn't and a good, healthy tap root is exposed. That's just as well, as regular monitoring hasn't yet identified the pathogen in this field of OSR, which Sandy's hoping could yield as much as 6t/ha judging from the performance he's currently getting from his best OSR crops.

"We're aiming for a farm average of 5t/ha, and that's what we're achieving throughout most of the crop. But put a non-resistant variety into a field with clubroot and the combine yield monitor shows up the patches where yield can drop below this by more than 1.3t/ha," he says.

Duncan Arable Farms crops a total of 2400ha across 24 farms near Turriff in Aberdeenshire. Soils are generally sandy to sandy clay loams, some high grade with a history of vegetable production. And it's this past cropping that has left arable manager Sandy with the clubroot issue.

"There have been a lot of turnips grown in the past, too. We monitor areas, testing through SRUC to keep track of where the infection is. But once you have it, it's there for good, and you have to manage it," he reports.

There's a "hard and fast" rule that no OSR crop is grown less than five years after the previous one, and Sandy's aiming to bring the cropping into blocks to ease management. There's currently 485ha of OSR and 65% of this is cropped with Crome.

"We generally look to grow the best genetics across all our crops, and OSR varieties rarely stay in the rotation for more than a couple of years. But Crome has been with us since 2018 — you cannae beat it where there's clubroot, and it's been the most consistent fixture of all our varieties," he says. This has come from side-by-side strip trials in which Sandy's put the latest varieties to the test.

There's a soil-sampling and liming strategy that sets the pH above 6.4. Having tried min-till cultivations across half the OSR area for 4-5 years, but found no benefit, all the land is currently ploughed and pressed then sown with hybrids aiming to establish the crop by the end of August.

"Autumn vigour is important for us up here, and Crome is up and out of the traps fast, which is what we like. Light leaf spot is our biggest disease worry and the variety seems to hold its own."

Crome is usually one of the first varieties to come into flower for Sandy and the entire area is swathed prior to harvest to reduce pod-shatter losses

Sandy Norrie has found Crome to be the most consistent performer in side-by-side strip trials.

and then harvested in mid-late August. Once the crop is cleared, fields are topped and then ploughed ready for wheat.

"With Crome in the portfolio, we're getting average yields of 5t/ha, including on clubroot-infected land. That's where we want to be, so I think Crome will stay in the rotation for 2023 harvest," says Sandy.

▸ cropping, such as brassicas used as forage crops.

So while clubroot resistance is effective, all varieties with clubroot resistance rely on the same gene. If these are used too frequently within the same field, the population will shift and growers will find genetic resistance is no longer effective.

This means resistant varieties must be used in conjunction with other control methods, in particular wide rotations and good field hygiene. Use them only in fields with a known problem, as part of your OSR variety portfolio.

What's the varietal choice?

The Mendel gene provides effective resistance to clubroot, but the original variety has a considerable yield lag — in situations where the disease isn't an issue, it doesn't yield nearly as well as leading varieties on the AHDB Recommended List. So the variety's rarely grown these days.

The clubroot resistance trait has been introduced across NPZ lines, however, and a number of other breeders have brought the same trait into their OSR portfolio. Over the years, this has allowed the yield gap to close.

Two varieties with specific recommendation on the RL for growing on land infected with clubroot are Crome and Croozer, both bred by NPZ and marketed in the UK by LSPB.

Crome is the only one with a UK-wide recommendation and the only clubroot-resistant variety on the RL for the North. It has a 4-5% gross output advantage in the North compared with other resistant varieties and a score of 6.2 for light leaf spot.

LSPB rates it moderate for vigour in autumn and early spring, best sown early, although early drilled crops can exacerbate clubroot. Crome is

Managing clubroot: top tips

- **Make the most of varietal resistance** – it's the most effective way to manage club root but should not be relied on, nor used as a blanket measure.
- **Widen the rotation** – Keeping brassica crops at least five years apart greatly reduces the build-up of the pathogen.
- **Regularly review your strategy** – Monitor suspect areas and exercise good field hygiene to limit the spread. Keeping clubroot out of uninfected fields should be a key priority.

Crome and Croozer at a glance

	Crome	Croozer
Scope of recommendation	UK	E/W
Gross output (% treated control)		
UK	99	-
North region	99	-
East/West region	101	98
Agronomic features (1-9, where 9 is high)		
Resistance to lodging	8.0	7.8
Stem stiffness	8.2	8.0
Earliness of flowering	6.8	8.0
Earliness of maturity	5.1	5.5
Light leaf spot resistance	6.2	5.7
Stem canker resistance	3.5	8.2

Source: AHDB Recommended List Winter oilseed rape 2022/23.

Clubroot likes an acidic soil, which is a reason why the disease is common in Scotland, where soil pH can naturally drop to around 5-5.5.

relatively early to flower with good stem stiffness, but is relative late to mature. The variety is noted not only for its yield, but the consistency with which it performs, with a relative high oil content.

Croozer is better suited to growers in southern England, with a respectable yield, *Rlm 7* phoma resistance and a strong score for LLS, according to the RL. It has the edge on autumn vigour over Crome, with a stiff stem and is earlier both to flower and mature.

What's in the pipeline for growers?

LSPB is bringing forward a variety for UK growers that has both clubroot and turnip yellows virus (TuYV) resistance. Currently in its second year of National List trials, it's indicating a 5% yield lift when compared with Crome on comparable sites . Following this are two promising-looking varieties with *Rlm7* phoma resistance, along with clubroot and TuYV.

Breeders are working on other sources of clubroot resistance, as well as bolstering background tolerance so that varieties are not so dependent on the Mendel genetics. But these advances are at least five years from growers' fields.

Advances in precision farming hold promise to deliver better management. If clubroot patches are accurately mapped, the technology is now available that can plant different varieties into infected and non-infected zones.

SRUC has also been investigating the use of elicitors encapsulated into seed dressings that "switch on" host-plant defences against clubroot. One interesting twist here is that the daughter crop of plants that use this response to battle the disease develop with an in-built heightened tolerance to clubroot. ■

Sponsor message:

LSPB varieties have led the way in bringing clubroot resistance to UK oilseed rape growers. The latest AHDB RL for 2022/23 features two restored hybrid varieties with a Specific Recommendation (Sp) for growing on land infected with clubroot.

Crome has a UK Recommendation with a high gross output, is early flowering with a high yield, good stem stiffness and resistance to lodging.

Croozer has a Recommendation for the E/W region with a high gross output, is early maturing with a high oil content and yield, and *Rlm 7* phoma resistance conferring very good resistance to Stem canker.

Next in line, and in second year of NL trials, is an LSPB variety with both clubroot and TuYV resistance — and a continuous pipeline of clubroot-resistant varieties featuring multiple traits, as this sector remains a key priority in our breeding programmes..

The future of OSR

> *“The trend for 2022 is very good but going further forward it looks very buoyant.”*

Oilseed rape

The oilseed rape planted area looks on the up, with establishment lessons and advancing plant genetics taking the crop to places it’s never been before. *CPM* attended a Limagrain briefing in Lincolnshire in March to find out more.

By Melanie Jenkins

OSR can be a tricky crop to grow, but refining establishment to cope with risks and selecting varieties with the right genetics can help mitigate threats and ensure a profitable crop at harvest.

OSR plantings have gone through an evolution over the past eight years, from highs of 740,000ha in 2013/2014, to lows of 275,000ha in 2020/2021. But the trend is on the way back up with around 361,000ha planted in the 2021/2022 season, according to Andersons and Limagrain market data.

“There’s an argument for whether the 2014 area was sustainable longer term, given the one in three rotation on many farms, and it marked the first harvest without neonicotinoid seed treatments,” says Will Charlton of Limagrain. “And in an ideal situation, with a brassica the rotation should be more like one in five.

“The positive thing is we feel the planted area reached the bottom last year (2020/2021), and we think there was just 2% of the crop lost. Of the 361,000ha planted this season, we believe around 5% of the crop didn’t survive after planting.

“For next year, our current assumption is around 400,000ha will go in the ground but it could be significantly more than that. We don’t think it’ll be less than this year,” he comments.

Hybrid growth

An interesting development Will has noticed over the past three seasons is the increasing inclination towards hybrid varieties. In 2020, 46.4% of the area sown was hybrid, 37.3% was conventional and 16.3% farm-saved seed. For the current season it looks more like 63.2% hybrids, 21.8% conventionals and 15% farm-saved seed.

“Hybrids have gained a lot of traction for a couple of reasons; they’ve pulled away from many of the conventionals, are more vigorous and incorporate a range of agronomic traits.”

He also feels a lot of farmers are no longer farm-saving seed because they want to plant their OSR so early they haven’t actually combined their last OSR crop. “The pattern of earlier drilling moves earlier and earlier every year,” he explains.

“Our sense is that farmers now have a greater understanding of strategies that work in their system to get a crop established through the main risk period for cabbage stem flea beetle (CSFB) migration, and they’re trying to manage CSFB larvae through the winter, which is really positive,” says Will.

He adds that genetics have improved significantly and this has aided establishment success. “And potentially, with less overall crop in the UK there’s been a reduction in CSFB pressure but that’s anecdotal.”

The other positive is the current price of OSR. “Prices were high before the terrible situation in Ukraine, but this has pushed them even further.

“UK demand for rapeseed oil is fixed,” said Will. “Most goes into the food chain and we need all that’s crushed in the UK. Our production is no longer self-sustaining so the UK does have to import rapeseed. The trend for 2022 is very good but going further forward it looks very buoyant.”

But he warns that flea beetle hasn’t gone away. “It’s not going to be a crop for everybody to go back into and the days of 700,000ha of OSR have probably passed, but certainly 500,000ha could be conceivable going forward.”

So what lessons around establishment has Limagrain learnt?

Through its establishment scheme, which is run by partners in the seed trade, growers with Limagrain hybrids report on drilling dates and crops losses.

Will Charlton has noticed an interesting increase in the proportion of hybrid varieties grown over the past three seasons.

Increasing branching is the best way to mitigate the impact of CSFB larvae infestations.

"Last year our scheme covered 19,000ha, so was a reasonable sample size to analyse and draw conclusions from," explains Will.

Around 4.6% of the area was lost, with the greatest percentage of losses coming from crops sown between the middle and end of August. "During those same weeks there was a close correlation between very a dry period subsequent to drilling and crop losses in the scheme."

The other factor was CSFB. "The risk period, according to Sacha White at ADAS, also maps in very closely with the period crops were lost," he says.

But for those growers taking drilling ahead of the traditional third week of August window, the risk from CSFB larvae becomes higher, he says. "You may save your crop from excessive adult damage and get a well-established crop but then it's important to look at how you mitigate and manage any larval damage. Your overall aim is to increase the branching of your crop to minimise this."

Selecting a variety with the right genetics can have a sizeable influence on a crop's ability to survive these pressures and achieve a grower's aims. Limagrain aims to present growers with optimal genetics through its new fully-loaded traits programme, according to the company's OSR technical lead, Liam Wilkinson.

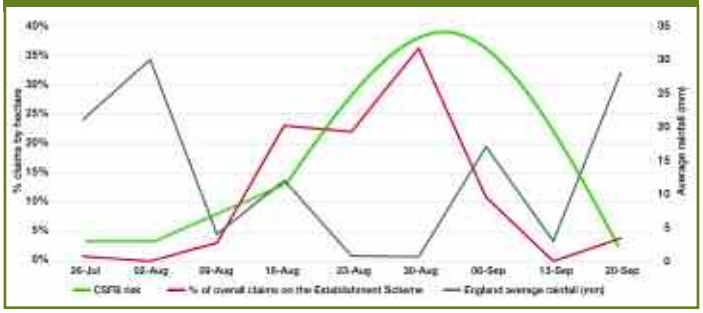
Liam explains a set of traits is incorporated into all new Limagrain varieties which should provide both security and yield potential. These include turnip yellow virus (TuYV) resistance, disease resistances and pod shatter resistance. Varieties are then screened for yield potential and nothing without these genetics will make its way out of the breeding glasshouses, he says.

Looking at TuYV, Liam believes we could expect a high-pressured autumn without a real winter to check the virus. "But genetics are holding up with the loss of insecticides and there's now no yield penalty in TuYV resistant varieties.

"TuYV resistance prevents the multiplication and spread of the ▸

Plant genetics are holding up against TuYV and there's now no yield penalty in resistant varieties, says Liam Wilkinson.

Limagrain establishment scheme losses by drill date



Source: Limagrain establishment scheme and CSFB risk courtesy of Sacha White, ADAS, 2021

Genetic improvements in OSR have significantly aided establishment success.

▸ virus through the plant after being infected. It's really the foundation of integrated pest management at the moment."

Liam highlights that in spring last year, TuYV was identified in 52% of susceptible conventional and hybrid crops and stresses this means the virus is still out there. "It's getting harder to find as we've seen a switch to hybrids with resistance, but the risk is still there for those choosing susceptible varieties."

Another key trait Limagrain has in all new varieties is pod shatter resistance. "I think it's the ultimate level of security in a variety as this genetic trait protects against adverse weather leading up to harvest. Even passing through the crop with the header of the combine can cause significant losses," explains Liam.

"Pod shatter resistance strengthens the bonds in the pods, making them more resilient in catchy harvests, meaning you've got more chance of harvesting the crop. And you can reduce volunteers — with the price of glyphosate at the moment, this probably isn't a bad thing either," he adds.

Limagrain's new variety, LG Auckland is second on the AHDB Recommended List but lit's the highest yielding with a combination of TuYV, pod shatter and *Rlm7* resistance, said Liam. "It has good autumn establishment and quick growth, together with strong light leaf spot resistance and stem health."

For those growers requiring more niche varieties, such as those with clubroot resistance, Limagrain is drawing TuYV, pod shatter and *Rlm7* resistance into these too, explains Liam. "We're bringing the traits that were restricted to traditional hybrids to our new clubroot varieties, LG Anarion and LG Scorpion, the latter of which is coming to the market this year."

The Clearfield sector is another area Limagrain has introduced its fully-loaded traits, the first variety of which is LG Constructor CL, he says.

Despite its focus on hybrids, Limagrain is still developing conventionals and its two new varieties for this year are Annika and Amarone, both of which include TuYV resistance, according to Liam.

Limagrain's next focus area is stem health (see Inside Traits, page 53), he explains. "We're looking to combine advances in phoma, LLS and verticillium resistance with our fully-loaded traits.

"OSR can be a headache of a crop to grow for a lot of farmers, but genetics allow you to take as much risk out of growing the crop as possible. A lot of problems can be solved by selecting the right genetics," he concludes. ■

Limagrain's next focus area is stem health, combining advances in phoma, LLS and verticillium resistance.

Chasing profits, not rainbows

> *Although establishment is fundamental to the success of the crop, it's only one component of its development phases.*

De-risking OSR

At the end of the rainbow lies a crock of gold, black gold. The trouble is chasing rainbows is a notoriously risky business. *CPM* investigates how to achieve something that in recent years has seemed increasingly impossible for many growers.

By Lucy de la Pasture

Oilseed rape has had a real change in fortunes over the past two seasons. The nightmarish infestation of cabbage stem flea beetle (CSFB) larvae, that put paid to a large number of OSR crops in the spring of 2018, didn't prove to be the death knell for the crop it was anticipated to be.

At that time, many felt that growing OSR really did fall into the chasing rainbows category. But those who kept the faith have since been rewarded with rapeseed prices on an upward trajectory.

Recent world events have combined to ensure that prices for OSR aren't likely to take a dive any time soon. Supplies of sunflower oil are already practically exhausted in the UK and no exports likely from Ukraine — which, together with Russia, grows 60% of the world crop. Beyond the present situation, there's great uncertainty about the sunflower crop in the longer term. All of a sudden OSR has become a more attractive proposition, not least because vegetable oil is in very short supply.

Establishment problems and yield instability have dogged the crop for the 40 years it's been a mainstay of British rotations, but growing OSR can be de-risked, according to Bayer commercial technical manager, Ben Frost. He believes that risk mitigation starts at the planning stage, not just for the OSR crop but for the one preceding it in the rotation.

Biggest threat

"There's little doubt that the biggest threat to OSR is currently CSFB. One of the best ways to get a crop established seems to be to drill increasingly early, which means the crop it will follow has to be cleared in time to achieve this."

Ben highlights that getting the timing of harvest right for the preceding crop is one of the most fundamental decisions when placing OSR in the rotation.

Agrii agronomist, Todd Jex also believes the risk from CSFB can be reduced by good planning. "Winter barley provides the best entry for OSR, it's easy to cut stubble at a decent height and that offers the most effective disguise for the newly planted crop."

That's a strategy Ben agrees with. "Long stubble seems to have a deterrent effect and I'd ideally chop the straw so the drill can follow in right behind the combine if conditions are favourable, rather than risk them deteriorating while waiting for the straw to be cleared."

Where crops are situated spatially on the farm throughout the course of the rotation also matters, suggests Todd. "Where possible, block the cropping within the rotation — which should be a minimum of four years — and make sure that the current season's OSR is nowhere near the fields planned for the next season."

Drawing on his previous experience as an agronomist at Velcourt, Ben suggests herbicide choice in the spring should also be thought through if OSR is the following crop.

"There's evidence that where some sulfonylureas (SU) are applied to cereals in the spring, young OSR plants can take longer to get going in the autumn. That means that spring applications of Hatra (mesosulfuron+ iodosulfuron) or Pacifica ▸

Todd Jex recommends carefully considering the rotation, making sure fields to be planted in OSR are nowhere near last year's crop.

Many growers are drilling earlier so plants have reached a size where they can withstand CSFB damage when the pest migrates into the crop.

▸ Plus (mesosulfuron+ iodosulfuron+ amidosulfuron) should be applied at the earliest opportunity, which will give the best results anyway as the target weeds will be small."

It's not just herbicides aimed primarily at grassweeds that may make a difference, broadleaf herbicide selection also requires a considered approach, suggests Ben. Todd agrees, having noticed that some spring-applied SUs used in cereals before direct drilling OSR in the autumn definitely slow the development of young OSR, especially if soils are dry.

"Herbicide selection becomes even more crucial when direct drilling, a light pass with a stubble rake isn't going to be enough to avoid possible problems from SU residues," adds Ben.

Variety choice is a personal thing, but many hybrids offer a stack of traits to reduce risks of diseases, such as phoma, club root and TuVY, but also pod shatter resistance. Both Todd and Ben suggest good autumn and spring vigour helps crops grow away from CSFB damage too.

In Ben's experience, direct drilling provides more consistent establishment for OSR. "It's often dry at the time of drilling so no-till minimises soil moisture losses, increasing the amount of water and nutrients available to the crop."

Todd emphasises that getting the seed into moisture is crucial for good establishment and he favours direct drilling into a companion crop of buckwheat to help deter CSFB.

The general consensus is that moisture conservation trumps tillage in a dry season, adds Ben, particularly as CSFB seem to be attracted to a green crop on brown soil.

ADAS crop physiologist, Sarah Kendall is also of the

Growing varieties with pod shatter resistance helps mitigate the risk of late season seed losses.

opinion that planning plays a key role in de-risking OSR. "Although establishment is fundamental to the success of the crop, it's only one component of its development phases. Understanding the implications establishment decisions will have for the duration of the season is equally significant," she says.

That's particularly important when it comes to drilling earlier than the norm, right on the heels of the combine. "It's important not to just think about how to establish the crop, but how to do this and produce one that's going to be resilient, so it's able to cope with the challenges that then will come throughout the season."

Crops drilled outside of the normal drilling window require different management, she highlights. "Drilling the crop really early (July) may help it establish well, but you've got to make sure you manage it accordingly. It'll be a very different crop to one drilled in the normal window."

Sarah gives the example that a very early drilled crop may have such rapid development it leads to stem extension before Christmas. "You're opening the crop up to more risks as you go through the season, so I think managing it is a balancing act."

Sarah suggests that seed rates is an area where many of the risks to OSR beyond its establishment phase could be mitigated. "Seed rates and plant population are hugely relevant to a successful crop. We're currently looking at the hypothesis that crops which have less plants, but consequently thicker stems and more lateral branching, have more tolerance to CSFB larvae in spring in an AHDB/industry funded CSFB project.

"That means that more resilient crops are associated with lower seed rates. And resilience mitigates risk, meaning the crop can meet the challenges of the season."

Todd has found that he's had to adjust seed rates to allow for extra mortality from CSFB and increased slug pressure where direct drilling. "All the things you can do to mitigate against flea beetle damage tend to make slug problems much worse," he adds.

One thing to bear in mind with early drilled crops is that canopy management is key, says Sarah. "Crops may require a PGR in autumn and spring so assessing the canopy biomass is really important, both for growth regulation and for planning N applications.

"Some crops have such big canopies this spring that they could achieve 3.5t/ha without additional N applications, so be aware that you may not need as much N as you think."

One of the most devastating situations for OSR growers is when, after doing everything right, yield is robbed towards the end of the season. One of the reasons for this can be when the weather comes dry and plants can't access the water for seed fill, she says.

Paying attention to field selection can help mitigate this risk, particularly avoiding ones that are prone to water-logging over the winter, suggests Sarah.

"My advice is to give the crop the best chance possible by being realistic about the quality of a field or block of land. If the drainage isn't good and it's prone to waterlogging, then the crop's root structure will be compromised which impacts on its ability to capture water and nutrients."

Weather events

At a time when extreme weather events are becoming all-too-common, there's an increased likelihood OSR crops will have to endure either a wet winter, a droughty spring/early summer or a combination of wet and drought, which all have implications for seed set or seed filling.

"In a droughty soil or waterlogged soil, the highest risk is falling at the final hurdle if crops run out of water later in the season.

"We have to set the crop up to be able to ride these stresses. If it can't and experiences waterlogging, late frosts or drought, then there can be consequences for yield. That takes us back full circle to planning," she says.

The oilseed YEN has helped identify characteristics that have associations with yield, adds Sarah. "We've noted that it's biomass on a per plant basis, rather than overall crop biomass per se, that's associated with higher yields. Again, fewer plants/m^2 leads to a higher individual biomass and each plant sets more seed. It's going back to basics."

High yields within YEN are also associated with longer periods between harvesting and desiccation and this is where fungicides can also have an important role to play, adds Ben.

"Light leaf spot (LLS) comes a close second to CSFB as an agronomic risk to the crop. Obviously selecting varieties with good disease resistance is the starting point. But I'd say that the second part of mitigating disease threats in OSR starts by assessing the crops for disease.

"Before I joined Bayer, as an agronomist I used SpotCheck — which is a service facilitated by Bayer in partnership with ADAS, where you pick leaves, send them off for analysis and get a report back telling you levels of phoma, light leaf spot, downy and powdery mildew. And that allowed me to make more informed decisions regarding fungicide choice.

Seed rate plays a very important part in risk mitigation, with the aim being to produce more biomass per plant than per m^2, says Sarah Kendall.

"SpotCheck should be targeted in the autumn, before any fungicide applications, and again in the spring before the main fungicide application. In the autumn phoma is the likely target and the timing of any spray should be reactive. SpotCheck helps get the timing right, rather than just applying it when you have to go through with a propyzamide-based product.

"For LLS it's infection going into spring that's a bigger issue. And ultimately LLS is the more damaging disease now," he says.

"The problem with LLS is that it's very hard to identify, requiring incubation before symptoms can be seen in the early stages, which is where SpotCheck comes in. Even when you get symptoms, it can look like frost damage or fertiliser scorch so it's a difficult disease to assess visually.

"When it comes to fungicides, it's all about using the right products at the right time to de-risk growing the crop," he says. ▸

Adopting Aviator XPro is a good resistance management strategy and provides useful physiological benefits, keeping the crop greener for longer.

Ben Frost recommends SpotCheck as a diagnostic tool to refine fungicide programmes and timings.

De-Risking OSR

OSR looks a much more attractive proposition this autumn, with rapeseed prices set to remain firm and CSFB possibly less of an issue than it has been. Following on from last season's *Battling the beetle* series, which explored strategies to combat the threat of CSFB, *CPM* has again teamed-up with Bayer to take a more holistic look at removing some of the undoubted risks associated with growing OSR — through agronomy, genetics and marketing.

Part of Bayer's role is providing trusted support to OSR growers and their agronomists that goes well beyond the robust and dependable varieties that have always been the Dekalb trademark. It's Bayer's hope this helps everyone improve the reliability of their cropping to take the greatest possible advantage of the excellent opportunities for OSR in the rotation.

▸ Ben believes there's a benefit to be had from using Aviator (bixafen+ prothioconazole) in the autumn, where a fungicide is necessary, and that using two effective actives from difference MoA groups is a good anti-resistance strategy.

"As well as offering a second mode of action, bixafen gives an uplift in LLS control and has some physiological benefits. So, Aviator gives good phoma activity and really good LLS activity which will give you protection through to the start of stem extension.

"And that's when you can start to see the symptoms of LLS take off again. Aviator can only be used twice in the crop, so if you've used it in the autumn then that leaves just one application in the spring. If you're not targeting early LLS in the spring, then you could use your Aviator as a flowering spray for sclerotinia, topping up LLS protection at the same time," he suggests.

In Bayer Forward Farming trials, Aviator has prolonged the flowering period and produced an average 0.3t/ha yield increase over the market standard, he adds. "It's a product which is nicely covering all the bases and giving physiological benefits. So, you're really protecting yourself."

All are in agreement that measuring is the best way to manage the crop, whether that's using NDVI imagery, utilising digital platforms or SAP testing for nutritional requirements.

"There's huge potential to improve this aspect of crop management in-season and make justified decisions to help de-risk growing the crop," concludes Sarah. ■

Performance stems from good genetics

> *“It’s often the disease in the stem, rather than the leaves, that causes the majority of the yield loss.”*

Inside traits

No one likes a flat oilseed rape crop, but how much do you know about the health of the stems that support it? *CPM* investigates the genetics of stem-based diseases.

By Tom Allen-Stevens

Your oilseed rape crop may already have taken you on a see-saw of emotions this season. But as the canopy closes over, there’s one aspect of the crop that’ll lurk unseen and can pull you from a harvest high to a crop disappointment: the health of the stems.

“Stem-based diseases often go undiagnosed, partly because you have a job to actually inspect it during the growing season,” says arable crops development officer Liam Wilkinson. “But no grower wants to end up with a flat crop.”

Although it’s related to important diseases, stem health seldom gets the attention it deserves, he believes. “The AHDB Recommended List scores diseases by the extent of their foliar severity. But there can be a difference between the cleanliness of leaves and stem symptoms, and varieties also differ in how the disease is expressed on the leaf and stem. What’s more, it’s often the disease in the stem, rather than the leaves, that causes the majority of the yield loss.”

Key diseases

There are some key diseases that affect stem health (see panel on p54). Some, such as sclerotinia and verticillium stem stripe are sporadic, while phoma that causes stem canker, and light leaf spot, resulting in cylindrosporium are prevalent in most years. While there are fungicides that offer good control of sclerotinia and phoma, azoles are losing their efficacy on LLS, while there’s no chemical control at all of verticillium wilt.

So what protection can genetics offer? “Stem health is a basket term, rather than a trait with a defined set of genetics,” explains Limagrain UK OSR breeder Maeve O’Rourke. “But it’s been a key focus for us across the LG European breeding programme. We select plants with good strong stems that stand well as a matter of course. But we’re also looking for resistant genes to specific diseases.”

Phoma stem canker is the obvious one here. “It’s more of a problem on the Continent than in the UK, and we’ve been successful at ensuring all our hybrids now have the *Rlm7* gene, as well as good background resistance, offering very good protection for growers,” she says.

Verticillium stem stripe is a relatively new disease, in breeding terms, and its sporadic nature makes it hard to select for. “There’s no genetic resistance yet, but we have identified QTLs (quantitative trait loci, or sections of DNA) of interest. We currently have material in year two of National List trials showing very promising resistance to the disease. It’s important we bring this forward as climate change is ▸

Stem-based diseases often go undiagnosed, partly because you have a job to actually inspect the crop during the growing season, says Liam Wilkinson.

Good LLS score essential in Scotland

For Scottish OSR growers, there's one key disease threat to keep an eye on, according to Scottish Agronomy trials manager Adam Christie: light leaf spot.

"We've never seen much in the way of verticillium leaf stripe and phoma stem canker, but LLS is endemic in Scotland," he says. "However, in 14 years of Scottish Agronomy trials, we've had no response to an autumn fungicide treatment."

Scottish Agronomy is the largest trials operator north of the border with 25,000 combinable crop plots. Much of the northern information on the AHDB Recommended Lists as well as the National Lists comes from the plots it operates across various locations. Adam draws his conclusions on OSR disease from the 2000 small plot OSR trials the company has as well as 7000 mini tussock plots, which are all assessed for LLS.

"It's a swine of an opponent — LLS has such a flexible genotype it adapts itself to its situation. It's no surprise that prothioconazole is losing its efficacy as we've been relying on it for years. The one line of defence we do have is the robustness of the genetics. The Limagrain varieties have that robustness built in, so it's no surprise they're performing very well in trials," notes Adam.

The trials don't specifically monitor levels of cylindrosporium, but another aspect he's noticed from results is that there's little response to an autumn spray. "There's a shift in focus up here to the early flowering fungicides where you get better returns for your spend. That suggests that late season protection is reducing LLS transfer to pods and stems."

Among the LG varieties, he picks out LG Aviron as one that's particularly strong. "It consistently performs well against LLS and there's little difference between its treated and untreated yield scores," he notes.

"It's essential for Scotland that OSR stays in the rotation as there are few other break-crop choices. It's good to see rotations extend as that will ease the clubroot pressure, but the crop will always come under pressure from LLS, so it's good to have a choice of varieties with the right genetics," adds Adam.

▸ predicted to make verticillium more of a problem for growers."

Maeve believes that cylindrosporium may be a disease where there are differences that are seldom apparent from disease scores on the RL. "LLS is now the biggest OSR disease threat in the UK, and becoming harder to control. There are now plenty of varieties with good resistance. But this is where there can be a big difference between the severity of foliar symptoms and resulting damage to the stems."

It's again a disease more common on the Continent than in the UK, and Maeve's

Stem-based diseases

There are a number of key diseases in the UK that affect the stems of OSR crops, and for some there's limited fungicidal control.

Verticillium stem stripe

Previously known as verticillium wilt, this sporadic disease was initially confirmed in England in 2007 and is caused by the pathogen *Verticillium longisporum*. A persistent soil and seed-borne pathogen, it lasts for over 10 years and can build in the soil when susceptible hosts, including vegetable brassicas, are regularly grown. The disease is now widespread, with most severely affected crops located in eastern England and found as far north as Yorkshire and west as Herefordshire.

Verticillium causes canopy collapse and seed shedding with yield drops recorded in trials of 3-34%. These are highly variable and weather-dependent with high temperatures and drought stress in the run-up to harvest exacerbating losses.

The soil-borne microsclerotia infect the seedling and the fungus colonises the vascular tissue and upper plant during stem extension. Leaf yellowing may occur from April onwards and warm spring temperatures will encourage this.

Yellow, followed by brown, vertical stripes occur on stems towards the end of June and early July. These lengthen and become more visible as harvest approaches — scraping an infected stem surface can reveal grey discolouration of the vascular tissue beneath the stripe. There is no chemical control of the disease.

Stem canker

Phoma leaf spot leads to stem canker in its latter stages and is caused by two closely related pathogens — *Leptosphaeria maculans* and *L. biglobosa.* It's one of the most important diseases of winter OSR in the UK, especially in central, southern and eastern England, causing economic losses estimated at £100M each season and yield losses of up to 0.5 t/ha.

Warm, wet and humid weather in the autumn releases ascospores from infected stubble. These land in young leaves causing the characteristic spotting symptoms visible on the upper surface. The pathogen grows along the leaf petiole to the stem, killing plant tissue cells around the leaf scars at the stem-base.

These develop further and girdle the stem, restricting water and nutrient transport, resulting in premature senescence. In extreme cases, the stem can sever, the crop lodges and plants can die. It can be controlled with a well-timed autumn fungicide and the earliest infections cause the largest cankers.

Cylindrosporium

This is the stem-based stage of light leaf spot, a disease caused by the pathogen *Pyrenopeziza brassicae*. LLS is a polycyclic disease, producing more than one infection cycle per season, and *Cylindrosporium concentricum* is its asexual stage. Once known as a Scottish and northern disease, all areas of the UK are now at risk, and it's prevalent across much of northern Europe, too. LLS has taken over from phoma as the key threat to OSR in the UK, and can cause yields losses of up to 1 t/ha.

Small apothecia develop on infected crop debris, releasing airborne ascospores. These spores can travel for several miles, infecting new crops as they emerge. During winter, rain-splashed spores (conidia) spread the disease up the plant or to adjacent plants, with warmth and moisture favouring spread. The pathogen remains active below temperatures required for crop growth, so the disease multiplies on plants during winter, cycling every four to eight weeks.

Often invisible to the naked eye, light-green circular lesions on the leaf surface are the first signs of the disease. In late winter and spring, leaves may curl, distort, become brittle and crack.

When the disease spreads to stems and lateral branches, elongated fawn lesions appear, surrounded by black speckling. The stems may form horizontal cracks as they extend. Under favourable conditions, the disease can spread to and distort pods, which turn brown and shatter prematurely. While azole fungicides have offered good control, LLS populations are becoming increasingly resistant and efficacy is waning.

Sclerotinia stem rot is another disease that can affect stems, infecting plants during flowering if conditions are favourable. But it is highly sporadic and fungicides currently offer effective control.

Source: AHDB Knowledge Library

Limagrain's UK OSR portfolio of Recommended varieties at a glance

Variety type	LG Auckland Hybrid	Ambassador Hybrid	LG Aviron Hybrid	Aurelia Hybrid	Artemis Hybrid	Acacia Conv	Annika Conv	Aardvark Conv	Aspire Conv	LG Adonis Hybrid	LG Antigua Hybrid	Amarone Conv
Scope of recommendation	UK	UK	UK	UK	UK	UK	UK	UK	UK	E/W	E/W	N
Gross outout (% treated control)												
United Kingdom	107	106	105	105	104	104	103	100	100	-	-	-
East/West region	108	106	105	105	104	104	103	100	100	108	104	-
North region	(104)	104	104	105	102	104	(102)	102	100	-	-	105
Untreated (UK)	-	107	110	107	103	104	104	104	101	-	106	-
Agronomic Features (1-9)												
Stem stiffness	7	8	7	8	8	9	8	8	9	8	8	8
Plant height (cm)	155	154	156	150	157	145	149	149	140	149	156	143
Earliness of flowering	7	7	8	7	6	6	6	7	7	7	7	7
Earliness of maturity	7	6	6	5	6	5	4	5	4	5	6	5
Pod shatter	6	R	R	R	R	-	-	-	-	-	R	-
N-Flex	R	Y	Y	-	-	-	-	-	-	-	Y	-
Disease resistance (1-9)												
Light leaf spot	7	7	8	7	6	6	7	7	7	7	6	7
Stem canker	7	7	7	7	7	5	6	6	5	8	7	6
RLM7	Y	Y	Y	Y	Y	-	-	-	-	Y	Y	-
TuYV	R	R	R	R	R	-	R	-	R	R	R	R

Source: AHDB Recommended List Winter oilseed rape 2022/23; R/Y – believed to be resistant to (R) or have (Y) the trait but this has not been verified in RL tests.

colleagues in France and Germany have brought lines through under extreme cylindrosporium pressure, to tease out those that fare best. "The next generation of LG lines are looking really clean for all the major stem-health diseases. These will begin to appear on the UK market this autumn, and will be more widely available in 2023," she says.

Stem health has been a key focus across the Limagrain European breeding programme says Maeve O'Rourke.

Liam points out that all of the LG varieties currently on the RL have been scored for cylindrosporium in the company's own trials, as well as for LLS in the RL programme (see chart on p56). He picks out LG Aviron, Aurelia, Ambassador and newcomer LG Auckland as frontrunners.

"All of them are fully loaded hybrids, with pod-shatter and turnip yellows virus resistance, as well as the *Rlm7* gene. ▸

▸ They have an RL score of 7 or 8 for LLS and have shown few symptoms of cylindrosporium in UK trials.

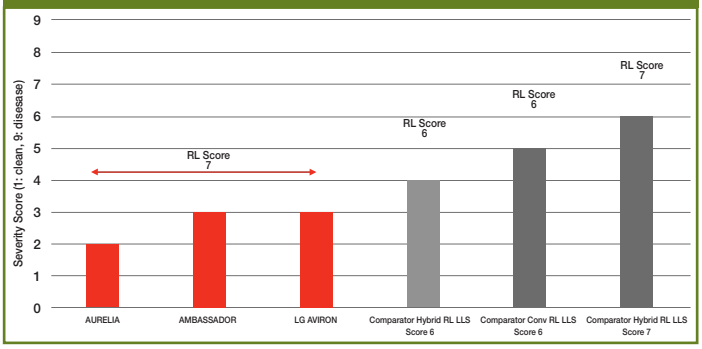
"Aurelia and Ambassador are proving farmer favourites, both with canopies that are easy to manage. Aurelia is a strong performer in the North, and sits a bit more, with a shorter stem. Ambassador has the N-Flex trait that helps crops utilise nitrogen more efficiently in low N conditions. Auckland is the highest yielding variety in the UK with pod-shatter resistance and has the edge on its stable mates for spring vigour. Aviron is the quickest in the autumn of the four." ■

Inside traits

Sustainable agriculture is moving to a new era in which plant genetics play a greater role in the integrated crop management toolbox growers utilise to get the best from their crops. In this series, *CPM* has teamed up with Limagrain to give growers insight into these new tools. Through privileged access to staff and related research these articles look inside the traits, explore the genetics and unlock the secrets of a successful crop.

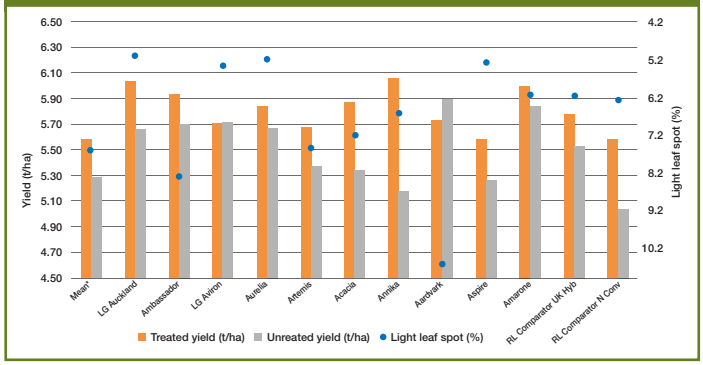
Limagrain started 50 years ago as a farmer-owned co-operative in France, and is now the fourth largest seed company worldwide. With an annual turnover of nearly €1.9 billion, 16% of this is spent on R&D. By developing varieties with higher yields, improved resource efficiency and reduced environmental impact, Limagrain is a major contributor to meeting agriculture's sustainability goals. And this guides the company's raison d'être: to cooperate for the advancement of agriculture everywhere, for everyone.

Varietal performance on cylindrosporium



Source: Limagrain trial network results, UK site, harvest 2020.

Performance of LG varieties in Scottish trials



*Source: AHDB Recommended Lists 2021 Harvest Results; *Treated yield is average over five sites, untreated yield is average over two sites, LLS score is average over four sites; The two RL Comparator varieties are a hybrid with UK-wide recommendation and a conventional recommended for the North.*

A strategic approach

> *Crop nutrition is much more holistic than just nitrogen.*

Crop nutrition survey

As growers grapple for alternative strategies in light of sky-high fertiliser prices, optimising the benefits of foliar nutrition could be a welcome aid this season. *CPM* finds out more.

By Charlotte Cunningham

Fertiliser prices have dominated the headlines of agricultural press over the past few months, and with ammonium nitrate and urea prices sky high this season, many growers will no doubt be weighing up the options when it comes to optimising their yields and input costs via alternative means.

But what are the options and what's 'best practice' for doing just that?

This concept was explored in a recent *CPM*/FMC survey, which aimed to delve deeper into the challenges and opportunities with crop nutrition in a difficult season.

Nutrition planning and programmes depend on not only the crop type, but the end-market that crop is destined for.

Wheat-wise, most participants said they're growing feed wheat only, while 35% said they'll be supplying both milling and feed markets. The outlook was similar for barley growers, with 37% of growers noting that they're aiming for feed specification only, while 29% said they'll be growing both feed and quality malting barley.

"Inputs like nitrogen fertiliser are clearly very important for growers targeting both feed and quality markets, and there's certainly been a lot of talk over the past few months over whether it's right or wrong to be thinking about cutting fertiliser rates this spring," says Chris Bond, commercial technical manager at FMC.

"As we move into the main spring window, the focus is on how to optimise what we do have to maximise output of yield and quality for those growing for premium specification."

Hardest hit

Richard Cromie, Crop Management Partners, says it's likely to be those growing for premium markets who will be hit the hardest. "With wheat, for example, ultimately this will depend on what the millers want — and will accept — in terms of a protein specification and whether growers are able to achieve this with the resources they have. It's going to be interesting to see where it goes over the coming season."

So what's the current outlook with regards to fertiliser supply?

While 75% of growers revealed they've been strategic with fertiliser (N and/or P and K) purchasing and have between 80-100% on farm already for the coming season, 14% said they only have enough for the first application and 5% said they have very little ready for the spring.

Price-wise, there was a significant gap between those who had forward ▸

Optimum crop nutrition is about more than just nitrogen, says Chris Bond.

Richard Cromie warns that those growing for premium markets will be hit the hardest by suboptimal N rates.

▸ purchased and others who had been stung with the unprecedented high prices. While 48% noted that much of their nitrogen fertiliser had been purchased between £300-350/t, 52% of growers had paid over this price, with 2% shelling out more than £650/t.

"While it's positive to see so many growers in at the lower end of the spectrum as far as pricing is concerned, from industry conversations we know there are many who have paid — and will continue to have to pay — significantly over the odds this season," adds Chris.

As a result of the supply and demand challenges, some growers have been left with no option but to slim soil-applied nitrogen rates.

More than half (53%) of growers noted that they'll be dropping back by 10-30kg/ha, while 5% said this reduction is more likely to be around the 50kg/ha mark. A quarter (25%) said that they're planning to apply the usual amount recommended.

While cuts are going to be no doubt necessary for some, Andrew Stilwell — agronomist and technical manager for Bartholomews — warns of the potential impact this could have at harvest, urging growers to be mindful when it comes to decision making. "I think it's important to remember the fundamentals of crop production in that decent yield and quality may not be achieved if a crop isn't fertilised properly."

It's been mentioned by leading bodies like NIAB that UK growers have historically overapplied nitrogen, meaning a rate reduction might not have as severe an impact on crops as anticipated (see *CPM* Feb 2022), and Andrew adds that it's important to take factors like seasonality, rainfall and previous cropping into consideration when contemplating application rates.

Rate reductions

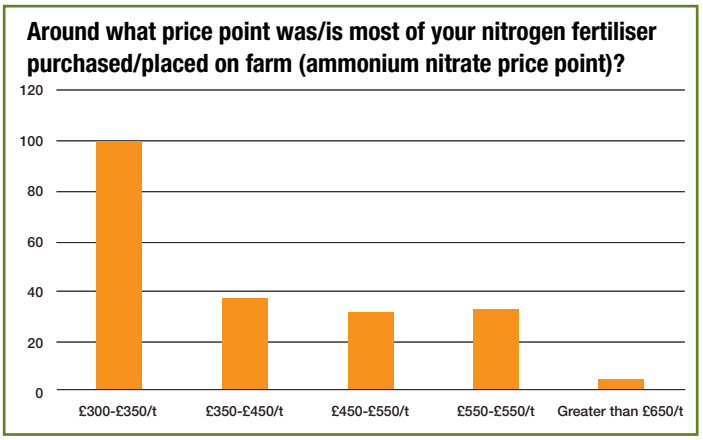
"Our own research work over the past 3-4 years has been based around slowly massaging N rates down and the proposed reductions this year aren't a long way from where we feel comfortable. Therefore, any reductions this season might not be as radical as growers think."

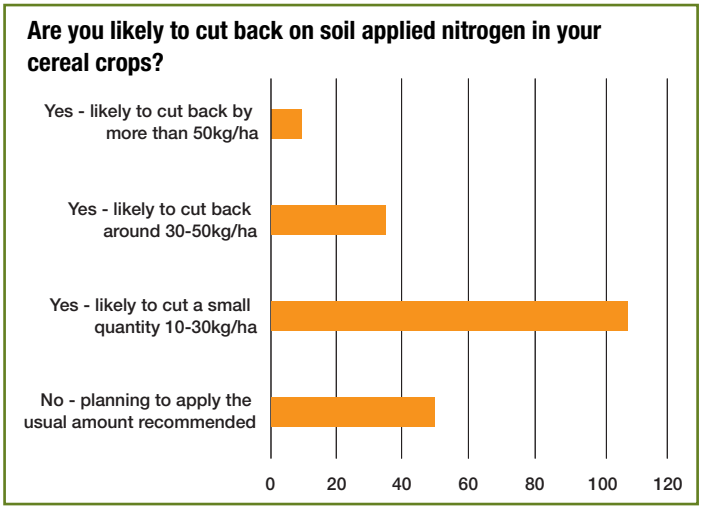
However, he adds that cutting rates is one thing, but suboptimal utilisation is another and in fact, this is where growers may have an opportunity to improve efficiency this season. "Dividing applications down into smaller amounts, applied more regularly, will often lead to marginal gains via nitrogen-use efficiency. Making sure every gram applied gets utilised by the crop is more important than ever this season."

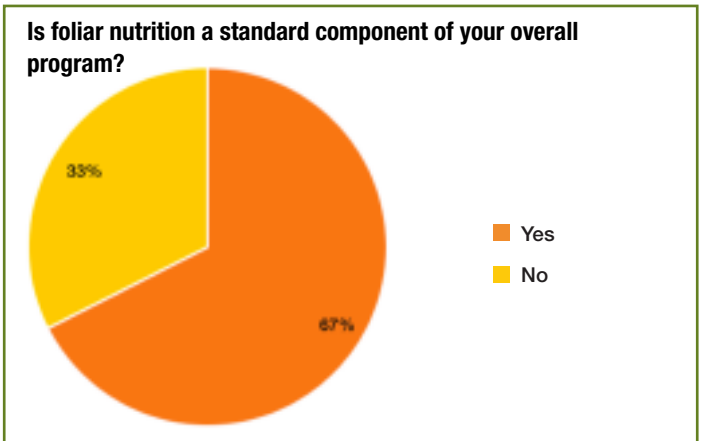
When it comes to other key nutrients like phosphate and potassium, 57% of growers said they'll be reducing or not applying P and/or K this season, in comparison with 43% who said they'll be sticking to plans to apply the usual recommended amount.

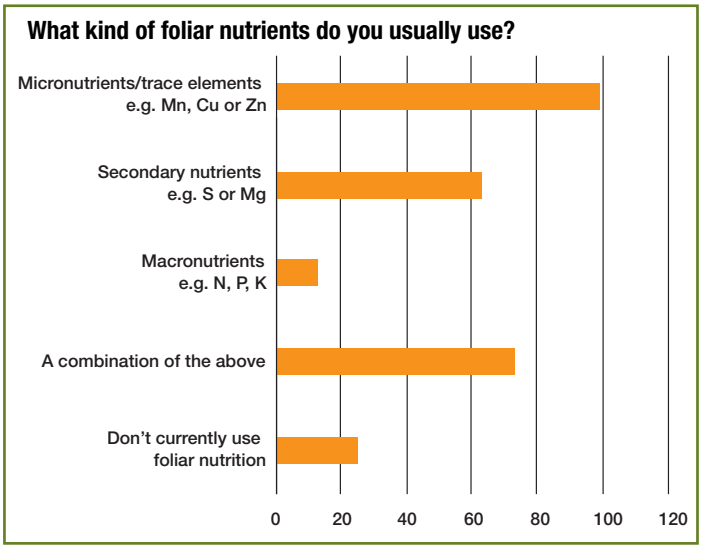
"I'm a firm believer in that getting the basics right is the key to growing the best crops," says Richard. "This includes excellent soil structure, drilling crops into good conditions and also ensuring the plant has adequate levels of essential nutrients — including P and K.

"It may be the case that some growers are able to take a P/K holiday this year in light of the









higher prices, but this can only be confirmed by a soil test, otherwise they may be taking an unnecessary risk."

He adds that, particularly in a potentially lower nitrogen year, a good supply of these nutrients could actually prove to be beneficial. "We know that potash increases the nitrogen uptake in crops, for example, so it's worth bearing this in mind before cutting rates."

For anyone contemplating taking a P/K holiday this season, Andrew echoes Richard's view and warns that it's essential a soil analysis is carried out first. "Having an up-to-date analysis is vital. Once you know what you're working with, a strategic decision can be made.

"Unknowingly having suboptimal levels and then cutting back or cutting out P and K this year could have a significant impact on crop health and the overall resilience of the plant."

Andrew Stilwell warns that decent yield and quality may not be achieved if a crop isn't fertilised properly.

Suboptimal levels

Chris agrees: "The recently published ADAS/AHDB report on dealing with the current fertiliser situation actually specifically referenced the danger of cutting 'non-nitrogen' sources this year without the warranted grounds to do so. It warned that if they are cut, and significantly so to suboptimal levels, then yields will drop further and as will nitrogen-use efficiency.

"While nitrogen supply and rates may be down in some cases, there's still a lot of other aspects and nutrients to manage and optimise to ensure yield and quality is maintained.

"We've done a lot of tissue analysis over the past four years or so and the general feeling has been that we've seen an upward trend in the number of samples coming back with suboptimal levels of P and K. If there are more growers planning to cut back this year, it becomes a question of whether crops have access to enough of the nutrients.

"What's more, both P and K can get locked up in the soil, reducing this availability further, which is likely to have a negative impact on crop performance."

With all of this in mind, Chris reckons there's an opportunity for foliar nutrition to play a more important role this season.

Over half (68%) of growers said that foliar nutrition is a standard component in their overall programme — with the majority focusing on micronutrients like manganese, copper, and zinc. A third (35%) said they include a combination of micro and macro nutrients as well as secondary nutrients like sulphur and magnesium.

So how beneficial can foliar nutrition be?

"Though nitrogen is fundamental, crop nutrition is much more holistic than that and bringing in other elements via foliar nutrition gives growers an opportunity to improve the overall nutritional and health status of a plant," explains Chris.

That's the case in a 'normal' year, but in a season like this, these nutrients are really going to come into their own and play a more important role, he believes.

"Magnesium and manganese are critical for photosynthesis, for example. In the case of manganese, though it might not be directly involved in the nitrogen use process, it has ▸

▶ been shown that manganese deficient crops don't utilise available nitrogen to its maximum.

"If you then think about foliar applications of P and K at key timings, while you're never going to replace all of the P and K the crop needs through the leaf, if you can do it at important growth stages (such as tillering and stem extension) where the crop is likely putting on a lot of biomass, there's a chance to give crops a boost.

Foliar applications

"Micronutrients have probably been the standard when it comes to foliar nutrition, but there's definitely scope for macro and secondary nutrients too."

To get the best from foliar applications, Chris adds that timing is critical, andapplications should be approached with the mindset of trying to boost the performance of the crop.

And with fertiliser prices likely to remain high in the short term, 63% of growers said they'd consider the use of foliar N, P, K, Mg and/or S to offset soil input reductions and boost the crop at key timings this season.

But is this advised?

Andrew agrees that foliar nutrition gives growers an opportunity to 'fine tune' their programme, and can help address imbalances if formulated correctly, however, he warns that it isn't a replacement for a solid macronutrient programme.

"Regular tissue analysis 7-10 days before a fungicide spray timing will help guide growers' foliar nutrition plans, but a good solid fertiliser programme should still be constructed efficiently as possible to get the best from crops.

"We're in a fortunate position that lots of crops have come out of the winter very strongly, so a clear plan before the main fertiliser window starts will help protect that potential."

Richard agrees: "With the main macronutrition, I still think that the majority of this should come from soil-applied sources and delivered to the plant via root uptake. However, foliar application can help to top this up and even out any little differences or discrepancies."

For those still on the fence, Chris stresses again the importance of tools like tissue analysis or sensors to monitor and measure nutrient content across the season. "The more aware growers are of what's going on within the plant, the more potential there is to react to any imbalances at an early stage in order to bring prosperous crops through to harvest." ■

Winner announcement

Congratulations to our winner Paul Cawood from Shropshire who responded to the *CPM*/FMC survey on crop nutrition and has won the fabulous prize of a 64GB 10.9" iPad Air — worth over £500.

Paul responded to the survey and completed the tie-breaker question, which asked respondents to detail their approach to achieving yield and quality potential in their crops this season, in light of variable fertiliser availability and rising prices.

His answer was: "I will use tissue testing and planned foliar nutrition sprays to complement my nitrogen programme. The aim is to optimise nitrogen-use efficiency and achieve optimal yield with a balanced nutrition approach."

The answer demonstrated a clear understanding of the benefits of taking a pragmatic approach to crop nutrition and how additional tools — like tissue testing — can be particularly beneficial in a difficult season, which impressed the judges.

To take part in the next survey, make sure we have the correct details for you by emailing angus@cpm-magazine.co.uk

The making of maize

> *“Keeping crops free from early weed competition is crucial to protect yield in the first month or so after emergence.”*

Pushing performance

There’s little doubt an effective herbicide programme can be the making of a maize crop. *CPM* gains an insight into how an adjuvant can spice up the mix to help get on top of weed challenges.

By Lucy de la Pasture

For a crop that can grow like the speed of light when the days begin to warm, in its early stages maize plants often look pale and wan, growing slowly and without the poke to battle weeds for those vital elements — sunshine, water and nutrients. At this time, herbicide performance can literally make or break the crop.

Back in the day, pre-emergence residual herbicides, such as atrazine and simazine, formed the foundation to maize programmes, staying active in the soil for very long periods and often taking care of many weeds for the duration of the crop. In modern times herbicide options are very different and now it’s post-emergence herbicides that are the go-to for many growers, explains Stuart Sutherland, Interagro’s technical manager.

Although taking out early competition to the crop is the main aim of herbicide programmes, it’s not the whole story. It’s often said one year’s seeding makes seven year’s weeding and possible seed return, especially where grassweeds are problematic, is another aspect to bear in mind when looking at weed control in maize, he believes.

“Herbicides can also reduce the weed burden in the next crop, so it’s important to ensure applications are as effective as possible. But even with the best product choices, weather, herbicide resistant weeds, herbicide chemical properties and suboptimal conditions can all contribute to poor weed control.”

So how can growers stack the odds to help circumvent these potential problems? By helping herbicides do their job better, believes Stuart.

Significant benefits

About to enter its third season on farm, Interagro’s adjuvant Sorrento has been adding significant benefits to weed control programmes in cereal and maize crops, he says, particularly against some tough to control grasses and for broadleaf herbicides applied in suboptimal conditions.

“Keeping crops free from early weed competition is crucial to protect yield in the first month or so after emergence, particularly in sensitive crops such as maize.”

Applying post-em herbicides can pose a particular challenge when it comes to delivering the herbicide to its target, he highlights. “Weeds can be tricky to hit within the crop. As maize plants increase in size, it becomes more difficult to hit weeds because they become shaded. Some of the herbicide is intercepted by the crop, leading to poor coverage and a reduction in overall control.”

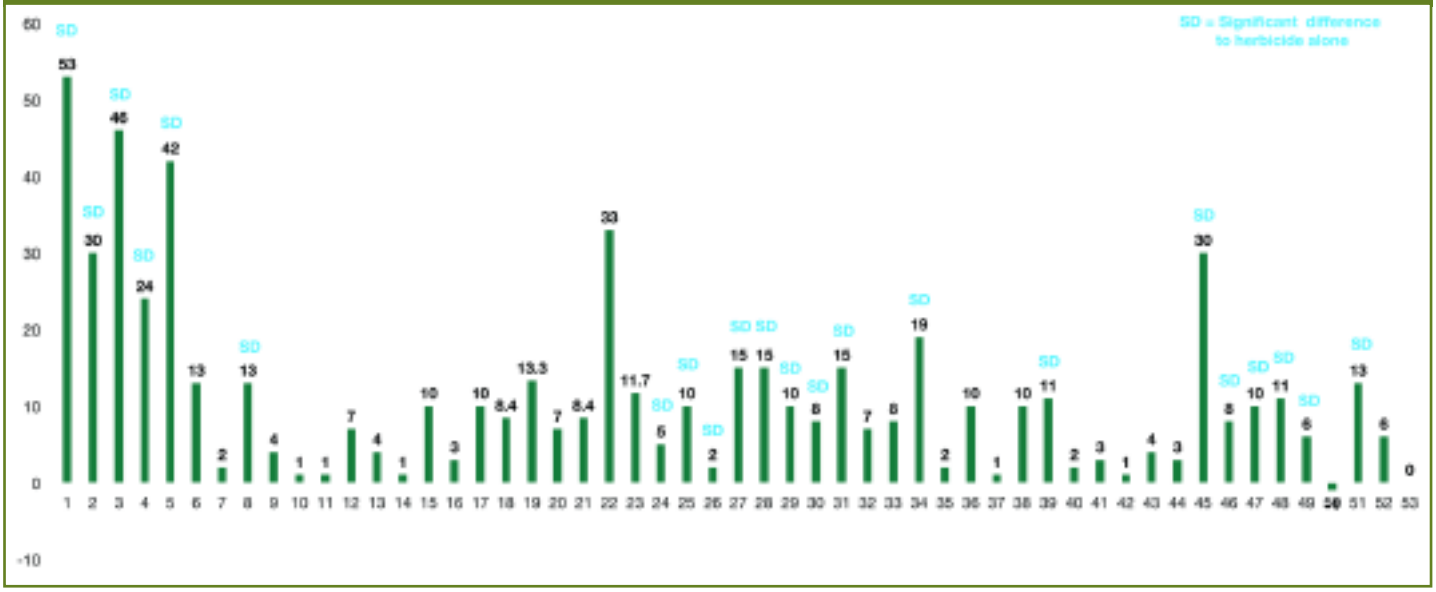
By their very nature, contact post-em herbicides must be distributed onto the leaves of the weeds they’re being applied to control, says Stuart. “As weeds get larger, the surface area of the weed also becomes greater and coverage across the whole weed becomes vital to prevent re-growth.

“Once herbicide droplets land on the leaf, spreading and retention becomes critical. Effective distribution across the leaf’s surface is necessary because contact herbicides don’t move within plants.”

Leaves are designed to protect the plant from water loss and damage by having a waxy cuticle — with variations in waxiness between different weed species. Some spring germinating weeds are notoriously waxy and problematic to control, such as fat-hen or orache, as are perennial weeds like thistles. ▸

Sorrento has been adding significant benefits to weed control programmes, particularly against grassweeds and for broadleaf herbicides applied in suboptimal conditions, says Stuart Sutherland.

% Weed control benefit from addition of Sorrento to a range of herbicides



Summary of 53 trials where Sorrento was used with different herbicides. N=53 comparisons

Source: Independent trials, 2016-2021.

▸ This natural leaf protection poses a bit of a problem when a droplet of spray solution lands on a leaf, he adds. "Approximately 95% of the spray solution is water and this beads on waxy surfaces and is prevented from spreading out due to the high surface tension between water droplets and the waxy surface.

"Poor coverage is even more problematic on hairy leaves, which can suspend spray droplets above the leaf surface, preventing contact. This is why the labels of contact herbicides invariably recommend the addition of a suitable tank-mix adjuvant to help reduce this surface tension and therefore increase the spreading required for effective coverage."

Stuart believes that the extra spreading ability brought by the addition of an adjuvant to the sprayer tank can't be matched by the 'in-can' adjuvants used in herbicide formulations. "For formulated products, the spreading ability is fixed by the pesticides recommended rate per hectare. But for tank-mixed adjuvants the use rates are based on water volume, and this ensures spreading and coverage can be optimised."

Waxiness of the cuticle also varies under different conditions of growth, with cold and dry periods increasing leaf wax and warm or windy periods de-waxing leaves. And thick, waxy cuticles are troublesome because they slow down herbicide uptake by weeds, he adds.

"Post-em herbicides have to penetrate the leaf cuticle and reach the living tissue to be able to exert their effect," he says.

That too poses a problem to contact herbicides as the cuticle is present on the upper and lower surfaces of the leaf and it forms the biggest barrier to herbicide active ingredients.

"As weeds increase in growth stage, their cuticles become thicker. This makes them tougher to penetrate, particularly in dry conditions. Weeds which are particularly waxy, such as brassicas and fat-hen, can be very challenging to control."

The properties of the active ingredients themselves also influence uptake by weeds, adds Stuart. "The ability of an active

When the weeds get tough…

In the Vale of Belvoir, nestled between the borders of Leicestershire, Lincolnshire and Nottinghamshire, Agrii agronomist Martin Frost is right in the arable heartlands. Maize comes and goes in many rotations, so he's been putting Sorrento through its paces in winter wheat.

"Last season I had some big grassweeds in dry growing conditions. The weeds were toughened and starting to grow away so it wasn't ideal for herbicide efficacy," he says.

Martin looked to Sorrento and tank-mixed it with Axial Pro (pinoxaden), where wild oats were the target, and with Avocet (pyroxsulam) in situations where brome species were problematic.

"Sorrento is one of the adjuvants recommended for use with Avocet and we find it has the edge where conditions are unfavourable. In these situations where I don't expect to get full control it becomes the adjuvant of choice."

Last year was Martin's first experience with Sorrento and it's encouraged him to utilise its properties in other ways.

"I have a few fields with wild oats and brome so I'm looking at using Sorrento early when conditions are unfavourable ie cool, dry and growth is slow, or later in the season when grass weeds are larger — which makes them much harder to kill.

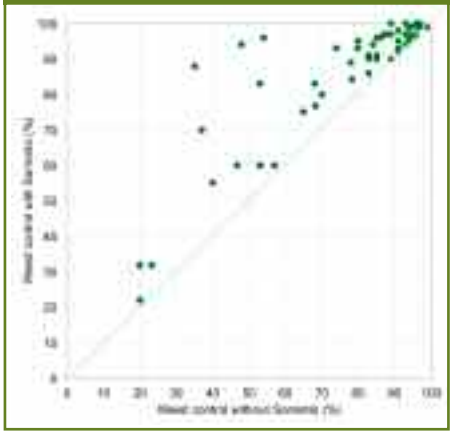
"The idea is to target the grassweeds early, while they're smaller, and to use Sorrento to try and get the actives into the weeds a bit quicker under cooler conditions — though I'll be avoiding any frosts," he adds.

"It can go very dry at about the time you need to apply post-em herbicides in maize and it's very easy to lose weed control," he says.

Martin Frost has had success controlling big wild oats and bromes in cereals by adding Sorrento to the tank.

He also may draw on Sorrento to accompany any sulfonylureas in the spring "if conditions go against you".

Benefit from addition of Sorrento



All trials 2016-2021 in cereals and maize. Range of herbicides and rates compared against a variety of weeds. N=53 comparisons.

Source: Independent trials.

ingredient to penetrate the leaf cuticle and plant tissue inside is determined by its intrinsic chemical properties. Active ingredients with low water solubility have a natural advantage. They're able to penetrate leaf cuticles by simple diffusion through the waxy components, which make up the most part of the cuticle, although this can be slowed in cold/dry conditions.

"In contrast, for active ingredients with moderate to high water solubility the mobility through the cuticle is much less, resulting in less active being absorbed. And this is where many herbicides sit in terms of their solubility," he says.

Stuart suggests that it's these actives, the group with moderate to high water solubility, which benefit most from the addition of a suitable adjuvant as this will help them penetrate the waxy cuticle and increase the flow of active ingredient into the leaf.

"This is highly relevant for the control of difficult weeds and in suboptimal conditions," he adds.

And this is where Sorrento appears to tick all the boxes, overcoming the host of potential obstacles to herbicide performance.

Interagro's claims for Sorrento are backed up by comprehensive replicated trials data, with significant benefits shown for herbicides with higher water solubility in 2021. These include Avocet (pyroxsulam), Samson Extra (nicosulfuron), Callisto (mesotrione) and Ally Max (metsulfuron-methyl+ tribenuron-methyl). The moderately water-soluble Axial Pro (pinoxaden) has also shown benefits from the addition of Sorrento.

Replicated field trials have shown that Sorrento can add significant weed control benefits against hard to control weeds, even in ideal application conditions. In dry conditions, the benefits to overall weed control will be even more beneficial, says Stuart.

Uplift in control

Significant differences in control of fat-hen, poppy and redshank were seen in maize, with better control of blackgrass observed when Sorrento was used with Diniro (prosulfuron+ dicamba+ nicosulfuron). A similar uplift in Italian ryegrass control was observed when Sorrento was used with Axial Pro in winter wheat, though neither of the results on grassweeds were statistically significant by the final assessment. The speed of kill, however, was significantly faster, he notes.

When faced with a young maize crop being smothered by fumitory last spring, William Pitts, agronomist at NB Pitts, decided to give Sorrento a try.

"The crop hadn't had a pre-em in half of the field and here the fumitory was about 100mm across in size."

Common fumitory is a prostrate and scrambling weed which can soon out-compete uncompetitive crops such as maize. William looks after a lot of mixed farms in his Devon region, so grassweeds can be a problem — as was also the case in this field — requiring Samson Extra.

With neither of the post-em herbicides options, Callisto and Samson Extra, offering good control of fumitory, William potentially had a problem on his hands.

"Sorrento was new to me last year but having had good results with other products in Interagro's range, I thought this would be the perfect opportunity to see what Sorrento could add."

William held his growers back from planting maize last spring due to the unseasonably late frosts and cool days at the time when the crop would normally have been going in the ground. When the post-em herbicide was applied on 3 June, the fumitory-troubled crop was at the 2-3 leaf stage and a tank-mix of Callisto and Samson Extra was applied over the whole field with Sorrento.

William Pitts added Sorrento to help post-em herbicides control large fumitory in maize.

"I noticed the weeds showed symptoms earlier and the fumitory was completely knocked out by 16 June. The crop had moved on to nine leaves and was motoring once the weed competition had been removed."

William intends to have a closer look at Sorrento this spring. He won't be adding it to the tank for no good reason but says it could be useful for improving herbicide activity on difficult weeds or even help reduce herbicide application rates in some situations. ■

Pushing performance

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

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

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

Sorrento reliability, it's a sure hit

Sorrento is a unique, low dose activator adjuvant that helps overcome herbicide performance barriers, leading to more reliable and effective weed control, by optimising contact and penetration into weeds. Sorrento is approved for use in a wide range of crops and is available to purchase through Agrii.

INTERAGRO
THE ADJUVANT EXPERTS

> *"We want to increase yield to make the most of higher prices but not by applying masses of fertiliser."*

Double reason to make most of N

Microbial biostimulants

With so much focus on biostimulants to help crops use nutrients more efficiently, *CPM* finds out how two growers are using different microbial bionutritional products on their farms.

By Rob Jones and Lucy de la Pasture

Using nitrogen more efficiently is a key goal for many growers and a Kent-based farmer believes biology holds the answer. With nitrogen prices heading higher every day, coupled with rising wheat values, Simon Chiles's agenda is to maximise yield without applying extra and expensive nitrogen.

"Some farmers might have bought N at the right money, but I can't see that many will apply more than 75-80% of their normal rate, which will enable them to achieve the best yield with the N they've bought," he says.

Simon started out as an agricultural contractor but has gradually migrated to farming. His business, based near Edenbridge in Kent, is now about half arable farming, with the remainder producing hay and straw for the equestrian market.

The farm of 120ha has an arable rotation, with crops varying year-to-year but including winter wheat, oats, triticale, linseed, soya, lupins and millet — mostly on seed contracts — plus 160-200ha hay for local equestrian market.

"I don't often grow barley because I don't think our heavy weald clay suits it," he says. "I like to have a market lined up for a crop before I plant it and have grown a wide variety of crops — anything where I can see a niche market."

Tramline trial

Despite the heavy ground, Simon has made a success of direct drilling, which he has practised for more than 20 years. "When direct drilling first came in during the 1960s and 1970s, this land was classified as not being suitable for it, but for 22 years we've proved otherwise."

Typical winter wheat yields on the farm are 7.5-8.5t/ha. "It is not the highest yielding land but we use the straw it produces for the equestrian market in order to maximise our margins," he says.

Interested in improving his yields, Simon hosted tramline trials for biofertiliser company, PlantWorks, which developed a bacterial product to improve nitrogen-use efficiency and yield. The bacteria colonise the plant root zone, promoting growth by increasing the supply or availability of essential nutrients to the host plant, he explains.

In the 2017/2018 season, applying the product five days before UAN boosted winter wheat yields by 5% compared with controls. For the 2018/2019 season the yield increase was more modest at 2% — believed to be due to the product being applied in late February when the soil temperature had not reached 10°C.

Simon Chiles grows a wide variety of crops, including triticale, mainly for seed.

"In the trials, PlantWorks refined the product using fewer but more targeted bacterial species; with fertiliser prices going up and the prospect of wheat prices continuing to rise, I decided to use it on spring wheat this spring," says Simon. "We want to increase yield to make the most of higher prices but not by applying masses of fertiliser; we need to be smarter than that."

He plans to plant 26ha of Mulika milling wheat by mid-April and will apply PlantWorks' SR3 Wheat plant growth promoting rhizobacteria (PGPR) at growth stage 13-19.

PlantWorks managing director Robert Patten says it's important to apply the product at least a week before or after nitrogen and when soil temperature is at least 10°C.

"Typically, bacteria are found to multiply more slowly in the presence of high levels of nitrogen fertiliser," says Robert. "Leaving a week window between the application of fertiliser and bacteria ensures the latter function optimally. Soil temperature is important as the bacteria replicate more rapidly when the ground is warm, and they have a ready source of food — root exudates — as the plant's growth accelerates."

Apart from the single application of SR3 Wheat, Simon will apply nitrogen as UAN in accordance with his usual spring milling wheat regime. "I'll put on 180kgN/ha with half going in the seed bed, or shortly after planting, and the other half going on later in the season in probably two applications, depending on the weather. I don't want a sudden rush of N as this alters the sap pH and makes plants more susceptible to disease."

Simon will also test N levels later in the season and apply foliar N if needed to achieve protein specification for milling. ■

Microbial biofertiliser shows promise in salad potato trials

Small is beautiful when it comes to salad potatoes, but it's the large numbers of tubers that drives profitability.

A high tuber number — the aim is over 1M tubers / ha — creates competition per unit area and divides the crop's energies and resources into maintaining a greater number of smaller tubers, perfect for salad potatoes where the ideal size is 25-45mm.

But around tuber initiation, having enough available phosphorus is crucial to avoiding tuber abortion, says independent potato agronomist Edward Maule.

"We have this issue in salad potatoes and also in seed crops, where we lose tubers around that stage and again two to three weeks later."

Phosphorus is relatively immobile in soils, and for crop uptake it also needs to be available via the soil solution. "When you apply P it's hard to quantify how much will be taken up and utilised by that crop in that year."

That's why Edward became interested in the potential of microbes to unlock phosphorus and make it more available at a key time in the growth of potato crops. He's been trialling microbial manufacturer Biolevel's PhosN product, which contains a mix of nitrogen-fixing and phosphorus and potassium solubilising microbes, on two potato farms in East Anglia.

Unlike some biological products, PhosN is easy to store in its powder formulation and use with flexibility around application method with a low use rate of 250g/ha, he claims.

"In two of the trials it was applied in-furrow with Amistar (azoxystrobin), which is easy for application at planting and fits into current systems. In the third trial, it was applied with the first herbicide spray. It can also be applied as a powder direct as a seed coating like Monceren used to be," adds Edward.

The trials were set up in 2ha blocks in field-scale trials within three mainstream salad varieties across the two farms — Jazzy, Venezia and Paris. Test digs were carried out in four places in both the treated and untreated control blocks at harvest to compare the treatments.

In each case the biological product increased both tuber numbers and marketable yield, says Edward. The highest increase was in Jazzy, where tuber numbers were increased by 260,000/ha with a corresponding marketable yield increase of 9.75t/ha, while the smallest increase was in Paris at 3.2t/ha, where the product was applied with the pre-emergence herbicide spray.

At current salad potato prices — around £390/t delivered — that would be worth an extra £1248 to £3802.50/ha, he says.

"The increases in tuber numbers are why we've been able to achieve the higher yields — we've got more potatoes in the 25-45mm bracket. If you don't get the higher numbers, you'll get a higher percentage in the over 45mm bracket.

"It answered the question about supporting salad, or seed, crops through that tuber initiation period, so we're planning to roll this out further."

Edward is also planning a new set of trials in both salad and ware crops where the aim is to increase or maintain marketable yield while reducing synthetic nitrogen requirements. It's an approach that's been successful in maize trials and a topic of increasing importance given the current capital cost requirements for purchasing fertiliser, potential supply concerns and the need to increase nutrient-use efficiency. Applications in ware crops are likely to be later, probably with the second or third blight fungicide spray.

Edward Maule became interested in the potential of microbes to unlock phosphorus and make it more available during tuber initiation.

"With the current prices and the environmental pressures on the use of fertilisers, reducing synthetic fertiliser use by 20% and using PhosN to make the nitrogen applied more efficient is the next step for potatoes, and also potentially onions," he explains.

"I think microbial biostimulants can help farmers with sustainable production and help reduce the problems associated with the use of fertilisers, such as leaching, runoff and nitrification."

Tuber numbers and yield +/- microbial bionutrition product

	Untreated tuber numbers/sqm	PhosN tuber numbers/sqm	Difference in tuber numbers/sqm	Untreated calculated Yield/sqm	PhosN tuber calculated yield (t/ha)	Difference in yield (t/ha)
Jazzy	90.75	116.75	26	29.75	39.5	9.75
Paris	107.5	117	9.5	32.6	35.8	3.2
Venezia	87.5	106.8	19	29.1	33.4	4.3

Source: Biolevel, 2021

> *“It’s been generally accepted as okay that a crop only utilises 5-10% of the phosphate applied.”*

Making better use of nutrients

Bioscience in practice

A greater percentage of soil-applied phosphate (90-95%) and potash fertilisers (60%) remains in an unavailable form than is actually used by the crop. *CPM* explores how growers can rely less on solid fertiliser as well as improve nutrient uptake, assimilation and utilisation, while maintaining yields.

By Lucy de la Pasture

In the words of Socrates: ‘change is to focus all your energy not on fighting the old, but on building the new’.

It’s fair to say that the world has changed significantly, even within the current cropping year. Tomorrow’s problems have very much become the pressing issues of the day, particularly when it comes to crop nutrition.

Change that has been coming has accelerated in the topsy-turvy economics which follow a pandemic and have been further distorted by Putin’s war. For many reasons it’s a good time to think differently about how to ‘build the new’ and still meet the needs of crops, believes Mark Hemmant, technical manager at Agrovista.

The agronomy company has been challenging itself to think differently for several years now and part of that process has involved better understanding how plants take up nutrients and ways of making the process more efficient. To that end it has been looking at product innovations, with several of those coming from specialist bioscience company Unium.

“Part of Unium’s ethos is to formulate and manufacture products which are not only rooted in science, but they’re also proven to work. Just as importantly they’re affordable to use,” he adds.

The same problem

Although much of the discussion is about nitrogen and improving nitrogen-use efficiency, the other major elements shouldn’t be forgotten, believes Mark. Improving phosphate and potassium-use efficiency is all part of the same problem, particularly as growers also face challenges with escalating prices for straight and compound products, not just ammonium nitrate and urea-based fertilisers.

John Haywood, director of Unium Bioscience, agrees. “Research shows that nitrogen-use efficiency and phosphate-use efficiency are intrinsically linked, a small change in one can give a big change in the other.

“Historically, the conversation around plant nutrition has been all about meeting the crop’s needs and not depleting soil supplies. That has to change to include how much of the applied nutrient is taken up, as well as how well it’s assimilated and utilised by the plant.”

Phosphate-use efficiency is an area which John believes has been largely ignored. “It’s been generally accepted as okay that a crop only utilises 5-10% of the phosphate applied. Because of this inefficiency, traditional forms of phosphate are over-applied in an effort to meet plant needs, with implications for the environment.”

One of the problems with soil applied phosphate is that it only moves very slowly in the profile, he adds. “P is very immobile in the soil, so spring application doesn’t have enough time to get it into the root zone of crops — you’re actually fertilising for the next crop.”

Other limiting factors for P availability include high calcium and high pH soils. “If you put TSP on an alkaline soil, 50% of the P will be locked up within seven days and 90% within three weeks. So you’ve moved rock phosphate from Tunisia/Morocco put it on a calcareous soil in the UK and effectively turned it back into rock phosphate.”

John acknowledges that MAP or DAP are more suitable forms of P for a calcareous

The conversation around plant nutrition has been all about meeting the crop’s needs, that has to change to include nutrient uptake, assimilation and utilisation by the crop, says John Haywood.

soil but he believes, because TSP is the cheaper form, the importance of soil pH is sometimes overlooked when making buying decisions.

When considering phosphate, it exists in three pools in the soil. Only the inorganic phosphate that has dissolved in soil water, which is the smallest pool of phosphate in the soil, is readily available to the plant, he explains.

"Some is adsorped onto the surface of soil minerals (such as clay, iron, aluminium, magnesium and calcium) and slowly becomes available to plants (active pool).The majority exists as primary minerals (such as apatite, strengite, and variscite) and organic compounds that don't mineralize easily (fixed pool) — and are therefore very unavailable to plants. These pools are in a state of equilibrium with one another," explains John.

"Between 30-65% of the total phosphate in the soil is organic, and within this fraction soil biology plays a crucial role in releasing phosphate into the active pool by mineralising the insoluble P held in organic forms and solubilising the P held in inorganic substances."

Using biology in the form of endophytes is one way that growers can help the plant take up nutrients more effectively, says John.

Unium endophytes can be applied as a seed treatment (Tiros) or as a foliar spray (Tarbis), which is new this season.

"Both products contain two strains of endophyte — one targets N-fixation from the atmosphere and the other P solubilisation and sequestration from the soil," he explains.

Secondary adsorption

As well as considering the effect of Ca in the soil, it's not the only place where it can limit P uptake, says John. He explains that nutrition within a root is primarily driven by calcium. So when the root brings P into the plant the Ca bonds to it, causing a secondary adsorption to the root.

"Biology has freed up the P where it was adsorbed onto soil particles but then it can become bound again in the root, and that's where endophytes have a secondary application. They're able to free P from the root to allow it to be translocated around the plant to wherever it's required — often either the root tips or shoot tips because these are actively growing.

"So not only can you improve the pull of P from the soil, it's also possible to improve the pull away from the roots. Both these attributes help improve phosphate-use efficiency."

Having first trialled Tiros and seen it in commercial use for the past two seasons, Mark has been impressed with its consistent performance, particularly getting crops off to a good start in the autumn. But it's also working like this in the plant for life, he highlights.

Once applied to the seed or as a foliar spray, endophytes work throughout the plant's life to improve nutrient-use efficiency, says Mark Hemmant.

"Tarbis fits where Tiros hasn't been used and looks a useful way to boost nutrient uptake when the crop has a high demand, particularly for P and K in the spring."

Agrovista's John Murrie echoes Mark's ▸

Feeding the plant, not the soil

At Topcrop Farming the emphasis is very much on looking at ways to increase nutrient-use efficiency. Based at Whittlesey, near Peterborough in Cambridgeshire, Roger Hunt-Pain says the fenland farm has complex and varied soils and being high in organic matter brings its own set of challenges.

"A lot of our black land is low in P but very high in K. I've been working with John (Haywood) because we're very conscious that a lot of applied fertiliser gets locked up, so we want to make sure that what we put on is bestused by the plant."

It's a working relationship that goes back a number of years, when Roger and John were both members of Crop Management Information (now Green Crop Information).

"CMI always highlighted that credible biostimulant products require good data from replicated trials. John's products have a good science base, are well tested and we're trialling some on the farm as well," he says.

Roger grows 130ha of onions — with some ground rented to help extend the rotation — and 80ha of potatoes in rotation with winter wheat, sugar beet and maize on the farm's 400ha. With high-value crops forming a fair proportion of his cropping, the rise in input costs has elevated risk to a whole new level, he says.

"The increase in costs and sale prices means more money is involved in the crop and that makes the cost of failure much higher. We're really having to dot the 'I's and cross the 't's on cashflow. It's all new territory for us and many businesses and the last thing we need is for the wheat price to evaporate."

It all reinforces Roger's view that the farm has to make the best use of fertiliser from a financial point of view. He says that his aim is to make sure the plant's nutrient use is most effective and valuable nutrients aren't left in the soil, unavailable to the plant.

One of the products he trialled is Luxor and the results showed he was able to reduce soil-applied P205 application by 75% and saw an increase in potato yields. "The PGA within Luxor enhances the nutrient use efficiency, especially for P, and makes them more available to the crop. This will be even more important where we rent ground, as we don't want to leave excess nutrients behind."

Roger has also had good results using Calfite applied as powder to coat potato tubers and onion sets. "We found it helps maximise root growth and makes P more available."

His farm has to make the best use of fertiliser from a financial and environmental point of view, says Roger Hunt-Pain.

One of the things that's important to Roger is the low salt-index of Calfite and other products from Unium, which are all formulated with both crop safety and the well-being of soil biology very much in mind, he says.

It's Calfite's ability to trick the plant into thinking it's short of P that can be utilised by growers to use P more effectively, says John Murrie.

▸ views, adding that both products also help plants withstand and recover from abiotic stress, such as droughty periods, which seem to happen more regularly in late spring just as the crop is growing rapidly.

Phosphites are another well-known stress busting biostimulant, with the low salt-index calcium phosphite (Calfite) the offering from the Unium stable. But it's Calfite's ability to trick the plant into thinking it's short of P that can be utilised by growers to use P more effectively, explains John Murrie.

"Because the plant thinks it's short of P, it pushes out more roots, increasing their depth and biomass and therefore their ability to scavenge for nutrients. And the PGA included in Calfite enhances nutrient uptake, further improving nutrient-use efficiency."

Phosphites also help nutrient-use efficiency in other ways, adds John Haywood. "Calfite activates root exudation, so roots produce more exudate which feeds the biology which bring P back to the crop. It's all part of a circle.

"So when you use phosphites early in the life of the crop, it improves root mass and elevates P into plant. It's a really efficient way of utilising the P that's found within the soil."

In a six-year rotational study (wheat/ barley/OSR), MAP and TSP were applied at either 100Kg/ha $P_2 0_5$ or at a reduced rate and supplemented with phosphite, explains John Haywood.

"The most cost-effective treatment was phosphite alone but over the duration of the study the soil P dropped from 14ppm to 12ppm. However, if 25% of the normal P was applied to the soil and topped up with phosphite this ameliorated the depletion."

Soil Biology

John Haywood notes that the low salt-index formulation of phosphite doesn't have a negative impact on soil biology, primarily on mycorrhizae, though phosphate does. "The challenge with high P fertilisers is that they have a negative impact on soil biology. For example, often there's a kick from starter fertiliser but as the P source depletes, or becomes adsorbed to the soil, the crop growth stutters as its forced to pause to form associations with the biology it needs to pull further P from the soil.

"However, if the P is in a low salt index source that supports biology, then the plant will form these associations from the very beginning and avoid the slump in growth."

And this is how Unium provides P in new product, Luxor. "Growers can now achieve the same result as seen in the six-year trial, with the same positive effect on soil biology, using a new innovation from Unium — Luxor — which contains two forms of P in a ful-vic/humic complex," he says.

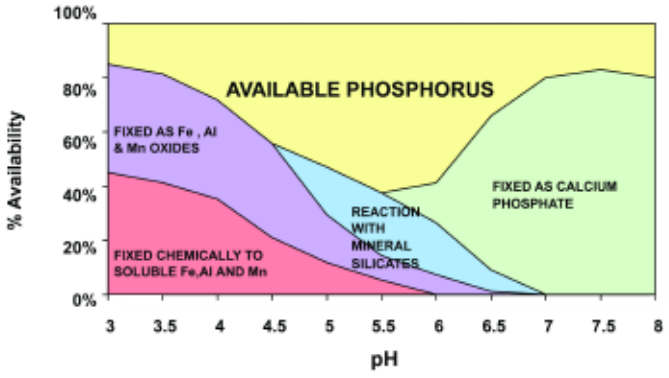
"Luxor enables growers to use some granular and top up with a foliar source of P. It provides an opportunity for potato growers on rented land to maintain soil reserves and deliver the P requirement of the crop at a much lower cost than if following conventional programmes."

In other crops, Luxor could be directed where it's still necessary to deliver P, either as a soil application or as a foliar in season if P-limiting, or where there are availability problems in the soil, he adds.

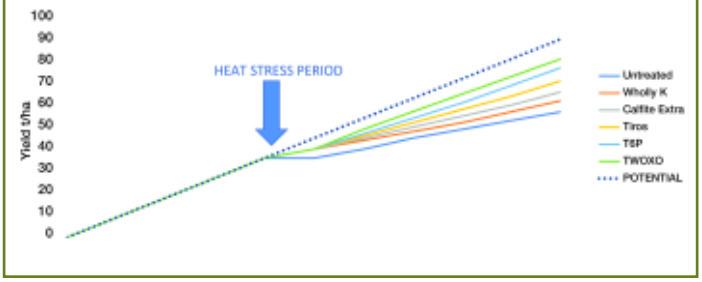
While it's become normal to consider the supply of nutrients as individual elements, for many of the physiological functions of plants they're interdependent on each other, says Mark. For that reason, supplementing K levels with a foliar complex can increase the overall nutrient-use efficiency of plants at a time when their requirement is high.

"Wholly K is a complex which delivers potassium efficiently through the leaf, while the 2-oxo metabolite drives nutrient use efficiency, especially nitrogen. This stimulates root production to allow better access to soil K to help overcome the deficiencies or lack of availability." ■

Effect of soil pH on available phosphorus



Different nutrient/biostimulant treatments on potato yield



Mitigation of heat stress period in potatoes, where bulking rate changed from 9t/ha to 4t/ha in the untreated. *Source: Greencrop*

Bioscience in practice

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

In 2021 *CPM* teamed up with Unium BioScience to open the science behind these innovations. In this second series of articles we explore how bioscience can be utilised in the field, building on our understanding of the physiological processes and trials data. Above all, these articles give the grower an inside view on some of the exciting opportunities biosolutions offer in the field.

Nutrient-use efficiency is a hot topic at the moment, with prices rocketing and products becoming hard to find. At Unium we are combining many years of experience with tried and tested technologies to help farmers find affordable solutions that will maximise their yields and profits.

over the gate

by Claire Eckley

Can we feed everyone?

The price we receive for rapeseed oil has shot up over the past year. Most of our buyers are pretty chilled about increases, passing on the price to customers or diners in their restaurants. However, our big catering customer understandably added in another supplier. Having been after the business for a number of years, our competitor offered a substantially lower price in November than we were supplying for. Ever the "cup-half-full" people, we thought we'd done pretty well to supply them exclusively for over five years.

A few months later, we're making emergency deliveries to this customer as the new supplier can't keep up with demand. Their price is now approaching ours, and we've been offered a good proportion of the business once again if we can match them.

We are quite liking the emergency bailout price though and are enjoying a change of lifestyle as we have excused ourselves from running our oil presses 24 hours a day, seven days a week. Honestly, it was like having livestock!

We made that decision as the numbers just didn't add up. Keeping a clear head while prices go through a volatile phase is tough at the best of times, but with unprecedented pressure on fertiliser, fuel, chemicals and wages, we certainly are in a whole new place.

Farmers are being pulled in many directions at the moment with regard to farm policy. Climate change, the biodiversity crisis, the cost of inputs, and now world food security during a war, are having large influences on cropping choices, and then crop husbandry.

With Russia and Ukraine supplying 30% of the world wheat export market, we have to pity countries like Egypt and Yemen that are so reliant on wheat imports. Prices tend to go a bit crazy when there's only a 10% shortage, so goodness knows where a larger wheat shortage could take us.

Governments around the globe are starting to wake up to this situation, and policy changes in various countries are being announced, removing land from ecological schemes and suspending green ambitions.

Maybe you've made your own policy change on farm. Guy has had the sunflower seed brochure out here, and I've been talking to one customer about swapping to sunflower from our rapeseed oil.

But can we be cleverer about this? People don't just need wheat to survive. We have long since stopped talking about calories on their own as a measure of a diet. As we all know, we need all sorts — protein, carbs, some healthy fats, vitamins, minerals, fibre and water. Five fruit and veg a day is good but it doesn't all have to be fresh.

Henry Dimbleby's wonderfully written National Food Strategy couldn't be more timely, coming out during a pandemic and now with tighter food security across the world. Even though it was published before the awful situation in Ukraine evolved, it still offers much insight.

The food system we have doesn't make for a particularly healthy population. Can we change what we eat as a nation so that more of our wheat, which transports and stores well, goes to places in the world that need it more? Can we eat less toast and sandwiches, and get the benefit of fruits and veggies? As farmers, can we make the most of pulses? Maybe we could export some more of those too. What plant protein crops realistically can slot into our food supply chains, and be welcomed into our kitchens? Personally, I love a lentil.

PGRO responded to the National Food Strategy in a positive way, asking for more research on pulse crops for the British market, and identifying their potential to bring diversity to rotations and benefits to soil. Public procurement could set the tone, and generate the demand needed to get processing facilities set up, and we could all get the benefit from growing these crops in a profitable way. With the AHDB review coming up, I'll be suggesting more money goes in the direction of pulses.

Kidney beans are a niche crop in the UK but could more could be home-grown.

With the National Food Strategy's recommendation to change the British diet, if not now, then when? And in case you were wondering, sausage and lentil casserole goes down very well with the whole Eckley family, even the teenagers!

Claire Eckley is a partner in her husband Guy's family farm, operating across 500ha of regenerative arable land in the Weald of Kent. As well as selling commodity crops, the Eckleys process on-farm to add value and market oil and flour under their Pure Kent brand.

@PureKent

Claire Eckley reckons now is as good a time as any to change the nation's eating habits.

naturenatters

by Martin Lines

Making sense of food security

At the busy onset of another spring, it's difficult to think ahead in the face of the ongoing tragedy in Ukraine, where the challenges experienced by farmers in a now war-torn country is unprecedented. My thoughts are with Ukraine.

The war in eastern Europe will have ramifications for years to come. It has already destabilised global markets and wheat prices hit a record high. It's driven relentless increases in costs for energy, fuel, fertiliser and agrichemicals, with the price of urea having more than tripled in the past year. Russian and Ukrainian grain, among other products, might be unavailable this coming season, which will negatively impact the global supply chain.

Now that the spotlight is on food security, there've been calls to relax environmental delivery to prioritise increased production. For me, and I know for many others, the areas of our farmland that support diverse ecosystems work in partnership with production. Without a functioning landscape — fertile soil, pollination and habitats to support biodiversity — we simply couldn't produce healthy, sustainable food. And if we tried, we would be paying exorbitant costs for inputs and fertilisers to replace what nature does for free. Can UK farmers rely on these global commodities when price volatility and climate change make this increasingly uncertain?

Severing our relationship to environmental stewardship for short-term gain will have long-term consequences. If we genuinely want to address food security, we must first review what we produce and the amount of otherwise edible produce that ends up as waste. We have to develop more efficiency in what we, the supply chain and the public do.

As costs rise, it adds increasing pressure on budgets and predicted outputs, and I have been thinking ahead to next season's cropping plan, availability and prices of fossil fuel-based inputs.

This past year I've been looking at my business costs differently by using the Maximum Sustainable Output (MSO) model (see *CPM*, February 2022, p16) which tries to obtain a 'sweet spot' where farming is at its most profitable and nature is at its best. I've been evaluating the costs that compensate for nature and what is resulting in financial output. If I look at fertiliser, not only do I count the cost of the fertiliser, but also the unloading, storage, handling, waste removal, machinery and tractor hours needed for the application. I try to use all of these costs and then only attach what the input will give to the increased yield. With healthy soils, nature can provide us with around 5-7t/ha of winter wheat in a good season, so all the additional costs must be attached to any yield above this baseline.

We often don't see these additional costs accounted for unless we work on a MSO approach. With the high price of fertiliser this season and potentially for years to come, plus a future without fossil fuel-based fertiliser, it makes planning for the future much more difficult. I believe we must take meaningful measures to start looking at our businesses and the cost of production in ways that value the natural resources at our fingertips.

Many of the fungicides we currently use give a very good return on investment, but if we take every claim for increased yield from every product we use and stack them together, should we be seeing far more output? When we factor in all the additional costs of storage, waste removal and handling, the figures look very different. With the updated Farming Rules for Water guidelines, we'll hopefully be able to use and manage organic manure better and more safely in the future. The real challenge may be making sure there's enough organic material for everyone.

Over the past few winters, we've welcomed sheep onto the farm to graze our cover crops using a local shepherd. I've been equally pleased and amazed by how little damage the sheep cause to our heavy clay-based soil, and it's a sign they're well managed. Plus, they provide the extra bonuses of adding free fertiliser and a helping hand to improve my soils' biology.

I have added an area of herbal ley in the hope of welcoming some cattle back onto the farm this year after more than 20 years without them. We will need to house them in the winter but will be planning on feeding them on a by-product of our stewardship areas — the hay we cut from flower-enhanced grass strips and flower strips on our farm and many others. We're also helping in closing our nutrient gap using the herd's manure.

I'm again hosting several different trials looking at pollinating and predatory insect benefits, soil health benefits, crop system and nutritional value of food from differences in production. These trials help us learn more about improving our farm's environment by using the best varieties and inputs to deliver the best return on investment.

Like many others, I'm very interested in the potential for carbon markets and have had our farm tested for carbon soil content to give us a baseline. We can then monitor our farming system to understand how much carbon we're storing and which strategies and operations can improve things. The carbon and biodiversity markets are available already but will be growing rapidly over the next few years.

Despite this ebb and flow of farming's trials and tribulations, no matter how far from certainty things may feel, I always remind myself to come back to the roots of it all and look at what nature can already provide.

Martin Lines is an arable farmer and contractor in South Cambridgeshire with more than 500ha of arable land in his care. His special interest is in farm conservation management and demonstrating that farmers can profitably produce food in harmony with nature and the environment. He's also chair of the Nature Friendly Farming Network UK.
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> *"Around 45% of farms are still burning or burying waste on farm, and if it's not separated properly it has to go to landfill."*

Recycling route to net zero

Climate Change Champions

A Lincolnshire farmer has made it his business to take in and recycle waste plastic from other farms. *CPM* visits to see how this fits in with moves to restore biodiversity to the family farm.

By Tom Allen-Stevens

Heaped up from floor to ceiling in one of Robert Moore's old potato stores are tens of millions of spent shotgun cartridges waiting to be recycled.

"These are mostly from clay grounds," he explains. "We think most private shoots still illegally put their spent cartridges in domestic waste that goes to landfill. But it costs just 0.01p per cartridge to recycle them."

Barff Farm, near Caenby in Lincolnshire, is home to Agri-cycle that has taken in 160M cartridge cases over the past year and has the capacity to process 1.6bn. The plastic is recycled, usually into drainage pipe, and the metal goes back to the steelworks. It's part of a business that collects and processes 12,000t/yr of waste plastics, much of this sourced from farms across the UK.

The business is based on Robert's family farm that comprises 350ha of mainly heavy clay, farmed as part of an 800ha arable and livestock business run by his brother Alistair and sister Janette. Moving away from the recycling plant, Robert explains the history of the land that surrounds it.

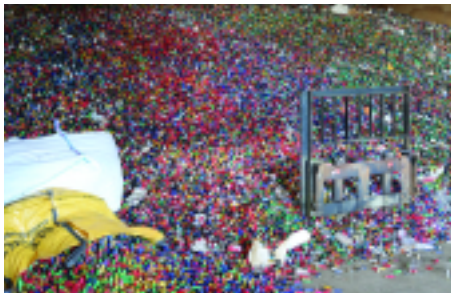
No hedges or trees

"We moved to the farm in 1988, and it had no hedges or trees, which had all been removed some time before — historical maps show there used to be over 90 small fields here which had been reduced to just 13. While the land is good productive arable soil, blackgrass has become a serious issue. The changes we're making now are not only restoring the productive areas to a more sustainable system. We've taken out less productive land, squaring up fields and restoring some of the lost hedgerows and trees."

By now he's reached one of the new plantings — a total of 5ha of trees were established last year next to Paunch Beck, with its strong clear flow into the River Ancholme at the edge of his land. Deliberately not planted in straight lines, the avenues between the trees are cut in alternating years to balance cover for wildlife value with good management to help the trees themselves establish well.

Robert inspects the trees within their tubes. "We've lost quite a few, despite irrigating them during establishment. These will be replaced this coming winter. We planted them on the south side of the dyke, which helps protect the water from farming operations, and provides shade — this area's already been visited by kingfishers and we're hoping more wildlife will be attracted here with the additional habitat. But we also didn't want to shade out any growing crop as the trees got taller."

The planting was done through The Woodland Trust's MOREwoods scheme, funded by Lloyds Bank, which covers up to 75% of costs. This included an expert advisor from the Trust who helped Robert ▸



Most spent cartridges probably end up illegally in domestic waste that goes to landfill, but it costs just 0.01p per cartridge to recycle them.

The avenues between the trees are cut in alternating years to balance cover for wildlife value with good management.

▸ design the planting scheme. "One thing I was keen to do was connect the woodland with the reservoir on the farm, to provide a wildlife corridor." So 1km of hedges were established at the same time, through the MOREhedges scheme, to complement 2km he had previously planted.

Around these plantings, Robert explains that areas have been strategically taken out of arable and put down to permanent pasture and grass margins while some temporary grass now also comes into the rotation. Working with his brother, there's a 100-head beef suckler herd with 400 sheep, and between 400-1000 more brought in over the winter to graze down the grass and complement the arable rotation — new introductions to a system previously all cropped. There's also 6ha of wildflower ley.

Livestock introduced onto the farm are one of a number of measures helping to increase the health and productivity of the heavy clay soil.

"The grassland has been located with hedgerows and fencing to allow the stock to be rotated around the grazing. Then we've squared off fields to maximise production from arable soils, aiming to cut out short work on headlands to minimise overlap of sprays and fertiliser," he says.

Fewer constraints

Although he's benefited from the Woodland Trust scheme, he decided against going into Countryside Stewardship. "I find that some of the guidelines go against what you'd consider to be good practice — I didn't want to be constrained in how we could use or manage the areas taken out of production."

Half of the land left in arable production is now spring cropped in a rotation that also alternates winter wheat, oilseed rape and winter beans. Stubble turnips in front of the spring crop help with blackgrass control and provide forage for overwintering sheep. Robert recalls how the heavy soils got progressively tighter in years gone by. These days, it's a Sumo Mono that passes in front of a Cultipress and 8m Väderstad Rapid drill. Hardly any land is ploughed now and soil structure is improving year on year as the changed cropping and livestock bring in their influence.

These changes have also vastly reduced the amount of fertiliser purchased and spread. There's also a family-owned broiler enterprise and the chicken litter from this is spread on the land, with further savings in fertiliser costs. Meanwhile, yields are creeping back up as the farm gets its blackgrass under control, with winter wheat averaging 9t/ha and spring barley 7.4t/ha.

The new environmental features connect the River Ancholme with a reservoir on the farm.

Total production is below what the farm used to achieve when everything was in a winter cropping rotation, but far less is spent on herbicides. "Three years ago, before we'd made the changes, the wheat on some fields would have to yield 9.6t/ha just to break even, which clearly wasn't sustainable."

As Robert returns to the farm buildings, he explains that the aim for both the farm and the recycling business is that they operate at net zero carbon. That's not just about minimising emissions and sequestering what he can into the trees, hedgerows and soils. Solar panels clad the roof and there's an additional ground-mounted array nearby. He now has planning permission to expand this by a further 300kVA, which would supply the plant with all it needs.

"Recycling plastic can also be a water-intensive business as it has to be cleaned after it's shredded. But we don't draw much water as it's all recycled within the plant. It comes from the reservoir on the farm, processed after washing with solids

What makes Robert Moore a Climate Change Champion?

Innovative ideas

Robert has built a nationwide business around helping farmers recycle the plastic used on farms, taking this further with other operators in an industry-wide initiative to encourage more recycling and less waste. This has gone hand-in-hand with a plan to restore biodiversity to the family farm.

Productivity push

With blackgrass among the biggest challenges, the poorest land has been taken out of production with spring cropping, a sound rotation, manures and the introduction of livestock bringing sustainable yields using far less synthetic inputs.

Cultivation care

The rotation and livestock are helping the farm's move to minimum tillage on the heavy soils.

Bio-based boldness

With the aim of net zero carbon for both the recycling side and the farm, solar provides the power while a water treatment plant minimises freshwater usage. Agri-cycle also helps other farmers cut their emissions.

Robert Moore has built his business around making it easier for farmers to recycle, which helps them cut their own emissions.

Climate Change Champions

UK Farming has set itself the challenging target of Net Zero emissions by 2040. Although led by the NFU, it will take the entire industry, working together in a partnership approach to meet this ambitious goal.

But there are individual growers, thought leaders who have already started on this journey. They have the ideas, the progressive outlook and the determination to shape positive change. *CPM* has teamed up with leading agricultural suppliers who have a credible Net Zero aspiration to identify these individuals and bring them into the top-level discussion about how farming can position itself as the solution to climate change.

https://www.cpm-magazine.co.uk/climatechangechampions/

CPM would like to thank our sponsors:

A new water treatment plant has cut by 80% the freshwater needed to wash around 12,000t of plastic processed every year.

separated out, then stored in two large tanks ready for reuse. Any water that comes off site passes through a series of reed beds to ensure it's clean."

Haulage, that forms a large part of Agri-cycle's footprint, has also been reduced. Robert indicates the new processing plant that takes in plastics, such as fertiliser sacks, packing them into dense bales for onward transport.

But this drive to reduce the carbon footprint goes further than just the business itself. Two years ago Robert, along with a number of other UK recycling businesses, started the Green Tractor scheme. This aims to make it easier for farmers across the UK to recycle their waste, with the ambition to provide UK agriculture with the ability to recycle all farm plastic by 2030.

"We estimate around 45% of farms are still burning or burying waste on farm, and if it's not separated properly it has to go to landfill. So we help with information and tips on how best to store plastic waste and new technology to help manage it."

Activities include lobbying of government and other bodies for support to increase plastic recycling facilities within the UK.

Audited figures are provided for the quantity of farm plastic collected and recycled, and the supply chain is encouraged to show corporate responsibility in how it sources plastic it supplies to farmers.

A lot comes down to the choices made on farm, however. "New silage covers can contain up to 30% recycled content. Bale wrap made from transparent film is far more recyclable. Perhaps the biggest difference farmers can make is to separate out their own waste streams — this is best done on farm, and the more you recycle, the more you cut your own emissions," he explains. ■

Banking on a relationship that delivers long term prosperity

The personal contact with his bank manager is one that Robert values. Relationship manager Darren Franklin from the Lloyds Bank Agriculture team joins a Zoom call to discuss the business. For Robert it's a chance to update him on the recent planning approval for the new solar panels and proposals to take this project forward — it represents an investment of around £280,000.

"If this is financed through Lloyds Bank, the business will benefit from our Clean Growth Financing Initiative," explains Darren. "All lending is subject to status, but to qualify, we look for projects that deliver significant carbon and greenhouse gas emission reductions, although there are no hard-and-fast rules. We waive the arrangement fee for loans made through CGFI, which is typically around 1.5%."

The initiative has already funded projects worth around £7bn. It's particularly geared towards those that involve buildings and infrastructure with an energy saving of 70% or more. Reservoirs and ring mains, renewable projects and bridging payments for capital expenses under environmental schemes also qualify.

Darren explains that it's a key objective for the bank to help farms invest towards a more sustainable future. "My view is that we've always been here to lend money. We aim to build an understanding of our customers' business and enable investment that delivers long term prosperity. The more money we can help customers invest in sustainable projects, the faster UK Agriculture will achieve its net zero objective. It's one of the reasons we're also involved in the Woodland Trust's MOREwoods and MOREhedges schemes."

The bank has a broad commitment to help plant one million trees per year over the next decade. Already the scheme has created almost 3000ha of woodland and 320km of hedges, he notes. Farmers looking to put more than 0.5ha down to trees or plant at least 100m of hedgerow benefit from funding for planting, as well as advice from the Woodland Trust on where and how to plant.

Renewable projects get favourable lending terms under Lloyds Bank CGFI, such as the plan to increase the ground-mounted array of solar panels at Barff Farm.

Lloyds Bank has been cutting its own carbon footprint too, ensuring its branches and offices are energy efficient. There are aims for operations to be net zero by 2030 and to reduce total energy consumption by 50% over the same timeframe.

The aims of both CGFI and MOREwoods fit neatly with the direction Robert has been taking the business, and the investments he's made, notes Darren — the water treatment system has reduced water usage by 80%, for example.

"Robert has geared his investments towards leaving the farm is a better state, both in terms of productivity and the wildlife it sustains. The Agri-cycle business takes that a step further and enables other farmers to cut their own carbon footprint, and the Green Tractor scheme makes it easier for farmers to recycle their plastic waste. It's the difference he's making both within his own business and for the industry as a whole that makes Robert a Climate Change Champion,"

> *We want to farm in a manner that maintains our livelihood, but we want to farm with Nature, not battle against it.*

The agroecology mindset

Helix agroecology

Hutchinsons has launched a new bespoke agroecology service for its farmer customers, linked to its Helix innovation network. *CPM* attends the launch at the Shropshire farm and asks what the term actually means.

By Tom Allen-Stevens

Not so long ago, if you'd told your agronomist you wanted to adopt a more agroecological approach to the way your grow crops, they would have looked at you in disgust.

Now it's been launched as a new bespoke service by Hutchinsons who have unveiled their first Agroecology Farm. This autumn will see the addition of Whitley Manor Farm in Newport, Shropshire (see panel on p75) to the Hutchinsons' national Helix network.

"As an industry, we're looking for answers as to how many of the practices associated with agroecology — such as reducing cultivations, using cover crops and reintroducing livestock — can really make a sustainable and profitable difference to our farms," explains Ed Brown, Hutchinsons head of agroecology.

"Our Helix farms were set up to test new technologies and practices in real farm scenarios and this is exactly what we are aiming to do with the Agroecology Helix Farm.

Bigger picture

"Our objective is not to look at the minutest details and trials but to look to answer some of the bigger-picture questions surrounding agroecology practices — there are plenty of observances and lofty objectives made with agroecology, but we want to gather the evidence.

"For example we want some clarity on questions such as when moving over to an agroecological approach, how are yields affected? Do they drop off and then pick up again? What are the direct benefits to soil health, biodiversity and soil nutrient availability? Are they measurable and definable?"

To answer these questions, Ed and the Helix team will take baseline measurements and evaluate the impact of agroecological technologies or agronomic practices on factors such as soil health, diversity and carbon, with the objective of improving economic and environmental sustainability.

For Ed, there are six key principles of agroecology:

1. Minimise soil disturbance
2. Always keep the soil covered
3. Maintain living roots throughout the year
4. Maximise diversity
5. Integrate livestock
6. Keep an open mind

"The really critical one is number six: you cannot follow an agroecological approach unless you're prepared to challenge the practices you currently follow," he stresses.

And this is one of the key aspects of Hutchinsons' new service. Agroecology is not going to be pushed by the agronomist — the whole idea is that it comes from the grower, as the company's Dick Neale

Ed Brown is looking to answer some of the bigger-picture questions surrounding agroecology practices.

explains. “It starts with the grower coming forward and saying ‘this is something we need to do’. Agroecological principles will work on any farm, but only where the grower is bought into it.”

He points to a herbicide trial on the farm as an illustration. “One of the principles of agroecology is to use minimum soil disturbance. The key here is minimum, so the plough may be the right tool where it’s appropriate. But you look at the soil first and the underlying issues, and judge the right approach from that.”

In this light, cover crops take on a different role. “It’s not about what they do directly to the grassweed, but what they’re doing to the soil. Cover crops add diversity, but also structure. We’re looking at how different species mixes and management practices influence the environment in which grassweeds grow.”

Fertiliser use is also coming under scrutiny as Hutchinsons’ Richard Watkins explains. “As a plant takes up inorganic nitrogen applied to the crop, it’s an energy-intensive process that also leads to depletion of soil carbon. The more synthetic fertiliser you apply, the more you draw down on the soil reserves and drive degradation. Meanwhile, the more artificial inputs you apply to the soil the more you shut off the relationship between plant and soil biology. The large canopy created is malso a haven for disease and excessive nitrate in the leaves is also a magnet for pests.”

Sap analysis

Richard and Ed are looking at tech developments and close measuring on N-Min levels, as well as sap analysis to help reduce fertiliser applications. Leaves are sampled three times during the spring, and the sap analysed for all macro and micronutrients. The farm’s combination crop of beans and oats (boats) will also come under scrutiny for how the roots share out the available N. And the potential for foliar applications to reduce overall N use is also being investigated, Ed explains.

“We’re also looking at the potential for a biological product from Corteva Agriscience. Utrisha N is claimed to increase a crop’s fix approximately 30kg/ha of nitrogen from the atmosphere and feed it to the plant onto which it is applied. ■

The same mix of cover crop can produce very different results, depending on the nature of the soil, says Dick Neale. One pot contains basic compost while in the other, the same compost spent two years as a wormery before each were sown with the same cover crop mix. The wormery pot initially established better, but then the compost pot caught up. Species mix was the biggest difference though – brassicae dominate in the basic compost while legumes thrive in the wormery soil.

Mindset change as Whitley Manor embraces agroecology

Harry Heath took over the running of the family farm at Whitley Manor several years ago. Based in Shropshire on sandy loam soils, its primary business was pigs, with 550-600 breeding sows producing 17,000 piglets. But the arable side is now set to take the prominent role.

“We’ve taken the decision to leave pigs,” he reports. “It’s an enterprise with an extreme level of market uncertainty. But that puts additional pressure on the arable side — it must be profitable and sustainable.”

The farm exited sugar beet in 2007. Potatoes were still in the rotation, with land let out to local producers. “But soil health has been in decline,” says Harry. “They’re very prone to slumping and you see evidence of erosion following rain events. We’ve been taking more out of the ground than we’d been putting in.”

The move towards agroecology started in 2019. “With a legacy of heavy cultivations which cost money and were not doing very much for soil health, we needed to look at how we could manage this differently going forward. This was the real spring board into looking at how agroecological practices could help us to do this.”

Ed Brown took on the agronomy for the farm and helped take discussions forward on the options available to address these issues. So the farm purchased a John Deere 750A drill. “We’re moving to no-till but recognise that we need to be patient and be guided by what’s best for the soil and the challenges an arable system presents,” notes Harry.

One of these is herbicide-resistant Italian ryegrass. “One field in particular has high ryegrass populations, so after much debate on the various options available to us to get on top of it, the answer was clear, we decided to plough it. It’s not what fits into an agroecological agenda, but it’s what the field needed to re-set and now we can move forward and focus on building soil health,” he points out.

“This has taken a real mindset change, so we are taking each step at a time. It’s not a rigid and defined approach but one that’s about responding to the field or situation that we have in front of us. So we’ve learnt to be much more flexible.”

Changes to the rotation have seen potatoes dropped out with hybrid rye introduced. “We’re also trying a combined crop of beans and oats.” Cover crops have come in, grazed off by sheep that are now a valued part of the system.

“We’ve moved to liquid fertiliser, and that allows us to add molasses to the soil, which feeds its biology,” adds Harry. “Manganese lock-up is an issue, and we have good levels of phosphate and potash but struggle to access them. I want to get the biology in to unlock them, and I’m comfortable we can pull back on nitrate, fungicides and insecticides without compromising productivity.”

Harry Heath is moving to no-till but recognises the need to be guided by what’s best for the soil.

That certainly doesn’t mean turning his back on technology. Trying the best of what’s new remains firmly within the farm’s strategy as it progresses on its agroecological journey, says Harry. “We want to farm in a manner that maintains our livelihood, but we want to farm with Nature, not battle against it.”

Harry has now started offering agroecology contracting services to help farmers in the vicinity looking to improve their sustainability.

What is Agroecology?

Like regenerative agriculture, agroecology is a term that's been used by scientists, environmental activists and politicians alike to describe a suitable direction for agricultural systems to make them more sustainable.

It has its roots in science, and is referred to in scientific literature as far back as the 1920s. A 2009 Royal Society report calls it "the science of sustainable agriculture, studying interactions between plants, animals, humans and the environment within agricultural systems." This is generally today's accepted definition, but just how broad its influence and what you can class as agroecological is left very much open to interpretation.

Importantly, it's an approach the Soil Association favours, but that's not to say it's organic. Most of those who favour agroecology promote it as a way of farming that spurns "intensive agriculture". But the scientists who compiled the Royal Society report promote "sustainable intensification" of agriculture as an essential element required to feed a growing population.

One UK-based approach to agroecology that has received perhaps the widest endorsement has come from the Food, Farming and Countryside Commission, that delivered its report Our Future in the Land in July 2019.

"Agroecology is nothing new," says FFCC chief executive Sue Pritchard. "The Food and Agriculture Organisation (FAO) of the UN has promoted its benefits for some time. It includes no-till, cover cropping, livestock in the rotation, enhancing the health of the soil and improving habitats and natural corridors for wildlife.

"For FFCC, it's also about paying attention to the governance of farming systems and how regulatory arrangements are made and upheld. We want to ensure there's a fair and equitable system in place for both farmers and consumers that encourages agroecological practice, that knowledge exchange and farmer-led innovation get the support they deserve. For us, it's not just about what happens in the field, but how that impacts on broader society."

The FAO 10 Elements of Agroecology, was approved by its Council in December 2019 and emanate from a considerable body of work carried out across the globe, culminating in regional seminars. With these 10 Elements, FAO says it aims to "operationalise" agroecology and they form a guide for policymakers, practitioners and stakeholders in planning, managing and evaluating agroecological transitions.

FAO places agroecology at the heart of its vision for sustainable food and agriculture. "It's a key part of the global response to this climate of instability, offering a unique approach to meeting significant increases in our food needs of the future while ensuring no one is left behind," it says.

The 10 elements (see infographic below) can be broken down into three categories, but all are inter-linked:

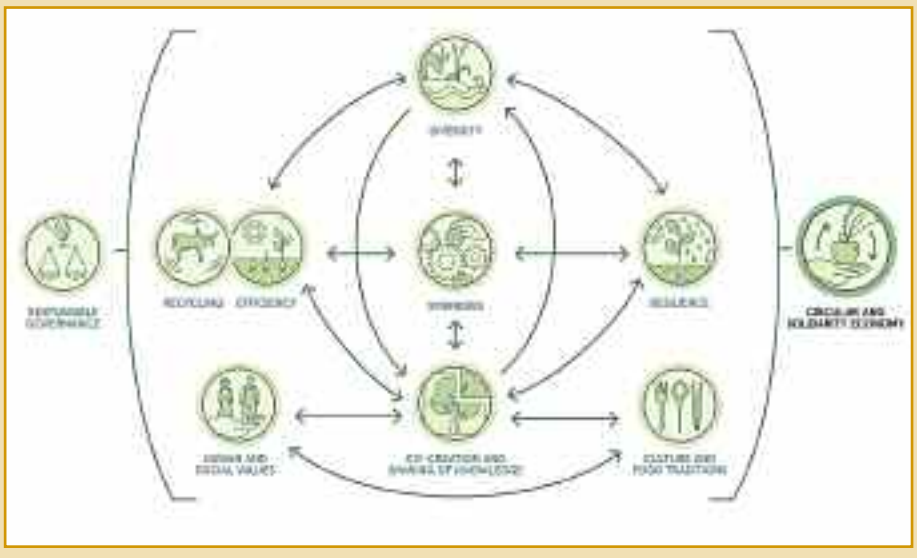
- Diversity; synergies; efficiency; resilience; recycling; co-creation and sharing of knowledge. These describe common characteristics of agroecological systems, foundational practices and innovation approaches — you could call them the farm-based elements.
- Human and social values; culture and food traditions. These are the context features, and may be how society interacts with agriculture.
- Responsible governance; circular and solidarity economy. These are geared more towards policy-makers for enabling the environment of positive change.

Lying at the heart of the 10 elements is what FAO says makes agroecology fundamentally different from other approaches to sustainable development: it's based on bottom-up and territorial processes, helping to deliver contextualised solutions to local problems. "Agroecological innovations are based on the co-creation of knowledge, combining science with the traditional, practical and local knowledge of producers. By enhancing their autonomy and adaptive capacity, agroecology empowers producers and communities as key agents of change," says FAO.

So agroecology is neither organic nor intensive — it's up to the individual farmer how they interpret what it means and how to implement it. But it's not about "tweaking" the practices of unsustainable agricultural systems, stresses FAO — business as usual is not welcome in the agroecology camp. Rather, it seeks to transform food and agricultural systems — farmers are encouraged to address the root causes of problems in an integrated way and provide holistic and long-term solutions.

What's more, there's an explicit focus on social and economic dimensions of food systems. Agroecology places a strong focus on the rights of women, youth and indigenous peoples. So if you choose to engage with agroecology, you may have to prepare yourself for some uncomfortable truths.

For Sue Pritchard, agroecology is not just about what happens in the field, but how that impacts on broader society.



The FAO 10 Elements of Agroecology.

> *“We’re aiming for a soil that is at its peak level of performance, and all the inputs and management practices are geared towards that.”*

Soil with true resilience

Green Horizons

Whether they’re capable of record-breaking wheats or full of blackgrass, soils can be enriched without compromising productivity, according to forward-thinking farmers in Agrii’s Green Horizons network. In this new series, *CPM* shares their sustainability improvements.

By Tom Allen-Stevens and Rob Jones

Two farmers with heavy land at opposite ends of Agrii’s UK-wide Green Horizons Network have each implemented a single-minded drive to improve their arable sustainability. Compost, cover crops, rotations and reduced tillage are threads that run through both.

But while these are often means to maintain yields while reducing reliance on agricultural inputs, these farmers have aimed to take their systems the other way. “For me, it’s about taking what we know as a packet and applying it as blanket,” says Rod Smith, at Beal Farm on the northeast coast of Northumberland.

“I know there are parts of our fields that will yield over 20t/ha of wheat, but we’re averaging between 12-14t/ha. So how can I sustainably raise the average?”

It all makes sense, especially for Rod who achieved the world record with his wheat crop in 2015. This was notched up with a field of Dickens that averaged 16.52t/ha, bringing the wheat record back to the UK from New Zealand. “I was actually disappointed with the average, as the combine monitor was regularly clocking up over 23t/ha while the Guinness adjudicator was sitting next to me,” he comments.

So the aim now is to bring every m? of crop to its optimum performance. That not only brings his cost of production down, it’s also recognised as the most sustainable way to produce food, on a per kg basis. And that doesn’t mean beating productivity out of every m^2 of soil — this is earth that can take a bit of pushing, and Rod demonstrates how. Standing in a field of cover crops, he digs in his spade to reveal its roots; and it bristles with life, intermeshed with fungi.

He’s joined by his Agrii agronomist Andrew Wallace, who explains the cover crops are employed as part of a true regenerative approach. “For Rod, if reducing spend results in a reduction in yield, that’s not the way to go,” he says.

“What we’re aiming for is a soil that is at its peak level of performance, and all the inputs and management practices, including the cover crops, are geared towards that.”

They’ve settled on a mix of 3-4 different plants for the cover crop, which is “more than enough to do the job”. Two different types of radish penetrate the soil at depth and scavenge nutrients. These complement phacelia with some cheap cereal mixed in with more fibrous roots, to keep a good tilth in the drilling zone.

It’s a far cry from the soils on the 400ha all-arable farm Rod took on over 20 years ago. “We have heavy clay and it used to be horrible stuff. We’d got out of livestock some years before and the break crops weren’t enough to keep the nutrients cycling. Everything was ploughed and often moved three times before we could get a seedbed.”

Gradually cultivations have reduced. These days, a Challenger MT755E puts the grunt in front of a 7m Horsch Cruiser, ▸

Digging a spade into the cover crop reveals its roots; and it bristles with life, intermeshed with fungi.

Rod Smith wants to take what he's learned growing record-breaking wheat and apply this over every square metre of his crop.

▸ providing the primary cultivations. "It's all about timing — there's not much of a cultivation window where we are, so ideally it's just once in with the Cruiser, taken from 25-150mm depth as required, aiming for a billiard-table finish," he explains.

"Ideally we'd be direct drilling, but the land's not quite there yet. We currently use a 4m Sulki power-harrow combination for the main cash crops, set at 1700 revs and going at speed." Cover crops are established using a seeder unit attached to a 12.5m set of Dalbo rolls, and it's these that are helping feed the soil.

Rod believes it's the well composted manure he adds that could be bringing the most benefit, however. He has a straw-for-compost deal with a near neighbour which is managed carefully to build body into the clay soils. He grabs a handful of the compost and inspects it as it crumbles through his fingers, taking in the good earthy smell.

"By the time it reaches the land, there's half the tonnage but it's nutrient dense. We used to spread in autumn but now top dress in spring with a HiSpec Xcel 1250 spreader. It spreads well to 18m, which fits with our 36m tramlines."

The seed rate on the headlands at Beal Farm is stepped up by 40-50% to ensure they have the same potential yield as the field centre.

The composting process also kills the weed seeds — brome is the main issue — and Rod has seen a lift in soil organic matter of 0.5-1.5% over a six-year period. "It's helping to make our soils more aerobic which encourages the microbes and this in turn cycles the nutrients."

The compost is applied to the cover crops in a system that ties in well with another local aim of reducing nutrient run-off. Lindisfarne is not only a tourist hotspot, drawing in around a million visitors a year, it's a nature reserve that helps safeguard internationally important wintering bird populations. Rod is one of a number of farmers working with the Environment Agency and the local water company to improve the quality of the water that runs into the nature reserve.

"We don't like to see land left bare over winter. The cover crops do an excellent job of taking up to 60-70kgN/ha that you capture into a green mulch. This is usually then followed with a low input spring barley," he says.

Vining peas provide a valuable and soil-enriching break in the rotation, with OSR now reintroduced just once every eight years. This is the system that's provided the framework for the record-breaking wheats, and Rod and Andrew wander over to the wheat next door.

As soon as you step onto the headland it's evident the benefits are feeding through into the main cash crop — the uniform lines of smartly tillered plants that snake right up to the field edge have just claimed the space between each row.

"One of the biggest changes we've made is to vary seed rates. There's no reason why the headland should yield less than the middle of the field, and we step up the seed rate there by up to 40-50%," explains Rod.

While he's maintained wheat yields, Rod admits that the output over the whole rotation has dipped below the highs he's achieved in the past with the introduction of the cover crops and low input barley. But there have been other spin-off benefits from the changes he's made. "The farm's wildlife has improved — we have 40-50 pairs of grey partridge where we used to have 20. It's not rare to see 20-30 brown hares in a single field."

But for Rod, the key difference is with the way his soil behaves. "What we have is a soil that's enriched — you can see the life in it, and you can feel that it's working with you. I have the confidence now to push it with the knowledge it has the resilience to perform. I don't want a 12t/ha wheat, nor even an average of 14t/ha. There's no reason why we shouldn't get an 18t/ha crop, because this land can achieve it."

Soil-centred sustainability drive

A single-minded drive to improve its arable sustainability has helped Tom Hughes bring into line various aspects of the family farm at Salford Lodge, Pitchill just outside Evesham over the past decade.

Home-made compost, reduced tillage and determined cover cropping have helped with the challenging silty clay land, contract-farmed with heavy kit for many years, and lighter sandy gravel ground that continues to be rented out for field vegetable production. The aim for Tom has been to match both the productivity and low environmental impact of the substantial broiler business developed and run by his parents, Malcom and Liz.

Working with his Agrii agronomist, Kathryn Styan, considerable improvements have already been made, including reductions in blackgrass and brome problems, better structured and more resilient soils, and in the all-important bottom line. Some of these successes have been captured in the first year of ADAS YEN Zero benchmarking.

Fresh from working on a progressive Wiltshire downland unit, Tom came back to the family business in 2013 to take the land in-hand. He recalls 'jumping in at the deep end' with the 120ha of heavy ground not in vegetable production, full of enthusiasm for the no-till approach.

"With all the land rented out until then, we had no machinery at all," he explains. "The ground had been demanding increasing amounts of horsepower to support deep-working and power-harrowing. Unsurprisingly too, given the poor soil conditions, blackgrass counts were knocking on the door of 1500 heads/m^2"

Tom gleaned some knowledge on how to progress from Agrii's heavy land trials site at Stow Longa, Cambs. "We were tempted to do a reset with the plough. Instead, though, we decided on a winter of intensive multiple stale seedbeds followed by five years of no-till spring cropping. At the same time, we mole-ploughed the whole area to link-in with the drains my parents had installed in the 1980s."

After alternating spring wheats and linseeds followed by canary seed, the first crop of winter wheat in 2019 averaged 10.75t/ha with no blackgrass in sight.

In 2016, the vegetable ground was brought back into the rotation to address worryingly low organic matters and poor structure, making the soils very prone to capping in the wet and baking hard in the

Forced to cover over fresh poultry manure by avian flu regulations, Tom Hughes has been trying out Bokashi anaerobic compost making alongside his traditional practive this year.

dry. By cropping the ground themselves three years in every four and working closely with their vegetable-growing partners, the team has made sure their soil improvement efforts are not compromised by the land's year in vegetables.

"We now have full overwinter cover ahead of every spring-sown crop, together with a programme of sustained annual organic matter addition," notes Tom.

"When we hand ground back for the vegetables — generally after a winter cereal — our partners spread certified green waste. We then establish the winter cover with a mix of species designed to suit their following crop on contract. At the same time, we are working closely with them to reduce their tillage in a number of ways."

Integrating this land into the arable business instead of leaving it permanently rented out has added a further complication. Poultry litter from the family's ten broiler sheds has been important in improving the rest of the acreage, but this cannot be applied directly within the vegetable rotation.

To address this issue, Tom has developed his own composting operation. This involves mixing the litter with chopped straw from the farm's 100ha of soft wheat — grown for the broiler rations — and grass silage from its 35ha of zero input grassland — which has to be removed annually under the Stewardship agreement.

"The grass silage adds extra green material which aids the composting process," notes Kathryn Styan. "With a nicely balanced analysis, including 24kgN/t and good amounts of phosphate, potash, magnesium, calcium and sulphur, the 1000t made annually has proven a much better manure than pure poultry litter.

"It's also just right for spring top dressing the winter wheat, overcoming the fundamental conflict between direct drilling and the requirement to incorporate organic manures."

Worm populations have improved sharply, and organic matter levels are up to 8% in places, with all the soils holding water and draining better, says Kathryn. "Ground we could seldom walk in the winter without getting covered in mud or sinking in now scarcely leaves a mark on our boots, or on the soil."

With organic manures providing 20-35% of the nitrogen applied to the wheat, only 180kgN/ha (40kg/ha reduction) was applied for a crop that averaged 9.8t/ha last season.

Results from six fields of winter oats, winter wheat and forage maize were entered into the initial year of YEN Zero last season as part of the Green Horizons initiative, she continues. "The yields Tom has been averaging for each crop are at the top end of the project results, whilst the greenhouse gas emissions remain some of the lowest. All crops scored especially well for emissions from the key areas of operations and synthetic nitrogen production and application."

Central to this is the 4.8m trailed Weaving GD drill used for all arable and cover crop sowing. Tom and Kathryn also have a keen enthusiasm for cover crops, currently trying a 12-way mix based on vetch, sunflower and black oats. There are also four species of clover, fodder and tillage radish, buckwheat and phacelia on the heavy ground ahead of linseed, and on the light ground ahead of maize.

Covers are matched to time of sowing and following crop, with more complex

Tom Hughes and Kathryn Styan test the latest batch of Salford Lodge compost.

mixes established after early harvested vegetables before autumn-sown cereals or maize (grown for a local AD plant). Something "simpler and cheaper" at a higher seed rate may go in as late as October.

Other notable successes on the cereal side include variable rate seeding to even-up field performance; using LiquiSafe liquid fertiliser treatment to eliminate at least one spring pass; better balancing crop nutrition to improve overall nutrient use efficiency; use of biologicals at T0 and T3 to reduce reliance on fungicides — all yield-mapped, with progress tracked.

"We are putting lots of little things together within our broader soil-focussed approach to improve what we do in crop production alongside and as closely as we can with all the other environmental and carbon improvements being made by our broader family business," concludes Tom. ■

Green Horizons

The farmer network is part of Agrii's ambitious Green Horizons plan of practical action to improve the sustainability of UK food and farming.

Focussed on increasing farm productivity and viability, providing integrated whole farm solutions, improving soil resilience, enhancing the environment, and extending stakeholder engagement, this initiative brings together the best scientific intelligence and farm experience to inform future improvement action.

Network growers are working alongside Agrii's extensive variety, soil resilience, IPM and other trial work, and collaborative projects with a range of partners to share ideas, test approaches and showcase progress.

Up-to-date information and a series of specialist insight reports is available from *www.agrii.co.uk/greenhorizons*

Sowing sustainability

> *“Advanced crop genetics have a vital role to play in achieving the vision.”*

Fit for the Future

As growers seek to ensure sustainability across the breadth of their businesses, variety choice could play a fundamental role. *CPM* finds out more.

By Charlotte Cunningham

From fertiliser products to the machinery used to establish and harvest crops, many arable growers globally are in the midst of examining all areas of their businesses in a bid to ensure they remain as ‘sustainable’ as possible.

Sustainability has arguably become a bit of a buzzword in agriculture. However, delving further into the etymology of the word, to sustain effectively means to maintain. Putting this into practical terms, sustainability should be about putting measures in place to ensure that both the farm business and the surrounding environment are maintained for future generations.

That’s the view of Jim Monaghan, professor of crop science at Harper Adams University who says building a sustainable future involves addressing both short and long-term challenges. “Short-term, the industry is facing dramatic fluctuations in input costs and market margins. Long-term, net zero and climate change is clearly the big point of discussion and the key goal.”

Industry changes

“But whether you’re focused on the short- or long-term, the industry has got to change and I believe the extent of the change required is probably going to surprise many.”

So what does he believe has got to happen to meet these goals and to grow sustainable farm businesses of the future?

Soil is the starting point, believes Jim. “Minimum tillage is likely to become a big part of sustainability as the industry seeks to improve and create stable soil structures.

“Many in the arable sector are already doing this or moving towards this, but for those growing potatoes and root crops, getting to a place of minimal soil disturbance is something that I think will be a real challenge.

“In fact, I’m already hearing stories of those on rented ground being told they can’t grow potatoes as landowners are wanting to be able to sell carbon credits.”

Looking further at cropping, Jim reckons legumes will become a more pivotal part of arable rotations. “Options like field beans will be really important from a regen/soil conservation perspective due to their nitrogen fixing benefits.”

But the level of detail required to build sustainable farm businesses goes beyond just rotations, and Jim says individual varieties have a role to play. “Gone are the days of just thinking about production when it comes to variety choice — now growers have to consider both how they can optimise

Gone are the days of just thinking about production when it comes to variety choice, says Jim Monaghan.

yield and crop performance as well as protect and nurture the environment. Specific traits are becoming more important and I think that's going to continue. Characteristics like nitrogen-use efficiency are likely to be highly desirable as growers seek to achieve good protein levels, but with less N, for example.

"I think growers should also be looking at genetics from the view of wanting to reduce reliance on inputs for pest and disease control.

"Resilient varieties which can do well and thrive in changing times are going to be the future and varieties and breeding are going to be a big part of the sustainability solution."

Sustainable practices

Continuing the conversation, KWS technical specialist Olivia Potter adds that a move to more sustainable agricultural practices often means growers have to reduce dependence on often costly crop inputs and intensive production methods to deliver a more balanced and environmentally-friendly future for crop management.

She echoes Jim's sentiments and says that alongside some of the more obvious areas to target — like diesel and energy — seed choices have a fundamental role to play in helping UK agriculture achieve both its low carbon obligations and reducing the environmental impacts of farming in the future.

"Advanced crop genetics have a vital role to play in achieving this vision and this has been the ethos behind KWS's 'Sowing for Peak Performance' (SPP) initiative which puts producing varieties that will help deliver greater future sustainability right at the heart of its future breeding strategy."

But how exactly can this initiative help growers to deliver a more sustainable future? Olivia says there are five key areas of impact.

Maximising production and profitability from available resources

Helping growers get as much as possible from their own land and resources through varieties that have optimum field performance and yields, but that also have key functional traits to make them more resilient and offer added-value market opportunities, is a key future objective for KWS, she explains.

"For example, varieties from KWS' portfolio of dynamic wheats already mean producers can maximise the market value of their production through optimising the balance between yield and quality to best target opportunities with the highest return."

KWS' 'Sowing for Peak Performance' initiative puts producing 'future-proof' varieties at the heart of its breeding strategy, explains Olivia Potter.

Varieties in this generation of wheats include KWS Extase — combining high yields with robust septoria protection — ▶

Farming for the future

With a focus on raising the farmers of the future, Harper Adams is now incorporating sustainability into teaching with the launch of its School of Sustainable Food and Farming — in partnership with Morrisons, McDonalds and the NFU.

Jim says this will bring topics like carbon sequestration and renewable energy to the forefront of priorities within its undergraduate teaching.

But what about the farmers of today? Philip Bradshaw is among those already taking significant steps to ensure the sustainability of his 220ha farming operation in the Cambridgeshire Fens. "If we're not sustainable, we're not profitable, and if we're not profitable we can't look after the land or grow quality produce from it," says Philip. "Looking after natural capital and conserving soils is something we have to be thinking about and doing now, and I like to live by the old adage of 'living like you're going to die tomorrow and farming like you're going to live forever'."

In practical terms, Philip takes a no-till, conservation agriculture approach to producing his combinable crops. "Apart from occasional soil loosening, we haven't tilled here for seven years — we're drilling crops mainly with a low disturbance disc drill. This has brought our fuel usage down, which is great for profitability but has also helped us to reduce the farm's greenhouse gas emissions."

Variety choice is also important for Philip, with traits like strong disease resistance and nitrogen-use efficiency highly desirable in his system. "In no-till situations, varieties that get up and away and emerge quickly may be useful, so breeding has a pivotal role to play here."

Breeding and building resilience is often something that's talked about when trying to future-proof businesses, and for Philip, it's multi-faceted. "As I said, profitability and sustainability go hand in hand, so yield is still incredibly important when it comes to variety choice.

"However, varieties that combine vigour with the ability to establish a good root system to aid nitrogen uptake, and can remain healthy without a heavy reliance on inputs are going be the ones that facilitate truly sustainable, resilient businesses.

"Arguably, on the Fens this may be slightly easier than in more challenging landscapes. But with our approach we can reduce our inputs and subsequently our costs, but what's more, there's actually the potential to increase our margins too."

Looking at the wider picture, and how the industry can facilitate this on a larger scale, Philip believes there's a want for more research.

Philip Bradshaw takes a no-till, conservation agriculture approach to producing his combinable crops.

"As farmers, I think we have to know more about what can be done on a farm level to maintain output and margins while farming with the environment in mind.

"This is only going to be achieved with collaboration — effectively, the supply chains and the food production industry working together, and I believe greater management of supply chains is needed to enable that going forward."

KWS' portfolio of dynamic wheats – including KWS Extase – means producers can maximise the market value of their production.

▸ as well as KWS Zyatt, a Group 1 breadmaking wheat with UKP for export and consistently high second wheat performance, she explains.

Looking to the future, Olivia adds that KWS is also already working on varieties that are explicitly targeted at wide or specific drilling windows, with greater ability to use the nitrogen applied and that require simpler management requiring less man hours.

Achieving effective crop management with reduced windows of opportunity

Availability of varieties that perform consistently in adverse growing conditions and can express their full genetic potential in a variety of less than optimal circumstances are essential for future crop production success, reckons Olivia.

"Developing more 'self-contained' varieties that are more tolerant of a range of growing conditions and extreme weather events — and less dependent on time-critical interventions such as specific spray applications — is also key.

"Such varieties will not only buy extra time for growers facing adverse weather conditions, but they will also reduce the man hours spent tending crops."

Achieving optimum crop health without a high level of agronomic interventions

Growing plants are likely to be under greater abiotic stress at key times in the future, and Olivia says the UK is likely to experience more of the conditions and micro-climates that encourage the development of yield-sapping diseases.

"KWS varieties that ensure genetics and chemistry work in partnership to the best effect are already established, but we plan to have many more in the future.

"Developing genetics that deliver the highest untreated yields and respond in an optimal manner to agronomic inputs when they're needed is a key priority for us."

Reducing the amount of all inputs used and associated costs

Stronger growing varieties with higher levels of vigour outcompete weeds more easily and reduce herbicide spend — plus stiffer straw means growers unlikely to be as reliant on PGRs and achieve easier, quicker harvesting, explains Olivia.

What's more, varieties that are also more efficient at utilising nitrogen results in more nutrients being used for growth instead of being lost from the system, she adds.

"A really high output Group 4 variety like KWS Dawsum has strong yield potential built into its DNA so it is able to make optimum use of key nutrients. What's more, its strong vigour and robust growth habit mean it's most likely to maintain good plant health — even in difficult growing conditions.

"This is borne out by an untreated yield of 92%, just 1% behind KWS Extase, in the latest Recommended List data. The fact that it can deliver top performance in a variety of geographical locations, on different soil types and in early and late drilling slots, speaks volumes about its genetic strength.

"Such varieties will not only deliver obvious benefits to the environment, they'll also transform production economics too. The less time spent applying agrochemicals and fertilisers in the future, the greater the savings on labour, diesel and machinery maintenance.

Getting greater productivity from soils long-term

As mentioned, the less inputs needed to grow crops, the less time growers will have to spend in the tractor cab, and Olivia adds that not only will this have financial advantages, but it will also benefit the soil.

"Less travel means less potential damage to soils and less time and money spent trying to correct the compaction problems associated with multiple wheelings and carrying out operations in unsuitable conditions.

"Earlier maturing and harvesting crops allows for better, less potentially injurious cultivations, with specific varieties optimised for zero and minimum tillage operations a real possibility in the not-so-distant future."

Many of these developments are here now, allowing growers to successfully align their crop production objectives with their own sustainability goals, believes Olivia.

"But KWS' ongoing commitment to its SPP initiative will ensure this grows even stronger in the years ahead." ■

Nitrogen-use efficiency could become an increasingly important part of variety choice.

The launch of Harper Adams' School of Sustainable Food and Farming puts topics like carbon sequestration to the forefront of priorities.

Fit for the Future

In this series of articles, *CPM* has teamed up for the fourth year with KWS to explore how crop markets may evolve, and profile growers set to deliver ongoing profitability.

The aim is to focus on the unique factors affecting variety performance, to optimise this and maximise return on investment. It highlights the value plant genetics can now play in variety selection as many factors are heavily influenced and even fixed by variety choice.

KWS is a leading breeder of cereals, oilseeds, sugar beet and maize. As a family-owned business, it is truly independent and entirely focused on promoting success through the continual improvement of varieties with higher yields, strong disease and pest resistance, and excellent grain quality. We're it's committed to your future just as much as you are.

Putting the buzz back in pollination

> *"Some plants are adapted to hold onto their pollen and only release it when a bumblebee enters its flower"*

Bumblebees

Bumblebees are probably the UK's most iconic insect and possibly the 'bee's knees' of the pollinators. *CPM* finds out more about them and picks up a few ways to make room for them on the farm in a webinar hosted by Nature Friendly Farming Network and the Bumblebee Conservation Trust.

By Lucy de la Pasture

Mention biodiversity loss and even those with few connections to the natural world will be able to tell you that the bees are in trouble. People care about bumblebees and more often than not, their decline is attributed to agriculture.

Their gradual decline began at the end of World War II, explains Clare Flynn of the Bumblebee Conservation Trust (BBCT). "Loss of habitat has been the single biggest driver due to changes in food production practices in the post-war period which led to the loss of species-rich grassland, in particular."

Eighty years ago food security was a government priority and farmers were encouraged to 'dig for victory' and as a result the landscape changed significantly, which had impacts on its flora and fauna. It began a push for productivity which was supported by synthetic inputs to remove competition from weeds and some quite unpleasant insecticides, which are now confined to the history books. The humble bumble simply ran out of suitable habitat and food.

Pollinating services

Pollinators are required by 75% of global crop plants to facilitate fertilisation — a prerequisite for seeds or fruits to develop. In the UK, it's estimated that the bumblebee contributes more than £690M to agriculture, says Clare.

For agricultural crops that require open pollination, such as beans and oilseed rape, it's common for farmers to work with local honeybee keepers, utilising the colonies' pollinating services in return for the honey the hives provide their keeper. But what about using nature's 'free issue' of wild pollinating insects?

"We have approximately 280 different species of bee in the UK," explains Clare. "Of these, the vast majority are solitary bees, made up of 250 different species. Solitary bees nest close to one another in big aggregations but, as their name suggests, they don't form colonies and the females work alone.

"The solitary bees are very diverse and often overlooked but are actually very important pollinators," she adds.

The honeybee is the only bee that ▸

Ditch management can play an important part in ensuring food supplies for pollinating insects.

This adult hoverfly feeding on yarrow provides pollinating services, but her larvae carry out pest control by voraciously eating aphids.

▸ produces honey. "There are different strains of *Apis melifera* present in the UK and these give the honeybee its different colour forms and regional specialists.

"In the UK, bumblebees belong to one of 24 different species — 18 of which are social but, of these, only eight species are common in the UK."

Social bumblebees have a very similar lifestyle to the honeybee, with a queen and daughter workers, with generally 50-200 in a colony compared with tens of thousands of workers in a honeybee colony, she explains.

There are also six 'cuckoo' species of bumblebee. Females of these species act in the same way as their namesake, invading the nest of social bumblebees, killing or replacing its queen and using the colony's workers to bring up grubs of its own, says Clare.

The 'bee's knees'

Bumblebees are known to be the bee's knees when it comes to pollination, so much so that buff-tailed bumblebees are imported to lend a helping hand to pollinate some horticultural crops. "These are factory bred, which can have massive implications in some countries where the species isn't native. In the UK the implications are more subtle as the imports are the same species but a different strain."

So why is it that bumblebees are so important as pollinators? The reasons are multifold, explains Clare.

"The female workers are corbiculate — meaning they have 'pollen baskets' on their tibia, which are formed from hairs. The female combs the pollen from her body, which she mixes with regurgitated nectar, to form pollen 'lumps', which are then transported in these baskets.

"Male bumblebees also get covered in pollen, but unlike the workers, they don't comb the pollen — only females have this behaviour to take food back to the nest for its young," she says.

In the matriarchal bumblebee society, it's the females that do just about everything, with the males existing for one purpose only. "They really just sip nectar until their services are required later in the season."

Bumblebees rely on pollen and nectar for 100% of their food supply. Known for their 'fuzziness', the hairs covering the bee's surface are electrostatically charged, so pollen literally jumps onto their coats, explains Clare.

But that's not the only way bumblebees collect pollen. They're equipped with a neat trick that ensures they're the only insects that some flowers will give up their pollen for.

"Some plants are adapted to hold onto their pollen and only release it when a bumblebee enters its flower, and then disengages its muscles to relax its wings. The 'buzz' from the wing muscles triggers pollen to be released from the flower's anthers — known as buzz pollination."

Flowering plants such as these recognise that bumblebees have the ability to make relatively long flights, which helps them survive in a 'patchy' landscape. They are also better adapted to cold conditions than some other pollinators, meaning they can forage on cool and cloudy days, adds Clare.

The social bumblebee year

The bumblebee year begins in spring when rising temperatures — often in early March — awake the queen, who has been hibernating alone in the soil having been mated the previous autumn. At this time the flowers of willow and catkins provide crucial food supplies as she drinks nectar to gain energy after her long sleep.

Once re-energised the queen searches for a nesting site, which is often underground or in tussocky grasses at the base of hedges. Having found a suitable site, she collects pollen and nectar to bring back to her nest.

She forms a mound of pollen and wax (which she secretes from her body) and lays her first brood of eggs. She also collects nectar, which she stores in a pot-shaped structure made of wax which she places in front of her mound. The queen keeps the eggs warm by sitting on her wax nest, like a bird, and shivering her muscles to keep warm.

Sipping from the nectar pot gives her enough energy to incubate the eggs for several days until little white grub-like larvae emerge. These are then fed on pollen and nectar that the queen forages from nearby flowers. Once they've eaten enough, after around two weeks, the larvae spin a cocoon and develop into adult bees.

As the spring progresses eggs continue to hatch in different cohorts, with the all-female first brood becoming the workers that tend to the needs of their younger sisters in the colony, and they build wax cells as the nest continues to grow through the summer. From this point on the queen no longer leaves the nest. Instead, she will remain inside where she lays more eggs.

The end of the nest cycles varies according to species but as the summer wears on, males start to be produced as well as female workers. The male bees leave the nest and don't normally return. Instead, their days are spent feeding on nectar and trying to mate.

New queens leave the nest and mate with a male from another nest and feed themselves up before going into hibernation. They store the sperm ready to re-start the whole cycle the following spring. All the rest of the nest die.

Female worker bees comb pollen from her body, which she mixes with regurgitated nectar, to form pollen 'lumps' which are then transported back to the nest in 'baskets' on her tibia.

Bumblebees are also able to reach the parts of some flowers that hoverflies, wasps and other pollinating insects just can't get to. The feature which sets them apart from other pollinators is the length of their tongue, with some species able to probe the deepest flowers.

"The honeybee tongue is approx. 6mm long so the flowers they can feed on are limited by its morphology. Bumblebee workers vary in size depending on the species, with the smallest equalling the honeybee tongue at 6mm, but the largest — the queen of the Garden bumblebee — has a tongue that's 20mm long. This means bumblebees can pollinate the widest range of flower species." ■

Hedgerows managed on rotation allow different lengths to flower in spring and provide important foraging for early pollinators.

Making room for bumblebees

The most welcoming thing farms can do for bumblebees is to make sure they have a continued food supply from when the queens emerge in February/March until new queens are produced in September/October, says Anna Hobbs, conservation officer at BBCT.

Her role involves helping farmers enhance their farms for pollinators by surveying the species present and suggesting ways they can be supported. "Our aim is to work at a landscape level and establish clusters of pollinator-friendly farms. That involves looking at each farm as a whole — including semi-natural habitats as well as the farmed area," she says.

As well as food, bumblebees need habitat that's suitable for nesting and hibernating. "That may mean restoring, enhancing, creating or just better managing existing habitats on the farm," she adds.

Often there are gaps in food supply within the year, and for the bees that can mean feast to famine. Planting wildflower areas, with mixed flowering species to extend the flowering period, or delayed grazing or cutting of grassland to increase the number of flowers in the sward in the next season are all strategies that can aid the bumblebee, she explains.

"Increasing diversity is good for bumblebees and other pollinators and managing tracks and margins so that tussocky grasses are present is also helpful."

Reinstating orchards, hedgerows or planting shrubs are some other ways to improve bumblebee habitat.

Some of the strategies to help bumblebees simply requires a change of mindset. Stuart Taylor is farming near Mold in North Wales. Although his land is grassland, the same principles behind the strategies he's adopted apply to arable farms.

Stuart has embarked on a programme of habitat creation in an effort to become more nature-friendly, creating a network of permanent habitats to buffer against his farming operations. For example, the woodland on his farm provides multiple habitats, he says.

"The woodland edge has flowering plants at ground level, beyond that there are small flowering trees such as rowan and hazel before reaching the woodland itself. We cut hedgerows every two years to allow the old wood to flower and fruit, as well as leaving some hedgerow trees for shade and shelter," he says.

Stuart has learnt that set stocking hasn't done his biodiversity much good in the past so now he rotationally grazes. The 60 days it takes to complete a grazing cycle on the farm allows the flowers in his grassland ample time to flower and shed seeds, further enriching his grassland.

"Parasol mushrooms have appeared over the past five years, along with yarrow and mouse-eared hawk weed."

The permanent pasture now has an understory of red clover and Stuart says he's learnt that his older leys are actually more useful than modern farming has perhaps led farmers to believe. Legume-rich and herb rich pasture also supply ample nutrition for his organic dairy herd.

"I have 16 different species in a herbal ley, compared with the 5-6 in more traditional agricultural mixes. They don't all make it but those species that do will be suited to the conditions of that field and thrive. It also gives us a longer flowering period and roots at different depths to help soil structuring," he says.

One of Stuart's top tips is that when cutting for silage, he always leaves a strip in the field to flower. He'll do the same for the second cut but in a different part of the field. It's something that could equally be applied to driveways and areas around the farm, which left uncut could be viewed as untidy.

"The trick to encourage biodiversity is not to be too tidy and leave some areas a little bit wild," he adds.

A network of flowering margins across the farm, containing species with successive flowering, provide food and habitat for pollinators.

Farm tracks can provide valuable sources of food for pollinators, and if verges have to be mown then consider leaving a strip uncut.

> *By listening to users' feedback, we've been able to increase efficiency, economy, performance, and functionality even further.*

Sprayers

Sprayers on the up

A raft of new sprayer technology aims to improve performance and efficiencies, both in product use and in the field. *CPM* takes a look at some of the latest offerings.

By Melanie Jenkins

Whether it's a case of increasing efficiency, honing costs, improving soil health, altering management systems or even improving comfort, having the right sprayer, nozzles or tyres can have a big impact on farm. Here are some of the latest innovations to hit the market.

Horsch

Horsch enters the three-point crop care market with the newly developed mounted sprayer Leeb CS. CS stands for CompactSprayer and the sprayer is designed to be both compact and manoeuvrable - ideal for smaller fields.

Horsch's Leeb CS, which was released last autumn, comes with a continuous cleaning system (CCS) or CCS Pro water system with a rotary pump, continuous inside cleaning and other automatic washing programmes.

The CS models are available with three different tank sizes; 1400 litres, 1800 litres and 2200 litres and an additional front tank will be available soon. Available with the technical innovations of its largest siblings, such as the active boom control system 'BoomControl', the Leeb CS can be easily adapted and specified to each customer's requirements, according to Horsch.

Spraying should result in less drift due to automatic boom control and constant target area distance, even at high operational speeds, claims the company. According to Horsch, active boom control is a unique feature of its machines in this sector of the market.

The 25cm nozzle layout is also available for the new Leeb CS. Horsch claims that the optimised centre of gravity makes the Leeb CS easy and safe to operate. A newly developed coupling triangle and hydraulic drive for the pumps allows the Leeb CS to be mounted easily and quickly. All functions are controlled via the Horsch user interface which customers may already know from the Leeb LT and advanced Leeb GS.

Horsch has also expanded its nozzle range and aims to improve wetting in ridge crops with its new tilted nozzle caps for use in band application. Two variants are offered: a grey nozzle with 17.5° angle for a 10cm tilt and a red nozzle with 8.75° angle for a 5cm tilt.

Using a combination of straight and tilted nozzle caps offers a broad range of row width configurations. Each nozzle cap is equipped with an Agrotop RowFan 40-02 E nozzle, including seal and nozzle inserter. The tilted caps are available for the 2022 spring spraying season.

In band spraying application with a 25cm nozzle spacing, the tilted nozzles allow the row width to be adapted by 5cm (red nozzles) or 10cm (grey nozzles). For example, in sugar beet a row spacing of 45cm is possible.

Another interesting aspect of these nozzle caps is the combination of main nozzle (HD) and secondary nozzle (ND) with a nozzle spacing of 25cm — this enables its highly effective wetting of ridge crop, according to Horsch.

John Deere

John Deere has moved into new realms in 2022, having produced its largest ever trailed sprayer in the form of the R975i. This 7500-litre machine joins the rest of the R900i Series line-up, with tank capacities of 4400, 5200 and 6200 litres and spray boom widths from 24m to 40m.

Like other sprayers in the range, the new model includes John Deere Precision Ag technologies and is targeted at customers requiring larger tank volumes and wider booms. John Deere's aim is that farmers and contractors can spend more time in the field spraying, covering a larger area with one tank.

Growers will also get the option of 24cm nozzle spacing on the R900I and M900(i) sprayers for the first time. This is an 'On ▸

Horsch has entered the three-point crop care market with the newly developed mounted sprayer, the Leeb CS.

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TOGETHER FOR A HEALTHY AGRICULTURE

ohn Deere has produced its largest ever trailed sprayer in the form of the R975i, which will be at Cereals alongside the R740 (pictured).

▸ Centre' solution that means an additional nozzle is placed between each 50cm nozzle body on the spray boom. John Deere has also added a nozzle body plus an additional nozzle at each end of the boom to offer full coverage and eliminate underdosing at the boom ends.

All trailed sprayer ranges can benefit from the options launched on the R700i Series for 2021. These include Individual Nozzle Control, which limits over — or underdosing to help preserve yields while saving input costs.

Another feature is the new Closed Transfer System, which is an ISO approved coupling. This prevents contact with any spillages of crop protection products, to ensure filling the sprayer is safe for the environment as well as the operator. The R975i and R740 will be on display at Cereals in June.

Kuhn

Kuhn is looking to incentivise precision-led trailed spraying by offering discounts on some specific models.

Both the Deltis and Altis mounted models and Lexis and Metris trailed sprayers will now be offered with GPS section control, boom assist, and five other options at a discount. "We want to incentivise precision farming methods that can reduce costs and increase yield," explains the company's Rupert Greest. "Therefore, Kuhn now offers up to £5000 of additional discounts on options for sprayers."

Further options available include the new Autospray droplet control feature, which enables adjustment of the droplet size from the cab. Also included in the scheme are automated filling and rinsing, Boom Assist automatic boom height control, nozzle by nozzle shut-off, automated steering axles and working lights.

"The ISOBUS compatible Metris is compact with a hitch-to-axle length of 4.4m and the choice of 3200-litre to 4100-litre capacities. At 3.35m high when specified with 36m booms, it's easy to store, light to tow, and may represent a more cost-effective option to farms looking to move away from a self-propelled sprayer," says Rupert.

The scheme works on a sliding scale, with three precision features triggering a discount of £1000. Thereafter, each additional precision feature adds a further £1000 up to a maximum discount of £5000 when all seven features are included.

Amazone

Amazone has further expanded its trailed sprayer range with its newly developed UX 7601 Super and UX 8601 Super, with volumes of 8000 litres and 9000 litres, respectively.

Both feature compact dimensions with a low centre of gravity to optimise stability and have a low weight, according to Amazone. The frame has been newly developed for these models and leads directly from the axle to the standardly equipped lower hitch drawbar.

The forward-sloping frame shape has been designed to provide ideal weight distribution of the sprayer, meaning permissible drawbar loads and axle loads should be optimally utilised. The centre of gravity is very low due to the new frame profile, which is designed to provide ideal stability on slopes and when cornering. The narrow profile of the spray agent tank with the freshwater tanks mounted on either side of the frame also contributes to its stability under all conditions, claims Amazone.

The machines have a comparatively low weight due to their one-piece frame without a separate drawbar and the maximum permissible total weight is 14t.

Depending on requirements, both sprayers can be equipped with a rigid or steered axle — up to 28^{0}steering angle. The axle is unsprung as standard, but a hydropneumatic axle suspension is available as an option.

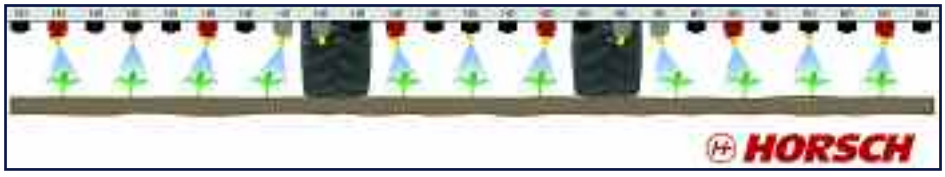
As is the case of the UX 4201 Super, 5201 Super and 6201 Super, the tanks are all made of polyethylene. The difference with the new models — and advantage, according to Amazone — is the generally very rounded form, both inside and outside of the tank. Along with the smooth inner and outer walls of the spray agent tank, the sprayer is designed to be easy to clean. The narrow profile of the spray agent tank should also help to enhance stability when it is partially filled. For example, the liquid cannot slosh around so much when cornering or on a slope, thereby ensuring a safer driving stability, says the company.

The new UX models are equipped with a 250 l/min spraying pump and a 350 l/min agitation pump as standard, both of which are piston diaphragm pumps. The dedicated agitation pump should allow for sufficient agitation intensity with these larger tank capacities, according to Amazone. The company believes the technology behind these piston diaphragm pumps should enable consistently high delivery capacities, regardless of the spray pressure.

Depending on the customer requirement, the spray agent and agitator pumps can either be mechanically driven by a PTO shaft or hydraulically driven. The hydraulic pump drive, which is fully integrated in the ISOBUS control, regulates the required pump speed fully automatically depending on the operating status.

Both of the new UX models can be equipped with the optional HighFlow+ system which should maximise work rates at the wider boom widths by means of higher working speeds. According to Amazone, it should still guarantee effective application by maintaining an adequate water spray rate.

Amazone's control technology should mean both pumps can be used for spraying while maintaining a high agitation intensity. Despite the high application rates of



Horsch aims to improve wetting in ridge crops with its new tilted nozzles caps for use in band application.

400 l/min, the machine should always have sufficient agitation capacity available to maintain a homogeneous spray agent, due to the intelligent control technology. All components of the HighFlow+ system are completely integrated into the cleaning cycle.

The UX 7601 Super and UX 8601 Super are operated via the SmartCenter, which is concealed under the large, one-piece cover on the left-hand side. All machines feature a 60-litre induction bowl with a rinse ring, canister rinse nozzle, mixing nozzle for the effective induction of powdery granules, spray lance, tank cover with large storage space and a function for cleaning the induction bowl with the lid closed.

Househam

Household's AirRide and Harrier self-propelled sprayers are now being fitted with a new X10 cab from Claas to upgrade operator comfort.

This replaces the current Excalibur unit, which was built by ABT, and should offer more space, a higher-spec interior and better visibility. Views to the boom have been improved, with large, sweeping corner windows and a redesigned engine canopy with chamfered corners.

Standard features of the X10 include automatic air conditioning, a Bluetooth radio, three-way tilting steering column and adjustable sun blinds on all windows. There's also a larger buddy seat with a 27-litre fridge housed underneath.

All of the vehicle and boom controls have been integrated into the cab's original controls which should allow for an easy operator experience, without the need to add additional switchgear.

Entry-level AirRide models will have a simpler interior spec with air-suspended cloth seat, while Harriers get a high-back leather version with climate control and heating. This will be available as an upgrade on all models though.

On both sprayers, Household has redesigned the mirrors to improve access, fitted LED work lights and installed a hydraulic-folding ladder with a controller integrated into the park brake. An illuminated pressure gauge has also been included, for clearer visibility when working at night.

Sprayer functions and vehicle readouts are housed in the latest high-spec TMC V6 Terminal, which is setup for auto section control (ANC) and auto nozzle select (ANS) as standard.

This has improved graphics and the option of NavGuide mapping software, which uses less processor memory than the FieldMaster system it replaces. The result is considerably faster operation when using additional functions such as individual nozzle control. The NavGuide system is compatible with most GPS setups and can import a variety of maps to suit different applications, such as variable rate application.

As well as cab upgrades, Household has brought in new optional engines. Its AirRide sprayers can now be specified with four- or six-cylinder Stage 5 Mercedes engines with power outputs ranging from 170hp to 240hp.

The 170hp option is a single-turbo four-cylinder, the 228hp version uses the same block with twin turbos and the 240hp version is a six-cylinder with single turbo.

These power a hydrostatic motor that drive Poclain wheel motors on AirRide 3000 and 3500 models and heavier-duty Sauer Danfoss units on all larger versions. However, buyers do have the option to upgrade the smaller models.

Tank options range from 3000 litres to 6000 litres and there's a choice of 24m, 28m ▸

Kuhn is looking to incentivise precision-led trailed spraying by offering discounts on some specific models, including the Altis.

Kuhn's Lexis trailed sprayer is included in the incentivisation offer, which could see growers get a £5000 discount off options.

The UX 7601 Super and UX 8601 Super are operated via the SmartCenter.

McConnel has unveiled the next generation of its low ground pressure, self-propelled crop sprayer, the Agribuggy2 AB30.

▸ or 30m booms.

The unladen weight is from 6700kg and ground clearance is 1.1m, with the option of increasing this to 1.7m.

Household's Harrier models have also had an update and now come with a six-cylinder 240hp Mercedes engine as standard and heavy-duty Sauer Danfoss wheel motors.

Spray packs are integrated into the chassis and come with the option of 4000-litre to 6000-litre tanks and boom options up to 36m. Unladen weight is from 8500kg and ground clearance is 1.1m.

On farm prices for the updated models start at £150,000 for an AirRide 3000 with 24m boom and £178,750 for a 4000-litre Harrier with 24m boom.

McConnel

Ludlow-based manufacturer, McConnel has unveiled the next generation of its low ground pressure, self-propelled crop sprayer, the Agribuggy2 AB30.

Redesigned from the ground up, the Agribuggy features a new Stage-V compliant Cummins engine, heavier-duty drivetrain and larger 3000-litres capacity spray tank to improve performance, durability, and output.

With a ground pressure of 8psi when the 3000-litre capacity tank is fully filled, the new Agribuggy AB30 is designed to be a light-footed sprayer that should allow growers to confidently treat crops in challenging ground conditions and allows for safe, productive working, earlier and later in the year, claims the company.

Featuring a robust mechanical drivetrain, larger axles and all-wheel drive the AB30 should offer safe, surefooted traction with the added safety of a mechanical HP24 gearbox and differential to arrest descent with engine braking. The new OMSI drive axles should provide improved traction and handling with 750mm ground clearance when fitted with large diameter row-crop wheels.

Powered by a new, high-performance Cummins 3.8L 148HP turbo charged diesel engine, the powerplant is Stage V compliant to Euro emissions standards. Delivering 600Nm of torque at lower revs and utilising an intelligent engine braking system, the new powerplant aims to provide responsive power and performance both on the road and in the field, according to McConnel.

Further performance optimisation should mean that average daily fuel consumption is circa 70 litres/day. The 110-litre fuel tank should allow for additional working range.

In the cab, new refinements include a category IV active filtration system, cruise control and additional 4WS features for reduced fatigue. An updated cab instrument layout includes a high-definition seven-inch full-colour display and software to help optimise accuracy and sprayer control.

Other upgrades include a new hydraulic powered braking system for enhanced performance, and LS hydraulics which should allow for greater capability at lower engine revs.

The AB30 comes equipped with a 3000-litre sprayer demount that has been internally baffled for extra strength and to prevent surges. A new electronic sight gauge with LED display for tank contents and remote PTO control has been added to improve convenience and accuracy. The 12/24m aluminium Pommier booms with a pressure recirculation system remain a standard feature.

"We're excited to bring these new innovations and enhancements to the proven Agribuggy format. By listening to users' feedback, we've been able to increase efficiency, economy, performance, and functionality even further," says John Davis, of McConnel.

Mitas

Mitas has introduced two new 'High Capacity' (HC) radial tyres designed for the next generation of self-propelled agricultural sprayers. The HC 1000 tyre line brings two new NRO (Narrow Rim Option) sizes; the VF 650/65R38 and VF 750/60R46, which are made to handle high load capacities and operating speeds.

"Our latest tyres are ready for an entirely new generation of machines, and in size and specifications ready to rise to the challenge," states Pavel Kott, of Mitas.

The advanced VF (Very High Flexion) construction should include benefits, such as carrying up to 40% higher load capacity with better traction, ground protection and crop yields.

"At Mitas, we want to provide a reliable solution for all the work our customers do. Our newest additions to the HC 1000 range have already shown tremendous promise for US original equipment manufacturers on the latest generation of high-load and self-propelled sprayers. Seeing this initial success, we are excited to bring these tyres to customers worldwide," adds Pavel. ■

Mitas has introduced two new additions to its High Capacity range of radial tyres, designed for the next generation of self-propelled agricultural sprayers.

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Two is better than one

> *"Sprayers are one of the most important parts of vegetable farms."*

On Farm Opinion

After being left impressed with the accuracy and precision on board, Scottish vegetable producer, Drysdales, invested in not one, but two new Fendt sprayers to help boost on-farm efficiency. *CPM* finds out more.

By Charlotte Cunningham

Overseeing the spraying of ground spanning more than 60 miles in the Scottish borders, Danny Milazzo is more than qualified when it comes to discussing the latest and greatest in sprayer technology.

Danny is the main operator at Drysdales, a vegetable producer growing brassicas, sprouts, swedes and leeks for supermarket chains. On average, crops are treated up to ten times a season, so when it comes to investing in a sprayer, efficiency is key. "For me, sprayers are one of the most important parts of vegetable farms, so it's vital that the kit is kept fresh and up-to-date."

The business has got a pretty robust policy when it comes to machine rotation and replacement, he adds, and says it tries to replace equipment before it becomes too costly to run with repairs and maintenance. "On-board technology is very important for us too — if something becomes available that can help us be more efficient with our applications, it's always worth looking into."

In 2020, when one of the previous sprayers hit the 10,000 hours milestone, it was an apt time to take a look at what the market had to offer. "Bills were getting high on the previous sprayer and we knew it was time to start thinking about investing in something new and, for me, the priorities are reliability, comfort and good back up."

Best tool for the job

Danny is heavily involved with the machinery decisions in the business, and with no particular loyalty to any manufacturer — instead more concerned about having the best tool for the job — he demoed all the mainstream brands in the UK. "We 'ummed and ahhed' about whether it was worth trialling a Fendt too, so we got it out on demo and quickly realised how phenomenal the potential savings would be with this piece of kit."

This coincided with the farm wanting to shift from 24m to 36m tramlines, making the self-propelled Rogator 645 a perfect choice. "We were actually so impressed by the machine, and we were able to negotiate such a good deal, that we actually ended up purchasing two of the Rogators," he laughs.

However, just like the automotive industry, COVID put a spanner in the works with production, meaning the farm ended up agreeing to take two ex-demonstrators, which arrived just ahead of the 2021 season before getting put straight out to work.

Looking at the nuts and bolts, how does the Rogator 645 work?

Marketed as 'the self-propelled machine for professionals' Fendt's Rogator 600 series comprises three models — the 645, the 655, and the 665 — ranging in maximum tank capacities from 3800 litres to 6000 litres, explains Sam Treadgold, sales engineer at Fendt UK.

"The Rogator is the product of many years of development and is available in boom widths from 24m, right the way up ▸

Danny Milazzo believes the sprayer is one of the most important parts of vegetable growing.

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Drysdales grow vegetables for supermarket chains on ground spanning more than 60 miles in the Scottish borders.

▸ to 39m meaning there is likely to be a solution for all growers."

In the guts of the sprayer is a six-cylinder AGCO Power engine, delivering a pony count of between 235hp and 307hp, depending on the model, he adds. "The Power engine was designed to combine high power and torque with low fuel consumption, to deliver performance which doesn't cost the earth. This is particularly beneficial in today's climate with input costs — including diesel — continuing to rise at a rapid rate."

The drive system also features Fendt's continuously variable HydroStar CVT gearbox. "The variable displacement pump and variable wheel motors work together within this system to ensure the right amount of oil and amount of torque is delivered when needed, at any moment in time."

To offset the weight of all of this, the drive unit has been installed between the axles to ensure the centre of gravity isn't compromised, he adds.

Danny Milazzo's Rogator benefits from individual section control as well as the 2+2 DualSelect nozzle select tool.

Inside the cab, the Rogator 600 series benefits from ISOBUS as well as some of Fendt's in-house features including the OptiControl leaver and the Optiflow control panel.

Hydraulic upgrade

Ride height can be as low as 75cm or up to 120cm and, specifically relevant for vegetable growers, the single-beam chassis has been designed to always protect both the crops and the soil, says Sam.

Track width is fixed as standard, but there is the option to upgrade this to hydraulic. "Hydraulic track adjust is specifically targeted at contractors who may need to adapt their track widths between customers, for example. With this option, the width can be adjusted inside the cab from 1.8m up to 2.25m.

"If there's a frequent width change required, there's also the option to pre-set and save this to the system."

Other optional features include the OptiSonic boom height control — which was introduced in 2020 — as well as the option to upgrade to a stainless steel centrifugal pump to increase longevity. "Fendt sprayers used to use Norac boom height control systems, but we've now developed our own in-house set up which uses four sensors to control the constant optimum average height."

Individual section control is another neat feature and valued by operators, adds Sam. "The nozzle body works in 50cm spacings, so on a 36m boom you would have 72 sections which all work independently of each other. It's estimated that this saves 5-15% of the spray liquid costs.

"Fendt's VariableRateControl system can also be added to increase that efficiency and precision — particularly important in challenging seasons like the one we find ourselves in."

Inside the cab, all machines benefit from ISOBUS as well as some of Fendt's in-house features including the OptiControl leaver and the Optiflow control panel — an electronic fill level indicator which allows automatic filling modes to be observed from the cab or at the filling station.

"For those with heavy workloads, the VarioDoc Pro feature could also be useful," notes Sam. "This allows operators to easily and quickly export documentation to and from the terminal."

There were a few teething problems with the sprayers, namely within the wiring harness, explains Danny. "We had a bit of an issue with moisture getting into the

Continued learning through FSOOTY

With a keen desire to learn, Danny saw an opportunity to get involved with Syngenta's Farm Spray Operator of the Year (FSOOTY) — leading him to be awarded second place at the competition showcased at last year's Cereals Event, with the organisers saying the contest was incredibly tight.

"I followed FSOOTY for a while, but I left the industry for four years and went into construction instead. However, when I came back, I saw an advert for the competition on Facebook and thought it would be a good opportunity to push myself."

Danny entered it twice — making the semi-finals on his first attempt, before claiming a very worthy silver place last year. "It was a brilliant experience, and if nothing else it allowed me to proof test what we were doing. With many of the other contenders working mainly in arable crops, it was also a brilliant opportunity to pick up new tips and tricks that may help us vegetable producers and vice versa.

"I'm a big believer in that you can never learn too much and the amount of knowledge I gained through the experience was truly amazing. I'd encourage anyone to do it — there's literally nothing to lose but potentially an awful lot to gain."

The FSOOTY 2022 will be presented at Cereals 2022 — look out for more information on what's in store in the event preview in next month's *CPM…*

The Rogator 645 working in leeks earlier this year.

plugs, so both sprayers had to be fitted with a new harness. But since then, it's been so far so good.

"We also had a bit of difficulty setting up the slug pellet hoppers which we run on the back of the sprayer, but Fendt was very good and very quick at sorting both problems out."

What's more, working closely with Fendt meant Danny has been able to help the firm develop a solution to an auto-height issue — a challenge specifically likely to effect vegetable growers, he explains.

"In its standard form, there was a bit of a problem with auto-height on the crops, and this was to do with the sensors on the rows. We worked with the product support team over the winter to develop this and test potential solutions and they were able to tweak things so that we're now working off of six sensors, rather than four." This is now in the pipeline to become permanent solution within the design.

With a season under its belt, Danny says on-farm spraying efficiency has improved by 30% — largely due to the time-saving benefits. "My favourite feature has to be the 2+2 DualSelect nozzle selection tool," he adds. "It enables us to run twin nozzles through one line and it runs off pressure and speed. This means it can self-regulate pressure when it hits a certain force and jump up to the next available nozzle. We've found the technology helps us to control droplet size too."

Useful technology

Sam picks up the conversation and delves a little bit further into how this technology works. "The easiest way to think about it is that the system does all the work for you and will optimise nozzle choice and keep drift reduction down based on pressure. It can increase time-savings by a significant amount — as Danny has found — and although this isn't a standard feature, many users report back to say it is well worth the extra investment."

The move to 36m, combined with the Fendt technology, has helped identify further savings too, notes Danny. "On our previous machine, we ran seven-section auto shut off, which did cause some issues with overlap. When we moved from 24m to 36m, we looked into pulse width modulation, but it's horses for courses —

Vegetable crops get treated between 10-12 times per season, meaning sprayer efficiency is key.

The Rogator is the product of many years of development by Fendt, explains Sam Treadgold.

were we really going to get a saving? We didn't think so.

"Instead, we see better results from the individual section control on the Rogator. With spacings every 50cm, we really do get that accuracy we're looking for. Not only does it minimise overlap, but also crop losses, while maximising chemical savings."

With backup also being a key priority for Danny, he says his local dealers have more than delivered. "We've worked closely with our local dealers, Ancroft Tractors, who have been really helpful. Having nearby support is essential for keeping the wheels turning."

Looking to this season, Danny says sprayers will get going by the end of March for weed control in early crops, followed by a two week break before getting started on the main crop towards mid-late April. "We're looking forward to seeing how we can push the Rogator as it enters its second season — but so far, we've been very impressed." ■

Farm facts

Drysdales, Cockburnspath, Berwickshire

- **Farm area:** 809ha
- **Soil type:** Varied – from sandy loam to heavy clay
- **Cropping:** Leeks; swede; sprouts; brassicas
- **Cultivation equipment:** Sumo Trio cultivator; Kongskilde steerage hoes; Jones Engineering bed former; Standen Engineering double bed tiller
- **Drills:** Monosem precision pneumatic air seeder; Agricola precision pneumatic air seeder

> *"With a damp or wet soil surface, some surface movement is good, to get air into the profile."*

Drill demo

Drills on demo...

With increasing numbers of its customers reducing cultivations and even moving fully to direct drilling, Hutchinsons held a March drill demo day in East Yorkshire for multiple manufacturers to show what their machines could do in different cover crop residues. *CPM* was there.

By Martin Rickatson

There's nothing like a wet demo day to draw the crowds. While there might be land work to do, it will be too damp to do it, and so arable folk will generally be forced to choose between a dull day in the office, sometime in the workshop — or donning the waterproofs to see just how well kit can cope in sodden soils.

To be fair, it wasn't raining on the day of Hutchinsons' East Yorkshire direct drill demonstration during early March, but it had rained plenty the day before — more than enough to make most fieldwork impossible. On the light land of the chosen demo site, though, it was still possible to put drills on the field and in the ground, and so it was that the demo went ahead.

While the cost of shiny new equipment continues to climb, the potential offered by direct/no-till crops establishment systems to cut costs by reducing fuel, steel and labour inputs, and benefit from soil's natural restructuring capacity, particularly when allied to the deep rooting of cover crop mixes, continues to attract interest. And with recent global events having caused fuel prices to climb steeply, minds have unarguably been concentrated on further reducing input costs, even if investment in a new drill may be required to achieve them

Well supported

To this end, the demonstration was particularly well-timed and very well-supported, attracting a dozen manufacturers to demonstrate direct drills through their local dealers. A crowd well into three figures watched the machines drill into sprayed-off cover crop mixes on some wet, light soil, allowing assessment of differences in soil structure, drilling ease, seedbed quality and seed establishment from each drilling system.

Among the most familiar machines present was Claydon's Hybrid, with its leading opener and following coulter arrangement. Shown in 3m mounted format, its design is said to meet the often-heard need for a farm to ideally have two drills depending on soil conditions by being modular in opener design. While a leading tine is the standard opener, it's also possible to fit a leading single- or double-disc opener in place of this. Likewise, there are single or twine seeding tine options and, at the rear, board, press wheel or cage wheel consolidation options, all with covering tines.

Sumo was another that chose to show a compact 3m mounted version of one if its direct drills, the DTS, or Deep Tine Seeder. The machine features leading opener discs followed by deep-loosening tines to alleviate compaction below the seeding zone. An opener boot makes the seed furrow, while covering discs place loose soil over the seed, and a foam-filled press wheel, which also governs drilling depth, provides consolidation. Again, there's also a fertiliser option. ▶

Sumo's Deep Tine Seeder features leading opener discs followed by deep loosening tines to alleviate compaction below the seeding zone.

A LONG WAY TOGETHER

RIDEMAX FL 693 M

No matter how challenging your needs, RIDEMAX FL 693 M is your best ally in applications with trailers and tankers. The radial construction, excellent self-cleaning properties, low rolling resistance and the speed index classes D/E make RIDEMAX FL 693 M perfect for road transport (up to 75% of use). Its reinforced bead and steel belts ensure enhanced durability.

RIDEMAX FL 693 M is BKT's response in terms of transport applications mainly on asphalt, in the agricultural sector.

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Claydon's Hybrid can be configured in multiple ways is the standard opener, with leading tine or single/double disc openers, and single or twine seeding tine options.

A high-output tine drill, Amazone's Cayena is reckoned particularly suited to hard, dry soils, its narrow-profile TineTeC HD coulters are arranged across three rows.

▸ Mzuri's Pro-Til, shown in 3T 3m trailed configuration, works on similar principles, but has some key differences. Optional front disc openers are designed to slice through surface residue, while auto-reset leading tines clean the sowing strip of surface trash. As with the Claydon, it's possible to specify a fertiliser placement option. Staggered wheels then reconsolidate the tilled strips before the individually hydraulically-pressured seed depth wheels with individual depth adjustment place the seed. A hydraulically-operated adjustable pressure harrow follows up.

Long established

Like most of the disc coulter-based drills, John Deere's long-established 750A remains available only as a trailed machine. Its single-disc openers are 457mm units angled at seven degrees. Smooth-sided gauge wheels aid seed placement precision, while semi-pneumatic press wheels consolidate the soil around the seed, and a following angled closing wheel closes the seed slot. The drill also boasts uniform depth control — active hydraulic down pressure of up to 250kg/seeding unit is claimed to aid contour-following.

Again available only in trailed format, the

On John Deere's 750A, single-disc openers are 457mm units angled at seven degrees, while smooth sided gauge wheels aid seed placement precision, and semi-pneumatic press wheels consolidate.

Avatar from Horsch features 16.7cm-spaced single-disc coulters arranged over two rows, with 33.4cm clearance per row, a format claimed to particularly suit high residue/post cover crop situations. Coulter pressure is up to 350kg/row, and each coulter has individual depth control. Closing wheels are adjustable to suit different soil types and conditions.

Amazone chose to demonstrate a high-output tine drill, a 6m model of its trailed Cayena. Claimed to be particularly suited to hard, dry soils, its narrow-profile TineTeC HD coulters, arranged across three rows, are reckoned to pull into the ground

Compromise required in most situations

Picking the ideal direct drill that's sufficiently flexible for varying soil types, moisture levels, trash presence and other factors is a minefield, acknowledged Dick Neale, Hutchinson's technical manager.

"You almost need different tine and disc set-ups for autumn creation of stale seedbeds and establishment of cover crops and, later on, the lower disturbance system required for planting the crop itself.

"Some drills, like the Claydon tine drill, can be adapted with disc openers. At perhaps £5,000 or so extra, specifying a drill that way, with an adaption option, is much cheaper than buying a second drill.

"With a damp or wet soil surface, some surface movement is good, to get air into the profile — it's no good direct drilling with minimal movement into an anaerobic environment, a sad-looking crop will result. Surface tilth is a compromise between good grassweed control and having a vigorous crop.

"Diesel costs have become a real issue, and are another reason for looking at reducing cultivations. But raking and rolling are important parts of the direct drilling process, and shouldn't be missed — they use little fuel."

Sky's EasyDrill HD features a 'Tandem' seeding arrangement, said to aid depth stability when large stones and clods are encountered.

while creating minimal soil disturbance. Further benefits are said to include a low power requirement — a minimum 136hp is reckoned sufficient for a 6m model — and minimal coulter wear.

While most of the smaller mounted direct drills are of the tine coulter type, Weaving offers its GD double-disc coulter machines right down to 3m mounted sizes. At Hutchinson's demo day, however, it was the trailed 6m GD6001T it chose to demonstrate. GD machines use a double-disc coulter design, for a claimed combination of low draught requirement and long service life. The leading outer disc slices through trash and cuts into the soil surface, with the smaller inner disc creating an opening for the seed placement, before the soil is firmed back into place.

Handled in the UK by Opico, the range of Sky direct drills from France includes the EasyDrill HD. Its 'Tandem' seeding arrangement, said to aid depth stability ▶

Getting cover crops right

"Lowest possible surface disturbance is important when you have a significant grassweed problem, or a weed problem in general," emphasised Dick Neale.

"But there has to be compromise between grassweed control and having a really good commercial crop. Getting air into the soil surface is also important, and the reason why a total lack of surface disturbance from a direct drill is not necessarily a good thing.

"Unfortunately it's too wet at this event to allow visitors to properly judge drill performance, and in normal circumstances this field would be left a week to dry. But visitors have still had a good opportunity to compare drill features, and also assess different conditions left behind by the different cover crop mixes that had been sown across this site. What I'm keen to do is help those who have had bad early experiences with cover crops, which I think have an important role in soil management.

"Most first ventures into cover crops are usually based on an oat species plus something like radish or vetch. These are cheap, reliable, cover the ground, look impressive and condition the soil underneath beautifully.

"However, almost all growers comment on how wet they can leave the ground underneath, and many give up on these covers as they see others drilling where their cover-cropped ground remains wet. But this is what oats do — they draw water up and with quite a bit of soil cover the surface retains moisture. When the cover is sprayed off, there's a lack of air movement across the surface as a lot of canopy remains."

In addition to spending his time in a soil pit, pointing out the impacts of cover crops and reduced cultivations on structure, Dick also demonstrated the role soil management can play in cover crop growth. Sample tubs had been filled last April with identical compost and Maxicover seed mixes, but one compost had been in a wormery for two years.

"Both tubs were sown with the same seed mixes, right down to individual seed numbers," he explained.

"The difference between them is that the compost in one had come from a wormery, and the worms have created a completely different microbiology in the compost. This has selected for the soil microbiology conducive to legumes but not brassicas. We can see the same in certain field areas.

"We selected seed mixes with brassicas in because when we did the original soil assessment the structure was good and we wanted to maintain it, but our key target was to maximise natural soil nitrogen, so we went for a legume-rich cover crop seed mix. However, we found that the soil here will grow brassicas, linseed, phacelia fine, but all of the legumes failed.

"It was not the legume seed that failed in itself but, I believe, the fact that the soil is bacterially-dominated, a situation found in many UK arable soils and one we've created through the use of ammonium nitrate, urea, residual herbicides, and fungicides," he commented.

Tine and disc drills both have their place, and many farms would benefit from having one of each according to the season – or an adaptable machine, says Dick Neale.

"This selects for certain weed species, and that's why we have fields with bad blackgrass and other problem weeds. So on top of managing structure and maximising natural nitrogen availability in the soil, we should target changing the balance of bacteria and fungi.

"Some of that can be done by taking advice from your agronomist before you jump into selecting a cover crop mix. Bear in mind the soil aggregate mix; soil nutrient fixation, storage and release; the need for adjusting factors, such as soil type stabilisation or the C:N ratio; the duration of cover planned; your exit strategy from it; and the following crop planned."

The Horsch Avatar features 16.7cm-spaced single disc coulters arranged over two rows, with 33.4cm clearance per row, to handle high trash levels.

▸ when large stones and clods are encountered, consists of a rubber front depth wheel connected to two rear metal press wheels which pivot bogie-fashion. The seeding disc is mounted between the front and rear wheels so that its depth is controlled by the wheels.

When drilling into cover crops, the front press wheel compress plant material to allow the disc coulter to cut through it and place the seed. The hardened discs are set at a 3.5-degree angle, which the firm says minimises soil disturbance, power requirement and subsequent weed emergence. Running alongside the disc and keeping it clean is Sky's carbide-tipped monobloc skim coulter, which is tungsten carbide-faced and cleans out the seed slot in front of the seed tube.

Behind each disc coulter is an angled metal press wheel which works in tandem with its neighbour. These press the soil sideways and downwards to close the seed slot and cover the seed. Weight distribution between the rear press wheels and front press roller can be altered to place maximum pressure on the rear in dry conditions to consolidate the seedbed and ensure maximum soil to seed contact. In wetter conditions weight can be transferred to the front to keep the drilling running clean.

While most smaller mounted direct drills are of the tine coulter type, Weaving offers its GD double disc coulter machines right down to 3m mounted sizes.

The Sicura SSP, which Yorkshire firm Ryetec imports from Italian manufacturer Ma/Ag, features floating disc coulters with individual pressure adjustment and depth control, each floating on a parallel linkage, an arrangement said to aid uniform seed placement across the full width on undulating land. Serrated opener discs aid drainage below the seed depth, promoting root development and discouraging slugs, claims the firm.

Coulters are spaced in two alternate rows at the front and rear of the frame for effective trash flow. Coulter pressures are individually adjustable up to a maximum 250kg. Rubber concave press wheels close the seed slots, and also control drilling depth, so once desired seed depth is achieved the full coulter pressure is then transferred to the rear rubber press wheel. As this has hard edges and a soft centre, it's said to press in the soil to both sides of the seed. Mounted models are also available. ■

Ma/Ag's Sicura SSP, from Ryetec, features floating disc coulters with individual pressure adjustment and depth control, each floating on a parallel linkage.

Smart technology

Handheld farms

Ever wondered what it’s like to hold your farm in the palm of your hand? Bayer’s FieldView pulls together and analyses data so this is almost a reality. *CPM* attended a transatlantic webinar in March to find out more.

By Melanie Jenkins

It’s hard to turn a combine without the header hitting six different data collection tools — metaphorically speaking — but Bayer’s FieldView aims to be different. All farm data is brought together in one platform in real-time, which should allow for ‘on the spot’ analysis and informed decision-making.

As no two farms are ever the same, Bayer hosted a webinar to explore how FieldView is being used around the world, explains Bayer’s digital activation manager, Max Dafforn. Three farmers from Canada, the US and UK speak about how they’ve adopted FieldView and the impacts it’s had on their farming systems.

Canada

Farming 890ha of predominantly cereals and oilseeds at North Battleford, Saskatchewan in Canada, Al Heidel started collecting data on his farm in 2005. He used FieldView to bring years of data into one platform and finds it useful to measure both trials and crop performance, keep track of machines and accurately plan his spray timings.“We used to record everything in a book,” he says. “I started my farming career in 1981 and began collecting data using GPS. It’s made such a difference to the way we do things and has been awesome for how we manage the farm.

”One of Al’s favourite features from his long list of favourites, is being able to see satellite maps so he knows how fast crops are growing, based on growing day degrees. “This indicates when I need to go and check a field,” he says.He further likes the accessibility of the data. “I’m in the Rocky Mountains right now — where we usually overwinter — and I have all the live farm data with me.” He can even monitor how much precipitation has fallen on his fields while he’s hundreds of miles away. “I get notifications if it snows so I know how much moisture the farm is getting, which is useful after a really dry year.”

The main thing he uses the platform for is record keeping. “Having everything with me, I can go back over multiple years through the data our equipment generates,” says Al. He likes to compare machine operations and used FieldView to compare two Case IH combines workings in the same field. Both machines were the same size but one was newer, and he could see it covered more ground over the same period than the older machine, proving that the new machine was capable of doing what the dealer said it would when they sold it to him.

He also finds the live access to machines useful as he can see where the combines are which helps him plan trucks, as well as grain bins on the yard. Knowing which type of bin each load needs to go to depends on moisture content, he adds.

Although FieldView can be used to conduct on farm trials, Al has also managed to use his own error to his advantage, by using the platform to turn it into a trial. ▸

Bayer’s Max Dafforn hosted a webinar with growers from around the world using FieldView.

Al Heidel uses FieldView to bring years of data into one platform and to measure both trials and crop performance.

▸ "While spraying I missed about 1ha and, though the field was sprayed again eight days later, the weeds had a chance to get bigger before I got to that patch." Using FieldView he could see the patch that didn't get the first spray yielded significantly less than the field average. "The trial wasn't planned but we turned it into something useful we could learn from."

Al has also been able to utilise the platform to help with spraying. "I needed to spray a field of canola, so I looked at the wind velocity and forecast that day. There was a south-west wind forecast but when I arrived the wind was from the east, but the forecast came true and the wind moved to a south-westerly. FieldView allowed me to get into the field and spray without drift damaging the adjacent crop," he explains.Al's next step is to start using FieldView for variable rate applications. "I want to build zone maps and I want to see it operate better with the Case IH portal, as I've had a few issues with that. But it works seamlessly with other products, such as My John Deere."

United States

Operating Leffler Farms in the east central part of Kansas in the US, Jacquelyne Leffler grows corn, soya beans, wheat and rears a herd of fat cattle, selling directly to over 600 consumers.

When she returned to the family farm after university in 2013, Jacquelyne wanted to implement a system that could pull all the farm's data together. "I'd watch my dad and grandpa memorise every single thing, but I grew up a millennial. I didn't have to have that memory and I couldn't remember which hybrid was next to which, or what we'd applied, let alone soil types of every field off the top of my head."

My dad started soil sampling a long time ago and I thought, why aren't we doing anything with the data?"

After seeing other farmers talking about FieldView on Twitter, she decided to give it a try. "We started backloading all our data from the early 2000s into the programme. I manually used a flash drive to put the data into our desktop and pushed it into our FieldView account," she explains.

"One time I didn't have enough broadband width to upload the massive amount of data, so I had to mail the USB to someone with FieldView who had better connectivity to do it for me. But now I basically have decades worth of our farm history in my pocket at all times, and that's been huge for us."

Internet connectivity can still be a bit of a tricky issue despite having transferred all the farm's historic data. "Our farm sits three miles from fibre in every direction and it's so expensive to get it where we are that we're basically out of luck," explains Jacquelyne.

To overcome this she is toying with the idea of getting Elon Musk's Starlink. "I think it'd make a huge difference to our operation, but at the moment I'm relying on a wire in the ground and when it gets wet, my internet gets really pixelated and I have to wait for everything to load."

But luckily this hasn't hindered her use of FieldView. "If we don't have cell phone reception in a field and lose GPS, FieldView never goes away and when we get back to the farm, all the data from the day magically starts to fill into the maps.

"Even if it doesn't happen automatically, I can pull out the USB and put that into our desktop to manually push data into our FieldView account," she says. "It gives me confidence that no matter how bad my service, I'll be collecting data."

One of Jacquelyne's favourite features in ▸

FieldView provides valuable information about spraying conditions so windows can be made the most of.

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David Fuller-Shapcott; Arable farmer; Kelso, Scottish Borders

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Despite having cell phone signal issues on her Kansas farm, Jacquelyne Leffler finds FieldView still records data.

▸ FieldView is used for her cattle operation. "I put all our pastures in as fields and then I'm able to map which paddocks are drying up fastest. We rotationally graze our cattle, meaning it helps give me an insight into where to move the cattle next. Some of our pastures are 30-40 miles away, so it saves me wasting a two hour round trip to look at them."

It's also helped her identify issues on the farm. "A few years ago a sprayer killed off some of the grass in a paddock and I don't think I'd have found out as fast if it wasn't for the satellite imagery," she says.

"I don't know if FieldView was intended to be used like this but I like to push the limits of the applications we're using."

On one occasion, Jacquelyne was able to use FieldView to demonstrate the benefit of different tillage practices. "We have one landowner who liked to do the groundworks on half of one of his fields as a hobby and we worked the other half. I used FieldView to show him that my half yielded a lot more because of the tillage practice, though I knew from the ride that it had a better structure. But if I'd said that he wouldn't have believed me – and now we work his entire field."

She also uses FieldView to educate customers and the public about what it takes to produce food. "I'm really into gadgets, data, pictures and videos and putting them on socials to show customers what it takes to grow our own corn and produce cattle. I can show them tractors moving live through fields and it's been a cool visual way to show people what we're doing."

Looking to the future, Jacquelyne would really like to be able to install a few weather stations on her farm that feed directly into FieldView and have real-time farm weather updates. "That would be a cool feature for record keeping and spraying and would help our decision-making."

United Kingdom

In the Lincolnshire Wolds, Alex Borthwick grows winter wheat, winter and spring malting barley, oilseed rape, potatoes and sugar beet.

Like Jacquelyne, he heard about FieldView through following American farmers on Twitter. After discussing it with his Bayer field manager, he became one of the first farmers to trial the programme in the UK and has now been using it for almost two years — encompassing three growing seasons.

"Initially we just used the data catcher aspect with our sprayers and spreaders to create data from our field operations," explains Alex.

"From the first harvest we put map layers together and started looking at some fungicide trials with Bayer to see the difference between treatments."

This has developed and now he mainly uses FieldView to evaluate crop performance. "We've quite a big data set now and can look at variations," he says. "I evaluate different varieties, fungicide treatments and can create reports on work we've done for other farmers. But we're constantly evolving how we use it."

He particularly likes that, whatever work is done on farm, he has access to it on his phone, iPad or desktop. "It's the same across all platforms which is key as I'm constantly double-checking application rates, dates or yield history."

Water usage maps have also been very useful. "With our fungicide trials these have been really interesting as they showed a reduction in water usage when using one SDHI compared with our standard treatment and this correlated to yield," explains Alex.

This year he's trying variable rate seeding

One of Jacquelyne's favourite features is to monitor her cattle pastures using FieldView.

for the first time and has used some field variation maps — created using FieldView — to make plans. It's a case of so far so good, according to Alex. "I couldn't ask for the field to be looking any better."

Like Al, one of Alex's favourite features is the remote view. "Being able to view the combine during harvest is really useful as I get an instant feel for how the field is yielding and I don't have to wait for the end of the day," he explains.

"I also like the ability to s elect tramlines, where different applications have gone on, to analyse the different yields without having to hand draw or make a rough guestimate of where the different areas are. That's probably the biggest and most useful feature for us."

FieldView has proven invaluable when harvesting OSR. "When we're harvesting, we're also trying to buy seed for the next season as well as drilling the crop at around the same time," says Alex. "So being able to get the data off the combine pretty quickly shows whether a variety has performed for us or not. This helps us commit to the varieties we want to grow, so we can get the crop in the ground straight away."

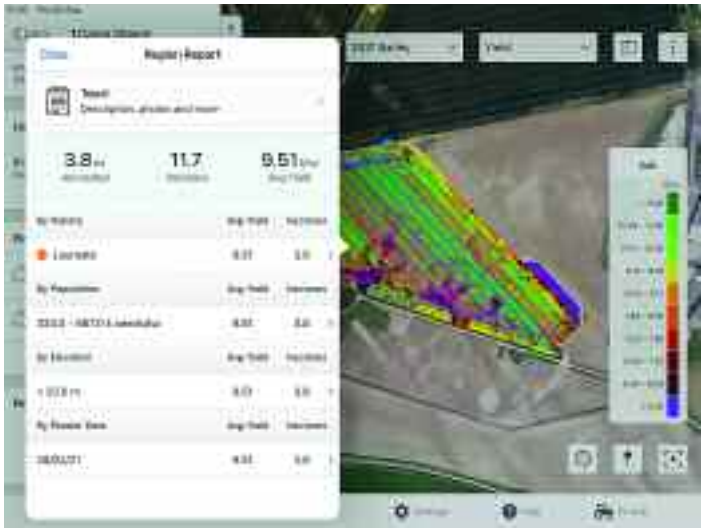
He's even found that his operators get on well with the platform. "Our combine operator is in his mid-60s and he's

Alex Borthwick was one of the first farmers in the UK to trial FieldView after seeing Tweets about it from American farmers.

embraced it. They've all bought into FieldView and it's key for them to see the data that's being captured so they can understand what we're doing and why."

One hiccough Alex had with FieldView was that his combine didn't have yield mapping. "We did have to buy a satellite receiver to connect to the combine, but once we had this it was straightforward to set up on a wet morning and took us about an hour to do."

Alex is hoping to be able to create soil maps using FieldView in the future. "I want to be able to create them and monitor soil health over a long period, then FieldView will be doing pretty much everything I want." ■



Alex likes that FieldView gives him the ability to select tramlines and to analyse the different yields from different applications.

> *"Broadacre works really well if you've used a pre-emergence in the programme, or if you have the 'correct weeds'."*

Sugar beet weed control

Beet the weeds

Beating back sugar beet weeds can be a tricky task, with growers often juggling jobs and finding clashes in spray timings but planning a tailored programme can help ease the burden. *CPM* finds out more.

By Melanie Jenkins

Although the loss of desmedipham may still be felt among growers, the future isn't entirely clear for phenmedipham. But the positive news is the UPL and Bayer task force (for phenmedipham) has met the renewal application deadline set by the Chemicals Regulation Division, explains Pam Chambers of UPL at the BBRO BeetTech22 in February.

"It'll take a little while before we hear any more and it's probably not going to be until around 2024 before we have a decision, but it's looking quite favourable at the moment."

So what's the situation for growers right now? According to Pam, it's a case of planning herbicide programmes, protecting the programme through management and getting it to perform, both in the field and in terms of cost.

Using programme trials, she's looked at two and three spray programmes, the broadacre approach, conventional programmes, high versus low cost and straights against formulated mixes. "We can generate a lot of data from these trials," she says.

Weed screens

Looking at the current effectiveness of phenmedipham, data taken from weed screens in 2018, 2019 and 2021 demonstrated its control of orache isn't that strong, explains Pam. Instead she suggests growers look at metamitron as the preferred active when the weed is present.

However, she highlights that in 2018, when conditions were really hot at spraying, phenmedipham gave good control of orache, at 83%. "But in 2019, the temperatures dropped during the second spray timing and that impacted how well phenmedipham worked."

She also points out that desmedipham was still in use in 2018, and when this was added to the tank-mix it increased the level of control of both actives. "Obviously we don't have it anymore and that's why it's important to get the best out of phenmedipham. Temperatures and relative humidity all make a big difference to its performance," says Pam.

She also compared three applications of quinmerac and dimethenamid-p against untreated situations and found these didn't provide a good control of weeds on the trials site. But what is being controlled is the cleavers, she explains.

"It's very strong on those but when we added phenmedipham and ethofumesate, the level of control was boosted considerably."

Dimethenamid-p is the go-to active for controlling cranesbill, which has become an increasing problem, and the combination of quinmerac and dimethenamid-p is a useful post-emergence option when used in tank-mix with other actives, says Pam. "So how the different combination of actives work is really important."

So what about formulated mixes? In

Pam Chambers says that using straights can be the most flexible and cheapest herbicide option.

It's advisable to also consider the daytime high and diurnal range when determining the rate an oil can be safely included.

many cases formulated products can be the simplest means of weed control, offering growers benefits in terms of easier spraying, less time spent mixing and fewer containers to store, move, wash out and dispose of, she explains.

"But with straights you've got the flexibility to adjust the rate and manage the amount of active that's applied. Using ethofumesate as a straight also allows pre- and post-em use, which isn't possible if phenmedipham is included as part of a formulated mix"

However, for all the advantages that formulated mixes offer there are considerations at application that, if observed, will help growers get the most out of these products, explains Antonia Walker, Bayer campaign manager for root crops.

"Even without desmedipham, we still have some excellent products available for reliable and effective weed control, but there's no overlooking the importance of application timing and the use an adjuvant oil post-em where appropriate," she says.

In trials, Betanal Tandem (phenmedipham+ ethofumesate) plus oil has given 90-100% control of a range of common weeds, but there are some species where the inclusion of Goltix 70SC (metamitron) has delivered enhanced control, she adds.

"We see excellent control of most broadleaf weeds, including fat-hen, from a standard mix of Betanal Tandem plus oil. But where annual meadow grass, knotgrass, redshank, ivy-leaved speedwell, pale persicaria or mayweed are expected to present a challenge, the inclusion of Goltix will take the level of control from good to outstanding," claims Antonia.

Performance benefits

"It should be reassuring to see that where sprays are timed appropriately and with the right tank-mix partner, it's still possible to achieve near complete control from a three-spray programme built around Betanal Tandem," she adds.

Across all species, the inclusion of an oil adds roughly 8% to the performance of Betanal Tandem, according to Bayer, but growers are advised to consult the BBRO guidance on rates to avoid crop damage, says Antonia.

"Growers understand the importance of not applying herbicides during periods of high heat, but it's advisable to also consider the daytime high when determining the rate an oil can be safely included. This is on a sliding scale from 14-21°C, above which it should be avoided altogether," he says.

In situations where harder to treat weeds are present, or where weeds have grown on past two true leaves, the inclusion of an additional partner such as Debut (triflusulfuron-methyl), Dow Shield (clopyralid), Venzar ▸

Applications of quinmerac and dimethenamid-p are providing control of cleavers.

▸ (lenacil) or Safari Lite (lenacil+ trifulsulfuron-methyl) can be added to the tank for improved control, she suggests.

According to FMC, broadacre weed control methods are increasingly replacing the little and often phenmedipham /active/residual (FAR) approach and the company claims it means sugar beet weeds can be kept in check during the early part of season, despite the loss of desmedipham.

"Just four tall weeds/m^2 can reduce beet yields by 1t/ha," says Georgia Antoniou, FMC commercial technical manager.

FMC's broadacre system is based around a foundation of two applications of Safari Lite. "Robust, larger mixes used in this technique perform better on bigger weeds, while fewer passes save time during a busy period, as do fewer tank cleanings, particularly if sulfonylurea products such as Debut or Safari Lite are used," explains Agrovista's Becky Finbow.

"This helps ensure good application timing, with a knock-on bonus for timeliness of insecticides for virus yellows, or Centurion Max (clethodim) for blackgrass."

In a DeSangosse and UPL trial, carried out by Silsoe Spray Applications Unit (SSAU), the impact of phenmedipham, different nozzles, water volume and the inclusion of an adjuvant on Chenopodium species, including fat-hen and fig-leaved goosefoot was explored. Using a tracer in the herbicide mixes, researchers were able to determine the effective coverage of different application techniques.

When 100 l/ha was applied with a flat fan, this provided 49.9% coverage, but when the water volume was increased to 200 l/ha, this fell slightly to 46.6%. "We then added an adjuvant, which boosted the level of coverage to 60.8%," says Pam.

Nozzle-type influences

"The interesting thing is that when we used a drift reduction nozzle at 100 l/ha, 200 l/ha and even with an adjuvant added in, we got a lot less coverage of those weeds," she explains. In the 100l/ha trial, coverage was only 24.7%. Adding an adjuvant increased this to 34.9%. But even in the 200 l/ha, coverage only increased to 34.1%, and with an adjuvant added, it rose to 47.6%.

"I don't think this is revolutionary, as there's been a lot of work done on application technique in the past, but it's a useful reminder," says Pam.

But one of the major factors for growers is costing. According to Pam, broadacre weed control works really well, and in trials came in costing £96/ha, with only two sprays. "But a word of caution," she says. "There was no mayweed or knotgrass present in the trial and if those weeds were there, I'd have thought twice about using broadacre. By the time you start the programme (crop at least first true leaves, 1cm), the mayweed and knotgrass will be getting a little too big and you could struggle to keep on top of them.

"Broadacre works really well if you've used a pre-em in the programme, or if you have the 'correct weeds'," she explains.

An application of phenmedipham, ethofumesate and metamitron as straights came in costing £116/ha but Pam says this could've been done cheaper. "I set the protocols at the beginning of the season before we started spraying. If I'd been doing the actual agronomy there, walking the field every five to seven days, I'd have probably been able to get that down to under £100/ha," she explains. "However, it would've taken a lot of my time and work and sometimes that's not a luxury you have. So do take that into account."

The highest costing application came in at £176/ha, and included phenmedipham, ethofumesate, metamitron, trisulfuron-methyl and lenacil, but Pam warns not to dismiss this mix. "In some cases it might be an option that you need to consider. If you can't get around to walk or monitor your fields on a regular basis, you want to have a good catch-all spray that'll be very effective. And looking at the number of actives in that mix, it basically has everything," she says.

Though it wasn't part of the trial, Pam has factored in the cost of using Conviso seed compared with conventional, and then added in the cost of Conviso One (foramsulfuron+ thiencarbazone-methyl), as it's sold as a package. "It comes to about £260/ha with Conviso, but if you've got weed beet there's absolutely no reason you shouldn't be using Conviso — it should be your first choice."

Pam suggests growers look at their approach to weed control, considering things such as monitoring frequency, time allowance and whether a pre-em herbicide will be used or not. "If you're getting the best out of the actives that you're using, hopefully you'll get weed-free sugar beet and the best margin over treatment costs." ■

Plan blight strategies in reverse

> *“In some situations it can be easier to plan backwards from desiccation.”*

Potato blight

Blight strategies have become increasingly complex over the past decade or so. *CPM* looks at the latest changes in the blight population and how best to design blight programmes in light of them.

By Lucy de la Pasture and Rob Jones

News that another previously undetected strain of late blight (*Phytophthora infestans*) has been confirmed in Great Britain will surprise few. Fortunately, 41_A2 has so far only been found in a crop of Maris Piper grown in Fife but on the balance of probabilities, it’s unlikely to be an isolated case.

That’s the view of Nick Winmill, Agrii head of potato technical and development. But its presence raises some interesting questions and one of the most confounding is how did the new strain get there? It’s a pertinent question given that the UK has not allowed seed imports for the past two years, he says.

There are several possibilities, but some are more plausible than others, notes Nick. “It may have been carried on the wind but at 700km against the mainly prevailing airflow, I believe this is unlikely to be the reason. A more plausible explanation would be that it has either been here for several years undetected — it was first detected in Denmark in 2013 — or that it spread from another host, perhaps tomato. Either way, once here these strains tend to stay.”

So what do we know about 41_A2 and does it have characteristics that set it apart from other strains? Perhaps more importantly, should growers be concerned? The short answer is that enough is known about 41_A2 to take it seriously but there’s no reason to be despondent, believes Nick.

Highly aggressive

“Research suggests it’s highly aggressive and we know from work in Estonia that it has exhibited some insensitivity to fluazinam. Work in Denmark suggests a shorter latent period, meaning it can cycle between sporulations more quickly than other more established strains. The consequence of this is yet another reminder of the need to be vigilant to the threat facing crops,” he says.

Results of the blight samples submitted by blight scouts reveal how the blight population is becoming highly regionalised. While this is perhaps a reflection of how the advice to growers on crop protection varies across the country, it could also be a function of how conditions at a local level influence disease spread. In Wales, for example, there’s a high incidence of the fluazinam-insensitive strain 37_A2, while in England 36_A2 accounted for 40% of samples in 2021.

The 36_A2 strain is less well established in Scotland, where 6_A1 dominates — accounting for 30% of cases tested. Another strain, 8_A1, has become more prevalent in Scotland in recent years and was found in 15% of samples in 2021, but it’s rarely seen elsewhere in Great Britain.

“The results are most valuable when viewed through the prism of the limited fungicide choice,” says Nick.

“We know 36_A2, and to a lesser extent 37_A2, can sporulate at lower temperatures than either 13_A2 or 6_A1. The reason neither of these strains have established successfully in Scotland is a mystery.”

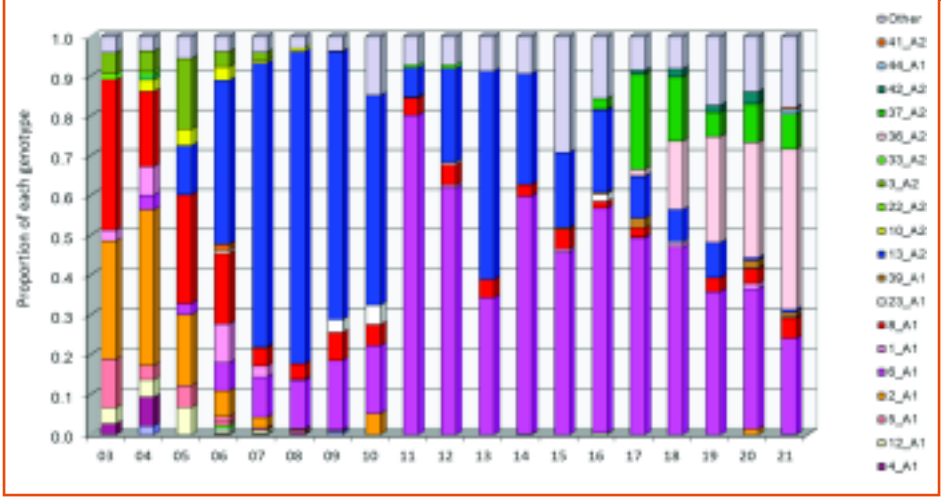
The shorter latent period of 36_A2, which is now an old foe, and most recently 41_A2 presents another challenge, says Nick. “How can we maintain protection between irrigation passes at times of high risk to crops?”

That’s when looking back can provide lessons for the coming season, he says. ▸

It’s the choices growers make earlier in the season that will shape the blight strategy towards the end, says Nick Winmill.

Blight programmes now have to start much earlier as blight genotypes have been displaced by more aggressive strains.

Blight genotypes in the population 2003-2021



Source: The James Hutton Institute, 2022

▸ In 2021, the period of high pressure in July, especially in the south and east of England, highlighted the capacity of modern strains — in this case 36_A2 — to inflict considerable damage in only a short period of time, he says.

It's the fitness advantage these strains demonstrate that's changing the way crop protection strategies are delivered, believes Nick. His advice to growers is to plan for the worst but hope for something far less devastating.

"In some situations it can be easier to plan backwards from desiccation. This way crops can be adequately protected, and programmes comply with resistance management guidelines.

"At the basic level, the main development (with the evolution of the blight pathogern) is that crops come under pressure at lower temperatures than in the past. This means keeping an eye on temperatures and being ready to start earlier than might have been the case just five or so years ago."

FRAC guidelines

If this were the only development it probably wouldn't be much of a problem but add in a latent period of less than four days and the complexity becomes clear. How growers schedule irrigation and spray timings to fit around blight spraying presents a problem," he says.

"Add in some high blight pressure for a month and this is when programmes can move from 10-12 sprays, to the mid to high teens. Under such circumstances, staying within the FRAC guidelines for resistance management can be a challenge," he adds.

The overriding objective, believes Nick, must be to preserve the integrity of the products available and minimise the risk of insensitivity developing.

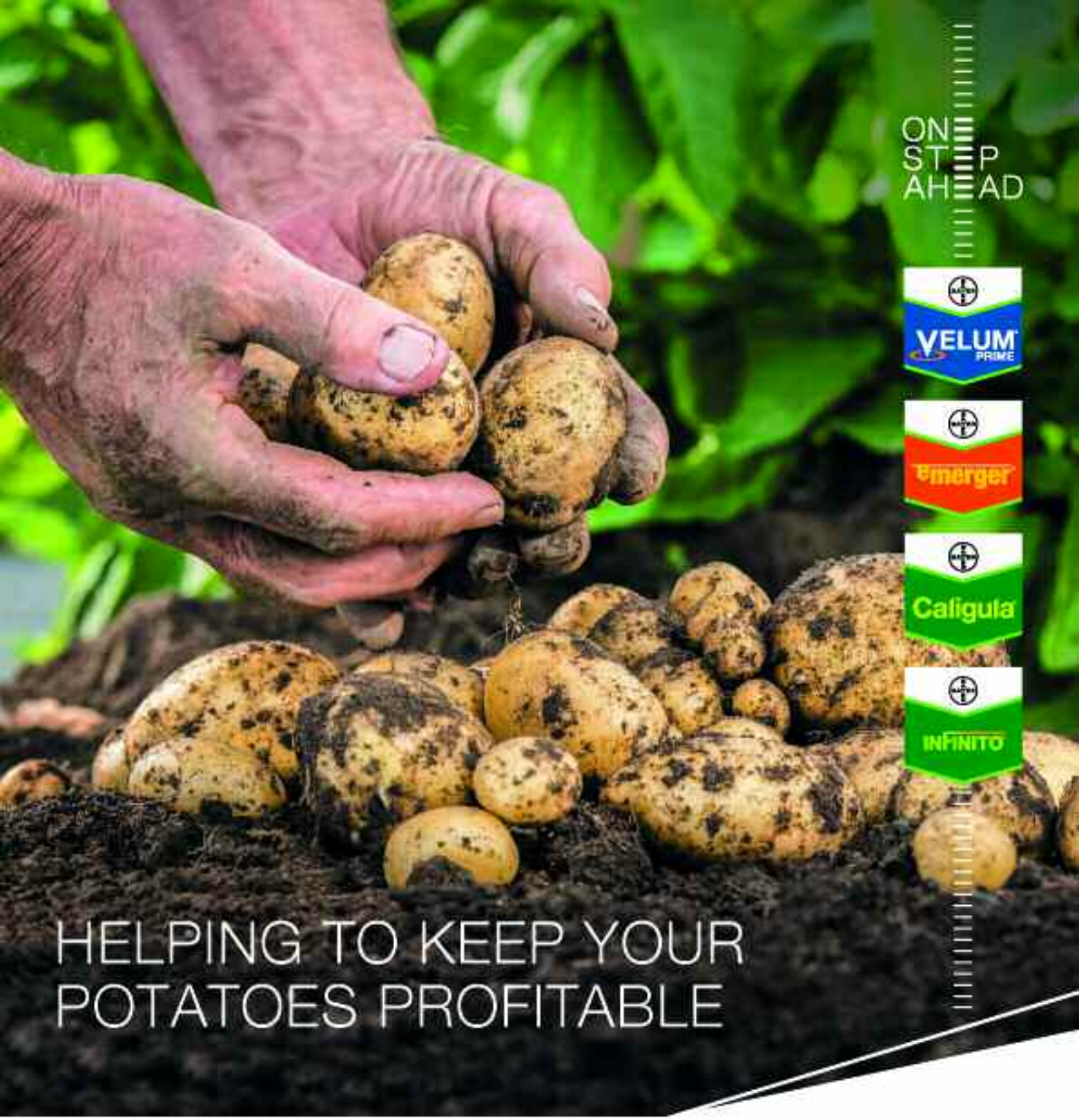
"I still favour mancozeb as a mixing partner, especially during the early season when it will be useful for protecting against alternaria, but also because of its multi-site activity. Multi-sites are important in protecting the effectiveness of not just the products we have now, but those coming in the future.

"We have seen this in our trials. The pipeline products coming through from manufacturers deliver strong protection in their own right, but they're all single site mode of action products so they need a strong partner to protect them from the risk of insensitivity developing. This is about being smart in the programme," he says.

As the season progresses, there's a necessity to bring in other partner products. ▸

Summary of blight genotyping finding in 2021

- **Population** – *Phytophthora infestans* continues to change – 2021 blight was locally serious with more than 200 outbreaks as part of AHDB's last season of Fight Against Blight reporting across GB
- **Displacement** – there was displacement of previously dominant genotypes (13_A2 and 6_A1) via continued expansion of the 36_A2 genotype that now comprises 40% of the sampled population
- **Incidence** – the incidence of the 37_A2 genotype with fluazinam insensitivity decreased from 10 to 9% of the population with 6_A1 reduced to 24%
- **Aggressiveness** – the aggressive clones are putting pressure on blight management – management mistakes may be costly
- **Inoculum** – more than 80% of the population is clonal, with primary inoculum surviving in tubers (e.g. seed, volunteers, dumps) from the 2020 season. The remaining one fifth of blight outbreaks start from genetically diverse inoculum (on the charts termed 'Other') emerging from long-lived sexual oospores. All sources of primary inoculum should be managed carefully; long rotations help manage oospore risk
- **Spatial variation** – local differences in genotype frequency apparent with 64% of samples being of 36_A2 in England compared with 6.5% in Scotland. Conversely, almost 42% of samples from Scotland are 'Other' compared with a mean of 8% from England and Wales. The 8_A1 genotype also comprised 15% of samples in Scotland but was not reported in other British crops
- **New threat** – 41_A2, a genotype never sampled previously in GB was found in a crop in Scotland (late August 2021); the 41_A2 type was first reported in Denmark in 2013 before spreading to other Nordic countries as well as Poland and Germany. The migration pathway into Scotland and its potential impact are unclear. This highlights the future threats of such incursions and the need to understand the spread and impact on IPM
- **Fungicide sensitivity** of isolates of the 6_A1, 36_A2 and 37_A2 lineages to seven key fungicide active ingredients were tested in the laboratory. No changes in sensitivity were detected but growers should follow manufacturers' and FRAC guidelines to protect the lifespan of active ingredients



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To stay within FRAC guidelines, careful planning is required so that fungicides to protect against tuber blight are still available for use at the end of the season.

▸ It's the choices growers make at this time that will shape the blight strategy towards the end of the season, he says.

"I would encourage growers to trade up from cymoxanil to Versilus (benthiavalicarb). There's strong data from SRUC comparing the curative performance and forward protection from benthiavalicarb and cymoxanil. We know from other work that cymoxanil has at best 36 hours of curative activity, but we now know Versilus plus the drift retardant, Crusade, that there's an uplift in performance that takes its curative activity above that of Infinito (fluopicolide+ propamocarb), which is widely regarded as the standard to beat. This will be vital in periods of high pressure in the mid-season," he believes.

"The strong performance of Versilus and its compatibility with a range of other active substances means that it has a place across the programme. Making the most of its contribution while staying within FRAC guidelines is the challenge. For those who favour Zorvec Endavia (benthiavalicarb+ oxathiapiprolin) it creates a difficulty," he adds.

Product sequences

FRAC guidelines state that no more than six fungicides from the Carboxylic Acid Amide (CAA) mode of action group, of which benthiavalicarb is one, should feature in a programme and that no more than three consecutive applications of a CAA should be made. It also gives the guidance that CAA fungicides shouldn't make up more than 50% of the programme.

For those keen on saving a CAA for elsewhere in the programme, one option is to switch to a zoxamide-containing product, such as Lieto (cymoxanil+ zoxamide), advises Nick.

"If we're to stick to the FRAC limitations, then it makes sense to use mancozeb — either with or without cymoxanil — in the early part of the programme because the focus is on protection in, what we hope is, comparatively low pressure. This leaves benthiavalicarb for use later, possibly in combination with Enervin (ametoctradin)," he says.

More consideration could be given to construction of the blight programmes to avoid becoming backed into a corner should the disease pressure intensify, believes Nick. The big question to consider is what to do if programmes expand from a typical 10-12 sprays to a programme consisting of 16-18, he says.

"There are desiccation implications stemming from the loss of diquat. In general terms, think about desiccating a week earlier than previously. In practice this means not being late with nitrogen fertiliser applications either."

It's often easier to plan the programme in reverse to make sure there's sufficient tuber blight protection at the end of the season to run alongside the desiccation programme, says Nick.

"This means we can use the two Quinone inside Inhibitors (QiI) products, amisulbrom and cyazofamid, with a suitable mixing partner and in alternation with products containing another mode of action, such as Infinito (fluopicolide+ propamocarb).

"The approach will change again in 2023 as we expect to have a new product come to market that will expand the product choices," he concludes. ■

Sums add up for potato weed control

Greater use of natural regeneration breaks and cover crops in arable rotations means the weed seed burden of some of the more troublesome weeds for potatoes are on the increase, according to Syngenta.

Potato growers feeling the pinch of price pressures this spring could look at simplifying herbicide mixes for more cost-effective pre-emergence options, advocates Syngenta technical manager, Andy Cunningham.

"Recent potato herbicide introductions have increased agronomists' options. In many instances, simple mixes can achieve everything growers want at lower relative cost," he suggests.

Many of the key weeds during early potato emergence can be controlled using the strength of mixes to widen the specific weed spectrum, adds Andy.

In recent trials, a mixture of Defy (prosulfocarb) at 4.0 l/ha plus metabromuron at a reduced rate of 1.0 l/ha, achieved full control of broadleaf weeds present, which included chickweed, mayweed, cleaver and shepherd's purse. Untreated weed pressure from these species was more than 70/m2.

That combination, typically costing just £43/ha hectare at current prices, was even more effective overall compared with Defy at 3.0 l/ha and metabromuron at a rate of 2.0 l/ha, which would cost nearly £55/ha and proved slightly weaker on cleavers, he says.

Using Defy at 4.0 l/ha plus metribuzin at 0.5 l/ha could also reduce costs, believes Andy, but the trial showed that overall effects on some weeds may be reduced. "It's important to know the target weed spectrum when putting together mixes of the most cost-effective actives and appropriate rates."

As well as the wide spectrum of broadleaf weeds controlled by Defy, it also offers control of grassweeds including meadow grasses and ryegrass, he says. "Using a higher rate extends the residual activity and means applications can be conveniently made soon after planting, until soil is rising over emerging potato shoots, to keep fields clean through to crop emergence."

New Syngenta potato trials for the 2022 season are set to investigate the extra benefit of total weed spectrum control from increasing Defy rates to 5.0 l/ha, at marginal extra cost in a high-pressure situation, as well as mixes with new and existing herbicides.

Andy Cunningham suggests simple herbicide mixes can achieve everything growers want at lower relative cost.

"Some options with newer herbicides in the trial add up to in excess of £100 per hectare, with others as low as £20. It's vital to tease out what each component is contributing, to enable better informed decisions in the future," he adds.

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BELCHIM CROP PROTECTION

talkingtaties

by Andrew Wilson

Making changes in volatile times?

The world is a crazy place at the moment, with volatility not seen before in my working life (I'm a mere pup of 45) that is largely beyond our control.

So how do we handle this? It's hard investing when cashflow is terrible and profitability has been meagre (why did I sell 30% of my wheat in December 2020?). But standing still is going backwards, and that isn't an attractive proposition.

A wise man said to me many years ago "do what you do best and do it better". Wise words but what do we do best? Adapt, that's what.

We're only a small operation, but that can be a strength. We grow feed wheat and barley, malting barley, milling and seed oats, human consumption beans, sugar beet, processing potatoes, and grass for hay. We've finished pigs on straw on contract for 30 years, generate electric from solar on a shed roof, and do some contract work for others in various forms. Until 2019 we ran a haulage business too but, after my father passed away in 2018, we wound it up (a good move as things stand today). After a lot of spreadsheets and soul searching, it didn't stack up at the scale we were at. Diversification needs to be both profitable and complement the core business, not hamper it.

So is regenerative agriculture a cool new buzz word or the way forward? I think it's different for everyone. Our business has been largely built on root crops, and that is where my passion mostly lies, so simply dropping them and buying a direct drill isn't the answer for us, but that said, there is always a better way to do everything. A direct drill for me is as much a strategic tool as a plough, and at certain junctures in the rotation, it's very much a tool of choice.

Our heavy land rotation is two wheats punctuated by cover crops and spring break crops, which has been much more successful than our previous wheat-barley-oilseed rape rotation, and before that continuous wheat with bits of setaside. The covers have worked very well, provided we don't sow them too thick, and the less we work this land the better it gets, but occasional strategic ploughing does help keep grass-weeds in check. Our straw is all baled and returned as muck in rotation, which dictates traffic is inevitable.

After many years of min-till, we had some demonstrations of strip-till drills last autumn and have ordered one for 2022, with help from a Defra FETF grant. We intend to fit some pipes to apply some Consortium and Bugboost down the legs after encouraging experiments in beet and potatoes.

My current dilemma is the oat price is stubbornly poor, versus OSR at a record high. Oats provide straw, use very little inputs, are low risk and spring sown. Potatoes command the largest share of attention, so chasing slugs and pigeons all winter doesn't appeal. Two-row barley on claggy land here has never been good, so it would necessitate a move to hybrid 6-row varieties. The jury is out for now.

Beet has finally seen a lift in price but being this far north it'll be swallowed in part by transport. It's been a good performer, uses low amounts of expensive fertilizer and spreads work.

Does it make money? Some years definitely. We're cutting cost out via strategic changes in cultivation and we're experimenting with applied biology and strip-till establishment. The potential is encouraging at least!

The pigs, solar and contracting help reduce our volatility and exposure, but the potatoes increase it, particularly from a cashflow point of view — never more so than now — and the future looks far from rosy. Risk and reward have been out of kilter for too long, and growers lack fat on their backs to ride these storms. So in a time when we must cut every cost we can, Red Tractor's insistence that we spend £179 on a pesticide residue test that is of no value to anyone sticks in the craw a bit.

Scale is an interesting part of my head scratching. Two years ago we cut our spuds back 30% and we're better off for it. Arguably the most profitable spuds we grow are at home, and if things refuse to improve, that's where we will go back to. Processors know that they need to step up, but we're at a point where it has to be more than the 'just enough to keep going' that often happens, due to the ever-increasing risks and work involved in growing the things nowadays.

I'm one to find solutions for problems, and we're tweaking where we can. We have changed a huge amount in the last 15 years or so to reduce fuel use, improve soil, maintain quality, and improve returns, but all too often it feels like the faster I run the faster the treadmill turns!

Volatility isn't going away, and there will undoubtedly be changes that need to happen that we haven't thought of yet, but I'm cautiously optimistic for the future of British agriculture. Where there's threat, there's opportunity. Where there's opportunity there's challenge, which brings satisfaction, and a few quid if we're lucky. All work and no brass makes Andrew a dull boy!

Andrew Wilson is a fourth-generation tenant of the Castle Howard Estate in North Yorkshire.

He has a strategic approach to direct drilling on his varied soil types and grows a wide variety of crops. He's passionate about the potato industry and having been utilising cover crops to reduce cultivation and chemical use since 2011, dipped his toe in the water of regenerative potatoes in 2021.

@SpudSlingsby

lastword

by Lucy de la Pasture

Waste not, want not

I'm not alone this month in finding it trickier than normal to find the words for this Last Word. Every one of our four farmer columnists has found themselves in the same boat — in spite of all the problems we're facing here in the UK, it pales in comparison with the unimaginable situation many are living under in Ukraine. But reading the column pieces as they came in, it's been apparent that we're all thinking about the same things — food security, market volatility and our connection with food.

The news that in the besieged city of Mariupol residents had resorted to killing stray dogs to eat got me thinking about how much we take food for granted in the western world and about food waste in particular. The stats that 30-40% of our food is thrown away is nothing short of shameful really. It's one of the biggest issues we should be addressing and yet it's something that's largely ignored in our society. We'll happily don a red nose, raise some money for those less fortunate at home and abroad and not think about our own lifestyles and attitude to food.

My mother was a war baby and my father served during WWII in the Royal Navy. As children we grew up with stories about ration books, powdered eggs and the luxury of sugar and chocolate. We were exposed to images of starving children in Cambodia on the BBC's six o'clock News (I think it was actually five o'clock in those days) — we knew we were fortunate. We each had a little plot in the veggie garden, so we discovered the excitement of harvesting the seeds we'd sown — though the weeding was never something I enjoyed much!

We learnt to eat what was in front of us and not pile our plates too high so that we left them clean — uneaten food would have been an afront to the hardships our parents had endured. We had a roast for Sunday lunch, and it then fed us for days to come as every single bit was used up and the bones turned into stock to make soup.

I never understood that other families had a different attitude to food until I went to University and lived with two other girls in a (very squalid) rented student house. When taking on cooking duties, it was normal to be relieved of clearing/washing up duties by the other two. Having roasted a chicken one night, to my horror I witnessed the remainder of the chicken — still sporting a leg, wings and that most prized of all morsels, the oyster underneath — tossed unceremoniously into the bin. In my mind that was lunch and supper for another day.

That's when I realised that the connection with food and its worth isn't the same for everyone. Growing up on a farm, you're acutely aware of the risk and hard work that goes into producing food and where meat is concerned, that an animal has died to feed us.

How to reconnect farming and food isn't a simple problem to solve. The true value of food has been undermined for decades to keep food cheap, though arguably the British love for highly processed foods has its own cost in terms of health. Quantity also often trumps quality in an 'as much as you can eat' culture.

Initiatives such as Farmer Time, which takes farming into the classroom or the classroom onto farms is a great start. The internet and social media have created more connection than there was 20 years ago, but the disconnect between farming reality and public perception has been stark when reading Twitter threads since Putin began his war.

People believe farming subsidies are still based on production, whereas that price support disappeared years ago. They believe that there are butter and grain mountains and milk lakes — again these products of the CAP disappeared decades ago. And then there's the old chestnut I've seen bandied around recently: 'have you ever met a poor farmer?'.

Misconceptions about farming abound and somehow as an industry we have look at our PR and reach out to the consumer, to people outside our circle of understanding. I don't believe we have a single body that's really achieving that, though we have individuals who are cutting through the barriers that separate those living off the land and the majority of those who regard food as something they buy in a shop.

The past two years of the pandemic should have taught us something, not least that our supply lines are inflexible and fragile. And here we are with another crisis threatening food and energy security. Let's hope the politicians wise up to the fact that out-sourcing our food supply to countries the other side of the world isn't the best solution. Neither is another 'dig for victory' campaign. Probably our society should look at its own eating habits first and foremost and work harder to embrace the mantra of my own childhood — 'waste not, want not'.

Based in Ludlow, Shrops, Lucy de la Pasture has worked as an agronomist, while among the Twitterati, she's ***@Lucy_delaP.***

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