ISSUE 27 | APRIL 2024

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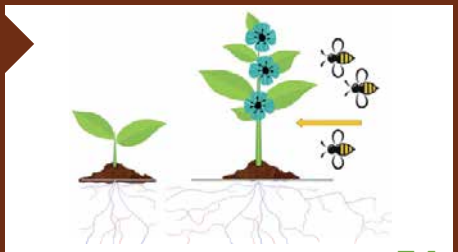

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DIRECT DRILLER MAGAZINE

Issue 27
April 2024

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INTRODUCTION

MIKE DONOVAN, EDITOR

Following the money

It looks like arable movers, shakers and advisors seem to be moving away from yield, costs and profits towards the birds, bees and ecology. They're 'following the money' as Warren Buffett might say. Today they are making the choice between AHL1 (pollen and nectar flower mix) at £739 / ha/year or leaving their Sustainable Farming Incentive programme at AHL3, (grassy field corners and blocks) at £590. The question is "will the marginal returns of going for the more expensive mix cover the added expense over the field corners? Are the corners going to satisfy outcomes more easily than the pollen?"

The SFI actions can extend to 25% of the farm, enough to alter investment decisions "will we need that bigger seed drill, combine or tractor when our acreage is reduced?" "Should we max out on SFI on the basis that the world grain market will continue to be well supplied with static or even depressed prices, even in a world with wars, storms, flood and drought?"

Advisors will be following the money as well. Graduates in ecology or environmental science find multiple openings for salaried work with numerous organisations which, only a few years ago, had no-one looking after this side of their business.

It's a new science with tentacles that reach back to the development of life on earth. It was not so long ago that ecology and the environment were areas of study that had a dilettante appeal that competed with art history and other esoteric areas of study. Ecology today has become mainstream and headline news, and there's a danger it will leave the study and world of agriculture in it's wake.

Why not have both? The agronomist who can advise on outcomes of both crop production and ecological enhancement has two vital feathers to their bow. The advisor who understands the downsides and well as benefits of traditional chemistry but who also has knowledge and experience in using bio-stimulants of all varieties is likewise one who can make the most of both nature and the continuously changing technology of agri-chems in its widest sense. Research and progress needs to continue at a useful pace, keeping on top of challenges which will present themselves as a consequence of climate change and other events.

What starts off as being a basic study leads to dozens of important interlinked pathways, all having a major significance to food production and other farming outcomes.

I truly believe that Direct Driller has a lead in publishing the integration of farming and ecology in the quality of it's articles (thank you contributors), and the quality of its readers (thank you, readers). I am always interested in contacts with both groups. mike@farmideas.co.uk

TO BE OR NOT TO BE

WRITTEN BY CHRIS FELLOWS

Never fear, I'm not venturing into Shakespeare here. Not only are my writing skills lacking, but I can't see Direct Driller ever making it to the stage either.

However, I am questioning the desire to be labelled a "regenerative farmer". Do you want or need to be labelled at all? This is not quite weighing up life and death, as hamlet does in his soliloquy, but it is important to know what you want to be. Because wants and needs on farms soon become costs and profits. Understanding your journey is a critical step to profitability and sustainability at a farm level.

When I read or listen to our Farmer Focus writers, they often seem clear on this path. This has led the likes of Andy Cato to set up a whole brand and ethos to go alongside their beliefs, allowing other farmers to join them. Tim Parton is part of the Green Farm Collective (not to be confused with Red Tractor's disastrous Greener Farm Commitment). They have set out their stall and now have put measures alongside that and you must be able to measure something to make it happen. Now, you can be a Wildfarmed farmer or a GFC farmer,. you can have a label but what is the point of a label unless it benefits your business? These labels can come with benefits.

All farmers in the UK can benefit from SFI payments from the government to add biodiversity to their land. Thus moving them all along a regen journey and that comes with income. There is definitely a reason to make this step but does doing SFI make you a "regen" farmer? Some might say yes, some will say no. For me, it will depend on the farm and farmer, whether they see SFI as part of a wider journey, or just a replacement for BPS.

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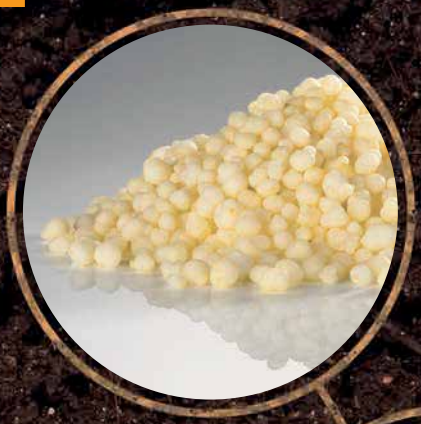

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FARMER FOCUS
BEN TAYLOR-DAVIES

January 2024

Neurodiversity and oubaitori, 2 words that presented themselves to me towards the end of 2023, 2 words which answer a lot of questions to many of my life's struggles, thankfully something that seems to have been put well behind me since finding regenerative agriculture and realising this would cure my mental health issues.

Typically, I had to find the answers to my problems before they found me, however I spend my farming life doing the same. Neurodiversity is now, quite incredibly, the name given to those suffering from anything on the autism spectrum; ADHD, Dyslexia and or Dyspraxia. As a farmer I have 3 times more chance of being neurodiverse than the rest of the population... It took me over 30 years to realise this is a good thing and in farming a great thing.

Historically a farming family would have many children, with the academics of the family heading off to the city to work and those with less academic ability to remain home and use their more practical brain to farm. Natural selection then meant this was kept as a trait as farms were handing down through generation after generation.

Farming throughout history was a problem-solving industry, without the ability to reach for packets, cans, bottles, bags and syringes, the ability to think laterally was a real asset. This kept these special minds occupied day and night. However, take away the need for the problem solving with the green revolution, a world of advisors and you still have a brain that is hugely active and needs feeding, often with all the things then beyond control and why mental health issues (in my view) is so high in agriculture.

Oubaitori is the Japanese idea that people, like flowers, bloom in their own time and in their individual ways. Education for myself was a struggle, certainly until A levels when my geography teacher Mrs Miles decided to change tac on my teaching and proceeded to bet I couldn't do something, the result was an A in A level geography and then a BSc in Geography at Liverpool University. However, what I discovered was education for myself only became interesting and exciting when I was learning about something I felt stimulated by.

I think many farmers I speak to have very similar sentiments when it comes to both Neurodiversity and oubaitori, what a great asset to implement a sustainable future for my own farm?! Put my mind to work with something that interests me and with it drive profitability.

Lunchmoney Lewis even sang about them "Bills", something we as farmers need to focus on far more than we do. It's easy and even lazy just to pile into the agchem industry, yet rarely do I see a pile on into the veterinary industry, insurance, banking, machinery industry and even auctioneer markets, all of which have based their industry extracting what they can from our profits. It's a real issue and something we are concentrating on at Townsend Farm (Ross-on-Wye) where we farm 220Ha of deep river silt or the red sandstone loam over sandstone the area is most famous for. As I've mentioned in so many podcasts, farming is essentially taking 3 free things (Sunlight, precipitation and carbon dioxide, putting them through soil) and making profit, yet somehow, as an industry most farms are in debt...

Agflation is frightening, my grandfather retired when he bought a Massey Ferguson 135 (which we still own) in

1965 for £885 purely on the basis that he couldn't see a future from farming if the cost of a tractor was to go north of £1000. Allowing for inflation, the £885 would now equate to £14,283.76, with all the modern technological advances, how much really have we gained? Our Ford 7810 (95hp) during the 90's ran a 4 furrow auto reset Kverneland plough, it would now seem driving around that between around 200hp seems the norm for a 5 furrow plough - what has gone wrong?

Dopamine is the simple answer, the feel-good drug our body releases as we prepare to and then complete the purchase of a new item. "The reward drug" from retail therapy for farmers is often used in the absence of this drug being released if you manage to solve a problem on the farm without using the 'industry standard', the latter of course being far cheaper! I am not saying the drive for new technology shouldn't be sort after, what I am saying is the machinery manufacturers use this dopamine drug to lure you into the showroom and you leave feeling great after parting with a small fortune...

"Intensifying diversity simply" is the 3-word motto of the farm, with the disappearance of BPS and the obvious need to demonstrate to the general public that any money they are being taxed for to give to farmers should be earned for the benefit of everyone as public goods. There seems to be real reluctance to embrace SFI, for everything it is, along with other schemes aimed at providing support to farms that now offer a financial incentive to protect their main asset (soil) because without this support many are happy to see it literally flow out of the gateway... Soil is simply like a bank account, if there is less going in than going out you are in debt, when you pass, how much debt are you leaving your kin? How many farmers reading this can honestly say they have more soil today than when they began farming? I'll be brutally honest - definitely not me!

Fighting the bills has become our major focus on the farm, our latest project has been the resurrection of our wind powered water pump which fell into disrepair in the 1960's and sat there as a relic for so many years, often meaning to push the tower down and send it off for scrap, we now have part A of our energy sustainability project up and running. A FIPL (Farming In Protected Landscape) grant helped us out a bit towards the cost of having the mill restored and to see the dopamine oozing out of me as the wind turned it and it started pumping water for the first time in 60 years is an understatement, but like anything on the farm this is the just the beginning. The water will be pumped to large storage tanks up at the farm, where of course it will provide water to ourselves and the livestock, but will also feed the solar powered electrolysis unit to split the water into hydrogen and oxygen. The hydrogen to power farm vehicles and the farmhouse heating system and the oxygen used in the compost extraction system. Can we be one of the UK's first fossil free farms?

The brewery on the farm is another example of our circular economy way of thinking; produce malting barley, have it malted, sell it to the brewery, use it for 4 hours and then feed the brewers grains to the few Wagyu cattle we now have, combined with their ability to swallow up the waste beer and the introduction of a rotating cattle brush as a massager - will we be producing A5 meat within a few years? Time will tell!

IS **REGEN FARMING** PRODUCING MORE NUTRITIOUS FOOD?

Written by Mike Abram

Can how you grow crops impact on the nutrient and health value of food? It's what farmer and doctor Hannah Fraser is trying to find out on a Nuffield Scholarship

For a long time there has been a suspicion that how you grow food will determine its nutrient status and ultimately impact how healthy consumers are. It's a claim some in the organic farming sector, and more recently regenerative farmers have tried to make but is there evidence to back that up?

That's what motivated first generation farmer Hannah Fraser to investigate the topic for her Nuffield Scholarship.

"Five years ago, I knew very little about food production," she says. That was the moment she and her husband Alex took on farming the land around the family home at Denby Hall Farm, near Huddersfield in Yorkshire.

Deciding to farm organically, Hannah and Alex, the pair have embraced practices designed to restore soil health as quickly as possible.

Linking how farmers can impact the health and nutritional value by how they farm was a natural step given Hannah's day job as a medical doctor at a Leeds hospital.

"I've learned a lot working in the medical profession," she says. "Sadly we

have a real issue in this country with chronic diseases, such as diabetes, high blood pressure, dementia and heart disease. They don't go away easily, often requiring a lot of medication and follow up, impacting quality of life."

In the UK, she says, just under half the adult population suffers from at least one of these conditions, and while life expectancy is a reasonable 81 years, the age to which we're expected to live well with no medical problems is only 63.

"What's more worrying is these numbers are in decline, so our health is potentially getting worse."

A lot of research shows the importance of food and diet in reducing disease risk, but, while nutritionally dense food is far from a new concept, much less research has been conducted linking how food has been grown to nutrient richness and our health.

There are essentially three components to food that determine nutrient density – macronutrients, micronutrients and phytochemicals.

Macronutrients are the big things – proteins, carbohydrates, fats and fibre, Hannah explains, while micronutrients are the vitamins and minerals present in small amounts. Phytochemicals include thousands of plant-made chemicals, such as beta-carotenes, anthocyanins, phenols and flavonoids.

"Macronutrients often get talked about more in dietary recommendations, but I think it is the micronutrients that can really make a difference to our health. We can't make these ourselves, so they have to come in our diet.

"In high income countries, where people are relatively calory-secure, just under half of children under the age of five and half of women of reproductive age are deficient in at least one of these micronutrients, so how nutritious our food is could make a real difference."

Research is also finding phytochemicals have remarkable effects in the body including anti-cancer properties and reducing inflammation, which can be an important component of those chronic conditions.

"It's why we get told to eat a variety of fruit and veg; eat the rainbow."

But there are a huge number of unknown phytochemicals in food, which have unknown impacts of our health or how farming systems influence their levels, she adds.

So has the nutritional levels in food declined? Some data suggests it has – a group of scientists compared UK government data between the 1930s and 1980s in 20 vegetable and found 19% lower calcium, 35% less magnesium, 22% iron, 81% copper and

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14% less potassium, Hannah says.

"Similar findings have been found in US and Finnish data, although there is criticism of this data. Testing will have improved since the 1930s, and there could have been errors, such as tiny traces of soil left on food which would have made the nutrients levels higher."

What about testing today's food and seeing if it varies? That's what US-based Bionutrient Food Association is hoping could be possible with a handheld device, Hannah says. "To calibrate the device they've been taking food samples from across Europe and the US to see how the amount of nutrients varies."

And the answer is in some foods it can vary a lot. For example, in kale the amount of calcium can vary between 15% and 40% of the recommended daily intake, so at the lower side you would have to eat three times as much to get the same amount of calcium.

The same applies for some other nutrients and vegetables, while similar analysis for polyphenol and antioxidant phytochemicals shows wide variations in some fruit and veg.

"We can't say what the health impact that is as we don't know how many phytochemicals you need to be healthy."

So can we produce more nutrient dense food through changing the way we farm? That's what those farming using regenerative or organic practices hope, and there is some evidence starting to emerge that might be the case.

Geologist and author David Montgomery and partner Anne Bikle, a biologist, have set up a preliminary trial comparing 10 regenerative farms with conventional counterparts in the USA.

Early trial data suggests, for example with cabbages, the regeneratively farms are producing food with more nutrients. "For vitamin K, 30% more of the amount that you need in a day was in the regenerative cabbage compared with conventional, and 10% more vitamin C.

"In wheat and oats, there was quite substantial differences in mineral content, but it's just 10 farms so we can't draw conclusions yet, and shows what a study looks like."

Other studies have shown higher amounts of ergothioneine, which is produced by fungi and nicknamed the longevity vitamin because it seems to prevent ageing, is found in soybeans and oats produced in a no-till system compared with plough-based establishment.

"It's an interesting example of how a healthy soil might be providing different compounds," Hannah suggests.

Or there's the study showing higher abundance and diversity of beneficial microbes on salad grown in soil compared with grown in a sterile vertical system. These microbes might be helping to populate our gut microbiome, keeping us healthy.

Breeding varieties with higher nutrient density is also possible, as shown by Harvest Plus, a group working in developing countries using conventional breeding to increase iron, vitamin A and zinc in crops.

"Could we breed a wheat that's high in zinc, iron and copper?" Hannah asks. Already in Finland a programme to apply a foliar selenium fertiliser to wheat has helped solve a deficiency issue in its population.

In livestock agriculture, researchers have found the amount of forage in dairy diets balances the ratio of omega 6 to omega 3 fatty acids in milk to around 1:1 when the animals are fed 100% of forage, compared with 8:1 when there is minimal forage in diets.

This is important as in modern diets we're consuming around 16 times more omega 6 than omega 3 and scientists think this could be promoting inflammation causing heart attacks, Hannah explains.

"So 1:1 is more in line what might be healthier for us," she says. "And the same 1:1 ratio has been seen with grass-fed beef compared with 10:1 for cattle finished on a mixed ration.

"There were also a lot more phytochemicals in grass-finished beef."

Those research findings are giving confidence to Hannah that there is real evidence that different farming techniques can produce healthier, more nutritious food, although more is required and will be needed to convince the public and for policy makers to put in the right incentives for farmers to switch practices.

"We're in the early days of recognition of the link between farming and health," she says.

Harking back to a quote in 1943 by Lady Eve Balfour, a British organic farming pioneer, that spoke of the connection between health and correct soil management and the need for any public health system to be connected to soil fertility, Hannah hopes that farmers will be recognised for the important role they play in public health.

"Maybe one day like today when we're starting to be paid for ecological services, we'll start to be paid for health services for the role we play in producing nutritious food," she concludes.

LONG AWAITED CLARITY FOR **CARBON ACCOUNTING TOOLS**

After a year-long investigation, Defra's report: 'Harmonisation of Carbon Accounting Tools for Agriculture' is providing much-needed guidance on appropriate standards for carbon reporting. *Direct Driller* spoke to Dr Emily Pope from Trinity AgTech to find out what this means for farmers.

A new era for carbon accounting: From the 'Wild West' to the 'Collective Era'

Emily explains that before Defra's report, the landscape for carbon accounting was unregulated with no clear direction or guidelines.

"Many people called this the 'Wild West', however, that era and its financial and environmental futility is shifting to a new era.

"This new 'Collective Era' is defined by a movement towards global standards, protocols, rigour, and well executed methods as well as continuous innovation, trust, credibility and collaborative learning.

"All these parameters will help to deliver robust supply chains, environmental progress, and prosperous rural communities," says Emily.

Detailing the positive implications of this for arable farmers, Emily adds: "We can expect to see farmers and the whole supply chain starting to earn fair and full recognition and reward for trustworthy and credible decision-making that delivers efficient environmental progress in tandem with food production."

Why assess a farm's carbon footprint

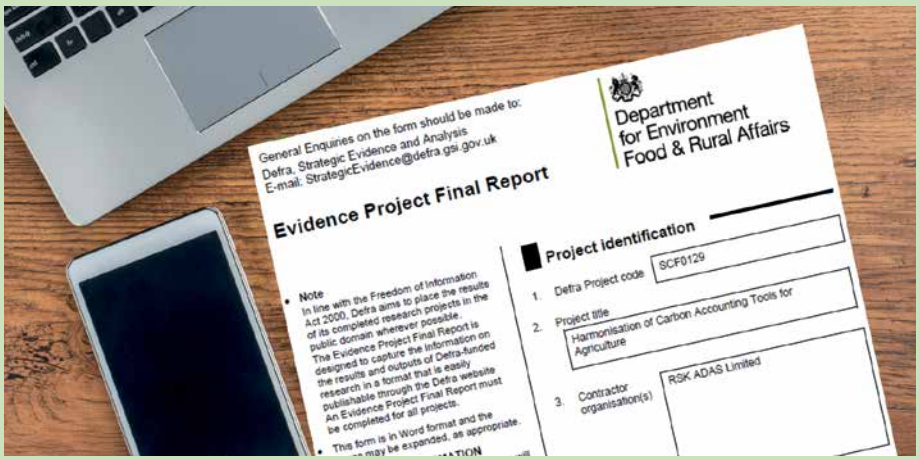
Emily stresses the inevitability of credible and trusted carbon footprint assessments for all farms, not least because of the increasing attention to the laws and regulations against greenwashing and simple box-ticking. She is also keen to highlight the wider opportunities associated with robust and reliable natural capital navigation.

"The push of carbon footprinting from the supply chain is unavoidable; we're seeing it increasingly in the livestock sector and other sectors will follow.

"I'm therefore urging farmers keen on better economic and environmental outcomes to remain firmly in the driving seat; this means using reliable software to ensure they have the most accurate data possible, on not only the carbon they emit but also the carbon they sequester," says Emily.

She explains that there is a big difference in emissions and sequestration.

"All farms have inputs, it's unavoidable, but they also have trees, hedges, and other natural assets on the farm.



The long-awaited Defra report provides much needed guidance on appropriate standards for carbon reporting

Dr Emily Pope, managing director of knowledge and collaboration at Trinity AgTech

"Often, these environmentally beneficial features are overlooked in carbon accounting.

"This oversight can unfairly portray farms as having a higher environmental impact by focusing solely on inputs and emissions.

"However, natural assets on farms play a crucial role in offsetting the farm's carbon footprint by absorbing carbon dioxide, essentially mitigating some of the emissions from arable operations," says Emily.

She adds that recognising and accounting for the positive environmental contributions of maintaining natural habitats on farms is essential.

"This allows farmers to demonstrate the comprehensive environmental stewardship of their operations, challenging the narrow focus on emissions and highlighting their efforts in promoting sustainability."

If farmers are asked to undertake a carbon assessment, Emily advises that the carbon accounting tool should be critically assessed. "Outdated 'first generation' calculators are still being recommend by some businesses, including a few

consultants, but these tools produce falsely simplified results that undervalue natural capital assets."

However, Emily adds that Trinity AgTech's Sandy is the only tool which complies with the most up-to-date recommendations, as per Defra's report, and also supports on-farm decision making helping to drive efficiency savings.

"Measuring and benchmarking a farm's carbon footprint is an important part of decision-making and its value shouldn't be underestimated.

"By assessing a farm's carbon footprint on a field-by-field basis, farmers can start to understand what's driving the footprint and make management changes to lessen it."

There is evidence that lower carbon footprints are associated with higher efficiencies, which are linked to cost savings.

"In the UK, emissions from arable production are generally between 1 and 4 tonnes of CO2 equivalent per hectare," says Emily.

She adds that the emissions intensity per tonne of crop produced can vary widely.

For example, emissions from high yielding crops, such as forage crops, can be less than 100 kg of CO2 equivalent per tonne of crop. Whereas emissions from crops with lower yields, such oilseed rape, can be more than 700 kg of CO2 equivalent per tonne.

Without undertaking an assessment, Emily notes that many businesses would be unaware of their output.

Worse still, they could be using a tool which is not fit for purpose, which could potentially be giving unreliable data and misguiding decision making.

Public and private investment around natural capital is also growing, but farmers should consider these opportunities with diligence.

"Farmers could do enormously well for themselves and the supply chain to properly understand the extent and the value of all of their natural capital assets, from carbon through to biodiversity, and be confident in the credibility of their assessments before embarking on any arrangements.

"This is the key to recognising the true value of natural capital using reliable, comprehensive and accurate software."

Choosing carbon accounting software

Emily explains the landscape of carbon assessment software is complex, but fortunately Defra's report has finally offered clear guidance and direction.

"Given that farm-level carbon accounting is currently completely unregulated, there is significant divergence in calculation methodology and the resulting information.

"This has reduced trust, stalled environmental efforts, and prevented proper recognition and reward."

Defra's report started by reviewing 81 global carbon calculators, analysing in detail the six most relevant and suitable for UK farming.

Reading the report we clearly see that only one tool stood out as being uniquely fit for purpose, Emily explains it was Trinity AgTech's Sandy.

"This was in part, but not solely, due to Sandy being the only tool to align with the recognised standards recommended within Defra's report, including ISO 14064:2, ISO 14067 and the draft GHG Protocol Land Sector and Removals guidance, supporting the Science Based Targets Initiative (SBTi)," she says.

Sandy – a new category of carbon accounting software

Having recognised the extreme pitfalls of 'first generation' carbon calculators that are often used to assess farm-level carbon, Emily explains that Trinity AgTech has pioneered food and farming's

Questions to ask before choosing carbon accounting software

If farmers are asked to use a specific carbon accounting tool, Emily encourages them to ask the following questions to ensure the enterprise is not being penalised and disadvantaged:

- Does it align with the standards recommended within Defra's report, these are ISO standards 14064:2 and 14067 and the draft GHG Protocol Land Sector and Removals guidance which is supportive of the Science Based Targets initiative (SBTi)? This is a must to produce trusted and reliable data.
- What data is required and how does the tool handle assumptions? This effects the accuracy of the output and the ability to identify specific areas for emissions reductions.
- Does the tool provide guidance and support for understanding and interpreting results? Given the complexity of carbon accounting, the tool must offer clear support to enable farmers to make informed decisions about reducing emissions and enhancing carbon sequestration on farm.
- Handling of low carbon fertilisers: the Defra report discusses the complexity of emission factors and how they vary between calculators, particularly with manufactured fertiliser and organic manures.
- Does the tool fully represent the farm's activities: a tool should comprehensively represent all farm activities, including emissions and sequestration.
- Does it allow for carbon sequestration on the farm? For example, all the great natural habitats and features which are absorbing carbon such as trees, hedgerows and permanent pasture.
- Does it have the capability to account for natural capital assets beyond carbon, such as biodiversity, soil health and water quality? These assets also hold significant value.
- Does it offer scenario planning functionality? This can help plan decision making and reduces the risk of management changes.

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"It uniquely provides farmers and key sector stakeholders access to distinctive and relevant science methods, services and platforms that are evidenced, credible and trusted, adding value throughout the supply chain."

She highlights that this development represents a significant leap forward in agricultural technology.

"By focusing on smart precision, continuous innovation, and comprehensively addressing the complexities of modern agriculture, we're not just keeping pace with the times and the assessment protocols – we are delivering a new standard for the future."

Sandy demonstrations available this summer

Trinity will be offering Sandy demonstrations at several shows and events this summer.

- Scottish Land & Estates Annual Conference 2024, Tuesday 21 May
- Green Farm Collective Regenerative Agriculture Conference 2024, Wednesday 22 May
- The Suffolk Show, 29 & 30 May 2024
- Groundswell, 26 & 27 June 2024

Farmer case study: Michael Kavanagh, Church Farm

First-generation Shropshire farmer and founder of the Green Farm Collective, Michael Kavanagh, explains how he set out to create a sustainable and profitable business using regenerative farming principles when he began farming at Church Farm eight years ago.

"After starting out using a strip-till system, I became interested in soil health which led me to consider how I could farm sustainably without using off-the-shelf chemicals.

"I realised that there was another way to farm as opposed to the conventional practices I'd always followed," says Michael.

The farm now follows a zero-till system; insecticides and plant growth regulators are no longer being used and in the last two years only one fungicide has been used across the entire farm.

However, he notes that if the ground isn't ready for no-till then the results will be affected.

"For example, on a large area of new land we've stepped back to strip till because the land is simply not ready for a zero till system.

"Implementing a zero till system wherever possible is a big change. By not moving the soil, we're keeping all the carbon locked in, with no impact on yields.

"Church Farm is also really pushing the boundaries of what's possible with on-farm changes including zero use of P & K bagged fertiliser," says Michael.

"We've also minimised our fuel usage as a result of zero till. During drilling, we've been using around five litres of fuel per hectare which is a miniscule amount for on-farm work.

"Nitrogen use efficiency has been hugely improved through the work we've been doing on farm.

"Nitrogen is one of the biggest killers on carbon calculations, so being able to improve the efficiency of this has been a great achievement.

"We've also extended our rotation and included cover crops which has demonstrated huge benefits."

Michael explains that as part of the Green Farm Collective, he was looking for a partner to be able to quantify the work they were doing to improve their sustainability.

"We knew we were doing the right things on-farm, in terms of carbon and biodiversity, but wanted to be able to quantify it.

"We explored various options and Trinity AgTech had the best understanding of the practices we'd adopted and the most robust science and analytics in Sandy.

"The agriculture sector is in pioneering times at the moment and there's going to be a lot of change in the coming years, so it was important to find a navigator we could rely on and trust."

Key recommendations from Defra's Harmonisation of Carbon Accounting Tools for Agriculture report

Defra's recommendations for supporting the harmonisation of farm-level carbon accounting are as follows:

1. Industry and HMG to clearly define what a farm-level assessment is, how it is going to be used, and what parts of a farm business should and should not be included.
2. Calculators to align with the requirements of the latest standards and guidance – currently GHG Protocol standards (including the upcoming Land Sector and Removals guidance), ISO 14064 and ISO 14067. Industry and HMG to provide guidelines to support a standardized way of applying these in an agricultural context.
3. Calculator providers to regularly review and update calculators to account for changes in scientific knowledge, carbon accounting methodologies and new emission factors.
4. Calculators to comply with the latest IPCC guidance (currently IPCC 2019) and use those calculations and emission factors as defaults where Tier I approaches are used. Where appropriate, calculators to use Tier II and Tier III calculations where robust emission factors and methodologies are available, such as emission factors created for the UK GHG Inventory.
5. Calculators to use emission factors from an agreed set of robust databases for embedded emissions in fertilisers, feeds and fuels. Industry to support the development of appropriate emission factors for embedded emissions in purchased livestock.
6. Calculators to present outputs in compliance with the latest standards. Industry and HMG to define consistent disaggregated output categories for use by all calculators to facilitate understanding of emission sources.
7. Calculator providers to build user confidence through transparency of approach and third-party verification of the alignment of calculators to minimum standards

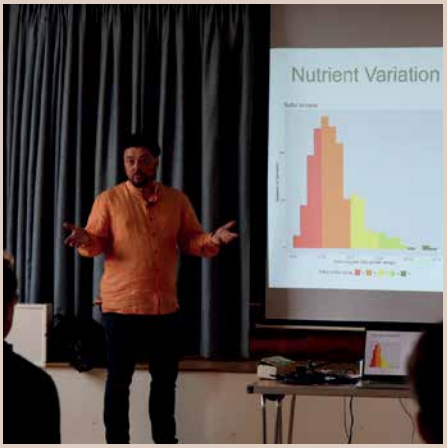
FARMER FOCUS
TIM PARTON

Water, water everywhere! I bet it turns off just when we need it!

What an Autumn/Winter! The rain keeps coming, which makes you wonder if it will turn off just when we rely on it. On a positive, it is wonderful to see how well my soil copes with these extremes. With fantastic infiltration rates and organic matter levels rising yearly, I can store a lot more water than I used to, which was always one of my aims.

At the time of writing, we have just had yet another storm, which on a positive gives me the time to go and speak at the Scottish Agronomy Technical Conference (there is always a positive, we just have to look for it). To date I have applied some calcium to winter crops, as calcium is the King of nutrients to me and is often overlooked and compared with pH - pH being potential hydrogen. Plants are weak and open to disease when calcium levels are low due to bacterial and fungal attack. It is needed for cell signalling, cell division and cell wall strength. Roots will cease to develop without calcium and if you have a low fungal soil, it can be sign of low calcium, which is why it is so important and why I refer to it as the King of nutrients! Calcium is also the carrier for many other nutrients.

The farm looks very well overall, with lots of potential going forward, but as we all know, things can change so quickly with the weather patterns we are now having to contend with. We have joined the SFI as it brings a nice income onto the farm which is gratefully received. It saddens me to hear many farmers looking at it as just another subsidy and only doing the bare minimum to obtain the cash or looking to put a legume fallow in the Spring, knowing full well it won't meet the requirements of the scheme. Wherever I speak in the world this scheme is envied by conservation regenerative farmers: the fact that we are being paid to improve the health of our soil, which is any farmers most valuable asset, should be applauded in my opinion. It is quite ironic for me that I always set out to be able to farm without subsidy, when now I am being rewarded for the way I wanted to farm all along. I am not a fan of farmers being encouraged not to farm, as I feel it is such an oxymoron to give ourselves a pat on the back at how green we are being, only to import our food from another country!

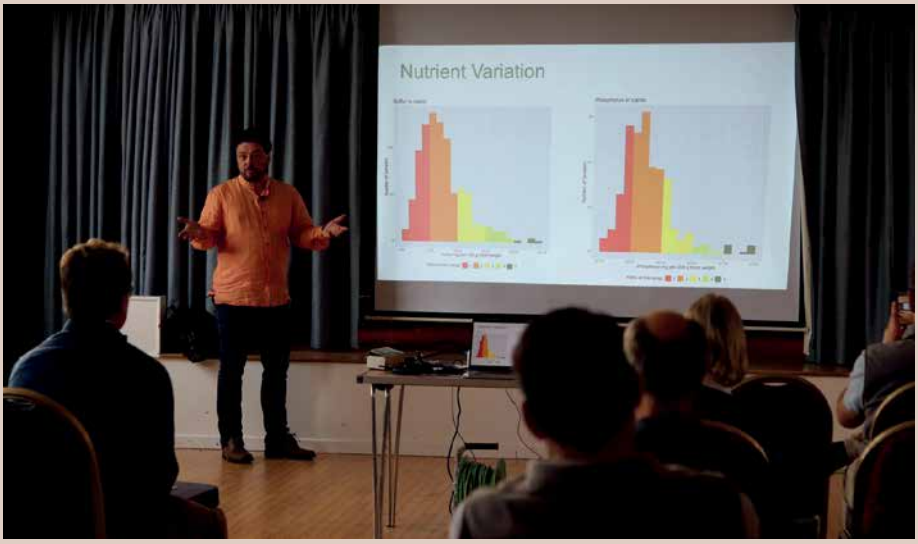


Robbing their water and resources in order to meet our demand for food, plus the carbon footprint in getting the food here. I have proved that I can still produce food, of better quality than what is imported, I might add! While healing the planet in which we live, putting the carbon back where it should be stored in our soil, to feed the underground livestock. By not producing our own food is just moving the problem elsewhere and we should be hanging our heads in shame at that.

Wood Vinegar will be featuring a lot in my application programme going forward, as it is a fantastic carbon source, which I have seen to improve root growth, leaf etc. Care has to be taken on rates, as it is with all products, balance is everything. What I have seen so far is very encouraging and I will be running more trials this coming season! Trials are always the way forward, as I like actual results and returns before rolling out across the whole farm.

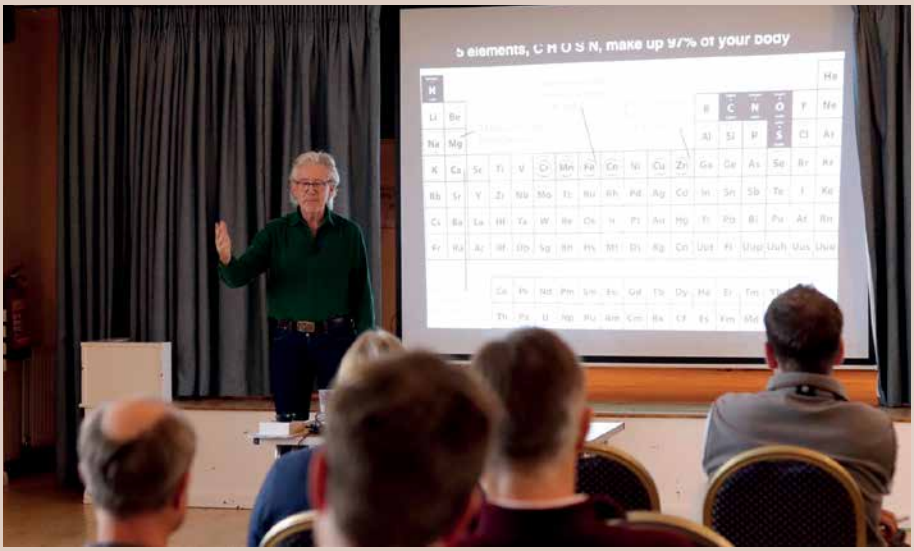
I have had a very busy Winter (Winter used to be a time to replenish my energy levels for the coming year) speaking the length of the UK, which I have thoroughly enjoyed and met some fantastic farmers and people. My website https://www.timpartonfarming.com/ has members from around the globe and is keeping me busy answering questions and helping people on their journey of discovery in the wonderful world of conservation regen agriculture. We all have so much to learn, but farmers have very similar problems wherever they are on the planet.

We have had a very busy few months within the Green Farm Collective, putting together biodiversity/carbon deals and the one where we have been focusing a lot is to be able to sell certified regen produce. This has taken a great deal of work and one which we are very proud of, with our first load of wheat due to leave very shortly, giving at least a £20/ton premium back to our members, be it milling or feed wheat. We are now starting to focus on malting barley as we are having Maltsters getting in touch with us. Demand is escalating, but I would urge everybody to stand together on this one as we deserve a premium for our produce when we are doing so much good for the planet in which we live. I find once you explain the story behind Regenerative Agriculture people want to buy in and be part of that story and will happily pay an extra five pence on a loaf of bread; but the story needs to be told and the produce has to be genuine, otherwise it will get swallowed up and spat out with no premium to the farmer and no achievement for the planet in which we live. It will all just become green washing! This is why we have a set definition within our membership of what Conservation Regenerative Agriculture is and one which will be added to, in order to achieve the ultimate, regenerative planet.



We have our Green Farm Collective annual open day on May 22nd which is free to members, and any non-members who want to attend can purchase tickets (see the advertisement within this magazine). We have a great line up of speakers and will be updating attendees on our progress with sales of produce, carbon and natural capital.

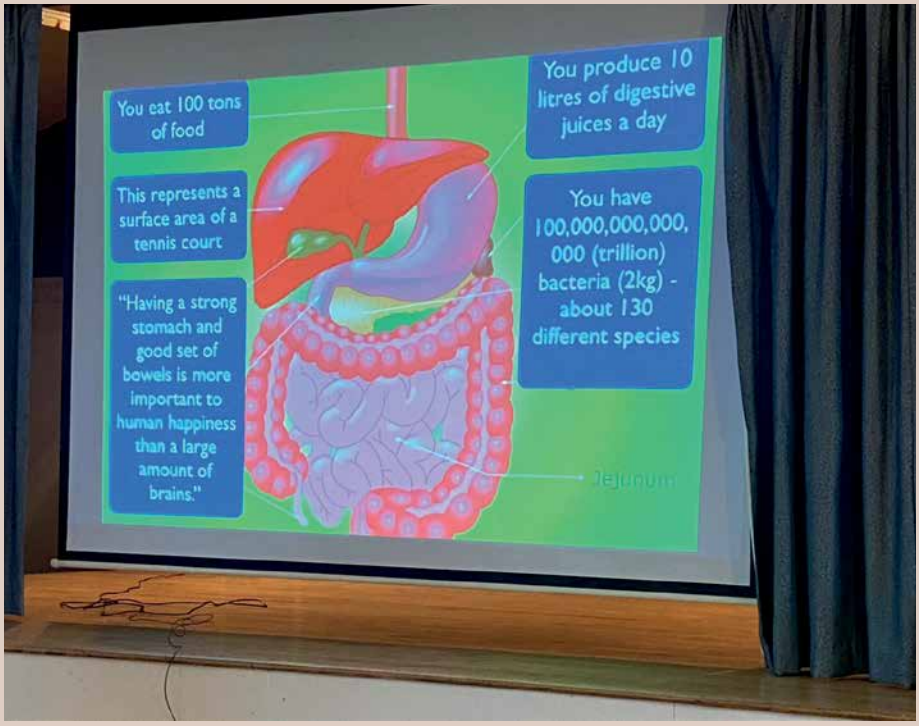
On a last note, we organised a great workshop with Dan Kittridge from the Bionutrient Food Association and Patrick Holford, founder of the Institute of Optimum Nutrition.



Dan spoke in the morning, talking about his work with the Bio-meter which measures the nutrient richness of the food we have produced. He had some fantastic results with the main theme being that a healthy soil produced the best food, regardless of the system, which all comes back to the microbes within and keeping them well fed: healthy soil is everything. The other interesting results were from beef produced of herbal leys, which produced by far the best meat, compared to cereal fed beef. To me, this is just common sense, as ruminants were never designed to eat cereals, which is why they burp and fart such a lot when being fed a cereal ration. as they have so much indigestion. Whereas a nice herbal ley gives the

animal so much choice, that they can get the nutrients they desire in order to keep themselves healthy and at peak production, with that health then being passed onto us. My family and I have been eating grass fed beef for many years now, which I buy from a good friend of mine, Martin Howard from Northcote Farm in Devon, which arrives in perfect condition, frozen, with next day delivery. Nothing beats the taste.

Patrick Holford spoke in the afternoon. He has helped many people including me with mental and physical conditions over the years using nutrition. He spoke on the prevention of Alzheimer's and dementia, which was a fascinating talk, making the connections with healthy soil, as food should be thy medicine. Like me, Patrick recommends supplementing nutrition with additional supplements, when disease is present, to help the body heal, as sometimes we just cannot eat enough nutrient rich food. This is exactly what I have found within soil, that sometimes the plant cannot get enough of one particular element, which is where sap testing comes in handy, so that I cannot only monitor levels, but also get the plant to the required elemental amounts, in order for me to keep the plant healthy and free from disease, but sometimes high rates are required to achieve the objective.



A SKY-HIGH REVOLUTION IN **CROP RESEARCH**

Written by Will Charlton, Seeded Marketing

Drone technology is poised to bring about a significant transformation in crop research in the coming years, according to leading agronomy company Agrii. This technology has the potential to not only enhance the capacity of plot assessments traditionally conducted by researchers but also to improve the consistency of results across all Agrii trial sites throughout the UK.

Dr Ruth Mann, head of research and development for Agrii, has been looking for disruptive innovation in field research trials for some time. "Assessments are completed in exactly the same way as they were when I was first involved in small plot trials work over 30 years ago. New technologies are providing opportunities to move this approach forward considerably," says Dr Mann.

Dr Ruth Mann, head of research and development for Agrii

Trials depend on researchers to collect in-season data on a range of factors like plant counts and NDVI. Given that most research sites extend to several thousand plots, this process is not only time-consuming and labour-intensive but also prone to subjectivity, leading to potential discrepancies in results among researchers.

Agrii has been actively working with specialists at Drone Ag and heliguyTM to explore the potential of drone technology in their R&D programme. Leading this research is Jonathan Trotter, the technology trials manager at Agrii.

"Agrii operates 40,000 trial plots at sites across the UK," says Jonathan. "Each of those plots requires different assessments at different times of the year according to the requirements of the trial. This is a huge logistical effort."

Dr Mann adds: "These assessments are subjective as they are completed by researchers with their innate biases. If we can complete these assessments objectively using software, we can remove any variability among researchers, resulting in data which are comparable across the country. This provides further enhanced technical backup for all products marketed by Agrii."

Drones will not be able to replace every trial assessment, so Jonathan has focused his work on analysing which are most readily replaced. To do this, he conducted trial assessments using a drone and compared the results with the data collected by a researcher.

"One example of work that can be

replaced by a drone is cabbage plant counts and head sizes. I flew the trial several times with a drone to collect the data and then sent someone out to ground-truth that reading. Most of the time, the drone gave the precise cabbage size; at worst, it was only two centimetres out.

"These data points were gathered using the photogrammetry method. The drone maps the trial with hundreds or thousands of high-resolution images that are stitched together for analysis. The downside is that it requires a lot of data and takes a long time to process," explains Jonathan.

New drone tech moving things forward

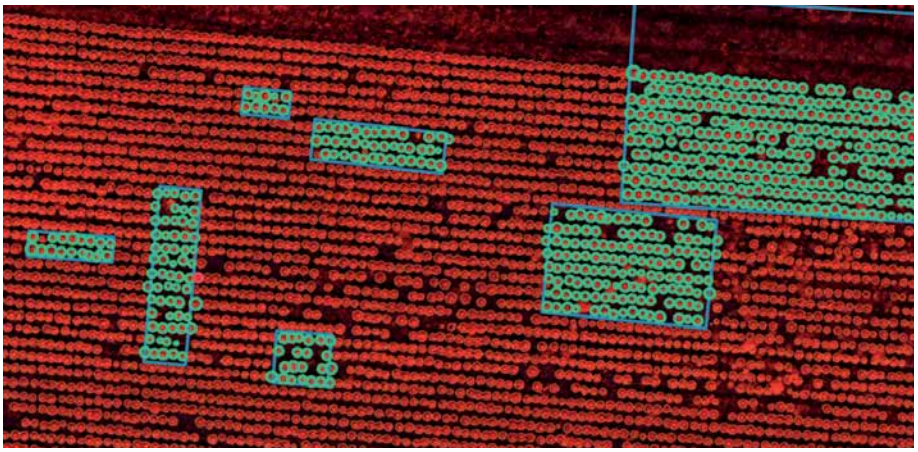
An alternative method uses Drone Ag's Skippy Scout platform. Currently, this is used to aid agronomy and decision-making in commercial fields rather than R&D. Scout points are identified across a field, and data are collected from them, which helps build a more complete picture for agronomists and farmers. Agrii is collaborating with Drone Ag to use this technology and their A.I. in trial plots.

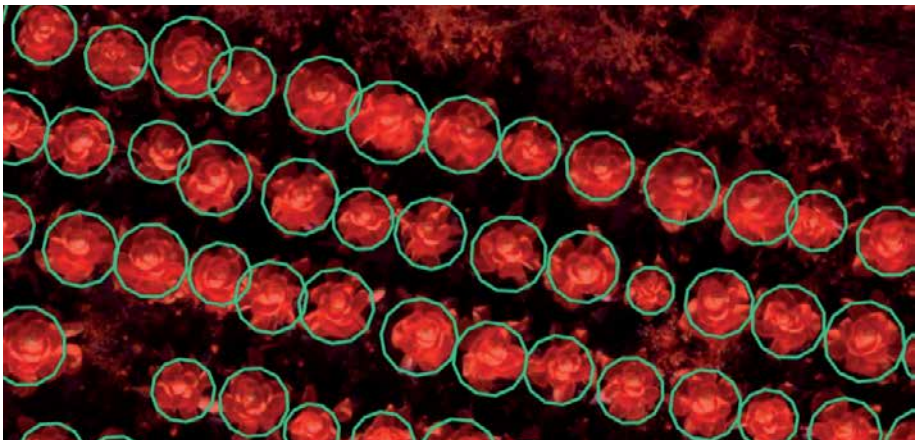
"Our custom flight control technology allows a drone to take detailed low-level images of each plot," describes Jack Wrangham, director of DroneAg. "It will speed up the process of assessing trials because there will be no need to stitch together many images like with the photogrammetry method."

The Skippy Scout system will allow the researcher to assess multiple fixed points per plot. The drone will return to the same point for subsequent assessments. The Skippy Scout method should also allow a greater range of assessments to be conducted by drones.

"Having the drone closer to the plot gives much more detail to the imagery. Photogrammetry is very good for detecting differences between plots, but it still requires ground-truthing by a person to analyse what the difference is attributed to. The Skippy Scout system does 95% of this.

"It should reduce much of the labour required to run trials and can help target where a researcher needs to check a trial by flagging specific plots that would benefit from checking," adds Jack.





Teaching the AI what a cabbage is and what a cabbage isn't to get plant counts / sizes.

Fully automated flight on the horizon

The game-changing development for using drones in R & D will be if they become fully automated. This would enable drones to conduct many more assessments than has ever been possible, all carried out on a fixed schedule without needing a human to be present at the trial site.

"In a fungicide trial, we currently do disease assessments perhaps three times in the critical spring period," says Jonathan. "If you really wanted to, you could fly every hour of every day to detect things we are currently missing."

The technology is capable of unmanned and beyond visual line of sight (BVLOS) operations, but current UK regulation restricts its use. Agrii is working with heliguyTM, a leading drone retailer, consultancy and training provider, to help build the case for BVLOS use.

"At the minute, the regulation is pretty limited in the UK," says Mark Blaney, head of training at leading drone retailer and training provider Heliguy. "Recently, the Civil Aviation Authority (CAA) has announced a 'regulatory sandbox'. They have appealed for stakeholders to come forward to participate in a trial test of their proposed regulation to allow BVLOS.

"Companies will have to build up a use case with evidence of safe automated drone use to get authorisation from the CAA, which Agrii has been doing with their existing work."

"Bringing together the skill sets in these three companies will lead to long-awaited innovation in field trials. Enhancing data collection methods beyond traditional photogrammetry techniques by using the advanced analytics of Skippy Scout and combining this with full autonomy will increase the value of the trials Agrii complete across the UK and reduce the monotonous field assessments that need to be completed by highly qualified researchers," concludes Dr Mann.

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FARMER FOCUS
ANNA JACKSON

February is supposed to be quiet?

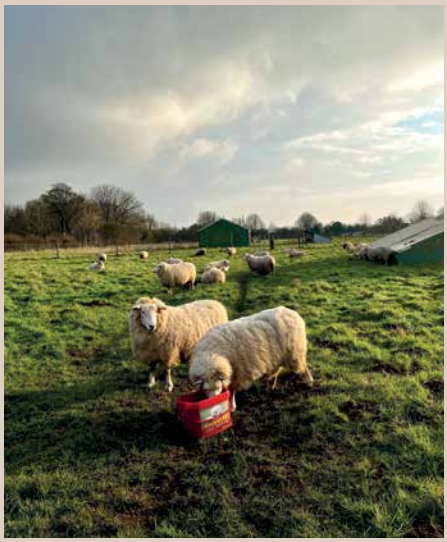
For those that I haven't met before, hello, my name is Anna and I'm 4 years into farming. I grew up on our family farm but made the move to return 4 years ago and haven't looked back since. You may have met my Dad, Andrew Jackson, as he occasionally writes articles here too. DD asked me to write an article because I've got quite a few projects going on at the moment that are making my February bloody busy and reducing my hours sitting on the sofa with a cuppa.

First off, we are coming up to lambing and for the first time ever we are going pasture fed only and lambing outside, a very terrifying prospect for me. We've always bought around £1000 worth of nuts to keep the sheep in good health ready for lambing. However this year I have direct drilled 90 acres of grass which can happily keep my 74 sheep fed until lambing, if anything we have too much grass. After my sheep have come off this grass it will be used for outdoor pigs. This means I have to anxiously wait until the 15th of March to see how it all goes and in the meantime compared to last year where I was feeding them everyday, this year all I have to do is top up their mineral bar once a month and check on them daily. I feel rather helpless but also a little smug as I've managed to reduce my workload.

The next adventure is drilling our 'boats', beans and oats. This is all very new to me, I am the drill person on the farm. A job I absolutely love, we have a Horizon drill. However I have never drilled boats before, a mixture of oats and beans. On the farm it is usually me who persuades Dad to try new ideas and sometimes I can work at him for a good 6 months until he says yes. So I tend to go for a really crazy idea first then I'll slowly make it more realistic. However after fighting for boats I didn't expect him to say yes straight away. So now I have to figure out the seed depth, which hoppers to use and fit that all around finding a weather window (near impossible with all of this rain we've had). Plus harvest! I'm really excited to see how we get on and I've promised Dad I'll just do a trial field (or two). So watch this space we will either be harvesting very green beans or very green oats.

I've been working with the Future Food Movement to help put a face to farming. They basically start conversations happening between the supply chain and farmers. The idea is that they ask about our harvest and how it went, how much money we took/lost and basically how it's going on our end. This isn't a project that's going to change the food system overnight but I'm hoping by chatting to them face to face we might start making steps to increase food prices and help them understand what is actually happening on the ground. So far I've also met some great farmers through this initiative such as Flavian Obiero (@thekenyanpigfarmer). I will keep chatting and keeping an open conversation, hoping for change.

Volunteer crops have always interested me. The idea that a crop falls out of the back of the combine and grows in the most harshest of environments. It just kind of made sense to me to have a play with them so I am trailing volunteer Oil Seed Rape with 0 inputs because that way if the crop fails at least I haven't put any money into it. We feel more confident going into this as we are being advised by RegenBen (Ben Taylor Davies). So



far I've let the volunteers grow and grow they did! We have way too much coverage. Then I hard grazed it with sheep and they munched the crop right down to little stumps. Then the weather gods decided to partly flood the field which was lovely, luckily because we've been no till for 4 years or so it wasn't too bad. And now it's starting to grow again mainly with little off shoots on the munched down stems. But the most interesting part to me is that the roots are growing directly down however last year with the rape crop that we direct drilled the roots were horizontal and basically on the surface. I had a chat with Tim Parton about this and he said it's because we put N on straight away last year and the rape roots are lazy so it wouldn't have been bothered to root down. So much food for thought (pun intended). So currently we are still using no inputs, even though our agronomist is getting nervous, and we plan to just see what happens... Hopefully finishing with a harvest.

We've spent the winter putting up fencing around our farm so that we can graze it all with sheep eventually, the fences make it easier to move sheep on and off quickly. We managed one third of the farm this year with outside help. I thoroughly enjoyed the mini trailer we borrowed because I could wizz around on it so easily, it's the little things. This year we've managed to graze our grass (for seed) which has a clover companion crop and the clover really needed munching down. We accidentally had sheep on the rape, some of them were very good escape arists, so we will see how that turns out. But our aim for next year is to put them on wheat and cover crops. I've been learning from Ed Horton (@e.a.horton) who has been putting sheep on his crop to reduce disease and has had some really promising outcomes. The final bit of fencing we need to finish this year is getting my sheep into some woodland because I believe ivy does wonders for sheep if they are in a bit of a pickle medically, this is a project I'm extremely excited about.

BYDV-RESISTANT WHEAT

BYDV-resistant wheat is a relatively new concept in the UK that is creating significant interest among farmers and the seed trade.

Pressure from BYDV is building after the ban in 2019 of seed treatments that controlled the aphid vectors, while resistance to insecticide sprays is increasing and government policy on insecticide use is tightening.

Concern is not just confined to the traditional BYDV disease hotspots. Sub-clinical levels of the disease can also shave yields and erode returns.

Overall, annual yield losses in untreated crops average 8%, according to AHDB figures, but can reach 60%. And it is estimated that 82% of the UK's wheat crop area is at risk from BYDV.

Clive Bailye is managing partner of TWB Farms, near Lichfield, a zero-till operation consisting of owned land, FBT and contract farming arrangements over several hundred hectares.

Whilst Staffordshire is not a high-pressure BYDV area, Clive suspects the farm's wheat crops have been leaking yield.

"I haven't sprayed insecticides for 16 years, but it would be very naive of me to say that we've never had BYDV since then," says Clive. "We've not had any noticeable disease symptoms or yield loss, even in bad BYDV years, but in any given season sub-clinical levels of disease have probably been present in certain fields.

"That may well be costing me a couple of percent of yield, and that's one reason why I'm keen to find out more about BYDV-resistant wheat varieties.

BYDV trial 2023 - Aerial footage

"The other reason is I want to maintain my no-insecticide policy at all costs. Whenever we use these synthetic products, or use unnatural techniques such as cultivation, we upset a balance. It might solve one problem but we could be creating another – there are consequences.

"Insecticides are more damaging to beneficials than most of us farmers realise. It becomes pretty obvious when you stop using them; on this farm, natural predators have increased in number to the point that they are doing the job for us."

Clive believes the farm's move to no-till, which began in earnest 16 years ago, is the reason why his no-insecticide policy has been so successful – visibly at least.

The move was initially a hard-nosed business decision, to reduce fixed costs and speed up operations as the farmed area expanded. However, it wasn't long before Clive started noticing improvements in soil structure; fields were travelling better, creating wider operating windows, and plants benefited from the more friable soils.

"We stepped up our cover cropping, keeping soil covered with plants year-round, and introduced a more diverse rotation. We took the decision to improve soil and try to grow bigger yields whilst reducing dependence on synthetic inputs.

"But we never made a conscious decision to stop using insecticides. We had used them regularly in the past – it was cheap insurance. When we became more aware of the soil food web and

Bdv2 line (left) versus non-Bdv2 line under high BYDV pressure

how everything interacted, we decided not to use insecticides routinely, only if we had a problem.

"By the time we got to 2012, we realised that we hadn't used an insecticide for over a year. We hadn't had the need, and we still harvested decent yields. Was that luck? Rather than find out, we looked at what we could do to improve our chances of not having to reach for that insecticide can again.

"We were creating this more natural environment where nature was more in balance. It's not perfect, of course, but we weren't getting those extremes of problems."

Clive admits that being in a low-pressure BYDV area will have helped. Despite that, he is now seriously considering what BYDV resistant wheats can do for his business.

"I only grow wheats that are resistant to orange wheat blossom midge, and adopting BYDV-resistant varieties is the obvious next step. It is exciting technology that comes at very little cost, especially when you consider that we can now claim £45/ha on land managed without insecticides. Suddenly that insecticide doesn't look so cheap any more – there's a significant opportunity cost.

"We also know that pyrethroids used to control aphids are less effective than they used to be. And, when you look at the direction of agricultural policy, it's obvious that pressure on their use will increase. It's probably only a matter of time before we will rely on resistant varieties to control BYDV."

Clive is growing 15ha of RGT Grouse this season as a "look-see", a high-yielding Group 4-type wheat which contains the Bdv2 gene that confers resistance to BYDV. He will assess its performance over the weighbridge, along with an adjacent field of Dawsum and a further one containing a four-way blend of feed wheats, none of which are resistant to the disease.

All will receive the same inputs. "This will give us some idea of the relative performance of the wheats on this farm in a no-insecticide system," says Clive, who will use ADAS Agronomics tramline trial metrics to analyse the results.

"We'll take out a 3ha block in the middle of each field, which should minimise any variation on what are fairly uniform fields. Of course, it might be that it happens to be a good Dawsum year or a good Grouse year, but it will still be valuable to see how these varieties respond."

In addition, each 3ha block will also be tested for virus loading

by RAGT, using quantitative PCR. "We may not be able to visually see any differences between the trials, but this will reveal whether we have subclinical disease, and how much, in the three different areas," says Clive.

"This will be the most interesting part of the trial for me, as it will indicate the extent of our BYDV problem and the potential value of BYDV resistance to our business.

"The trait costs a few pounds per hectare, and it wouldn't take much loss to cover that. And you get peace of mind, ease of management and all the environmental benefits, and an SFI payment as well.

"Eventually this technology will be available in many varieties, like orange wheat blossom midge resistance. That said, given the potential benefits, I don't see any reason why I wouldn't include a BYDV-resistant variety on my farm now."

New trials network aims to reveal true impact of BYDV on wheat

RAGT has established a comprehensive set of insecticide-free trials across the southern half of England and Ireland to assess the true impact of barley yellow dwarf virus on a range of wheat varieties.

Jack Holgate, RAGT's arable products manager, says the aim of the trials is to provide growers with much-needed information so they can make the right varietal choices to help manage the disease.

Jack Holgate, RAGT's arable products manager

"Official Recommended List trials don't include this sort of assessment," says Jack. "As a result, the effects of BYDV on the relative performance of wheat varieties are never considered. Varieties that are bred specifically to resist the disease never get a chance to show their true potential, so many growers are unaware of how the yield pecking order changes when the disease strikes."

RAGT has set up an 18-trial matrix across the Midlands, south and west of England and in Ireland this season, using a range of popular commercial wheat varieties and some of the company's current and pipeline BYDV-resistant Genserus (BYDV-resistant) varieties.

RAGT is working with several partners including seed merchants, Eurofins, AICC, agronomy companies and growers to establish the trials network.

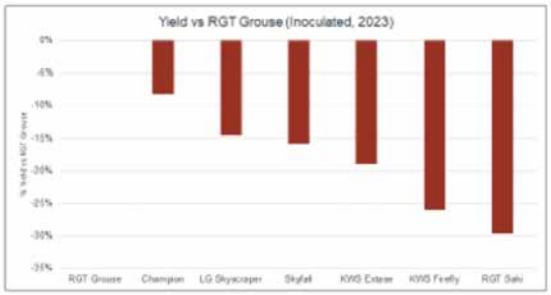
"Some sites will be inoculated with BYDV-bearing aphids, others will be left to nature," says Jack. "None will receive insecticide.

"We want to demonstrate what can happen under very high BYDV pressure and how Genserus varieties can cope with that, reducing costs and greatly easing autumn management. We also want to see what happens under a range of natural conditions. Growers can then decide for themselves whether Genserus technology should play a part in their risk management strategy."

The trials will build on RAGT's existing BYDV work, which reflects the resilience of the resistance trait, as seen in more than two decades of commercial production in Australia.

Yield under BYDV pressure (2023, Inoculated)

Rank	Name	Yield (Tns)	% of Trial Avg
4	RGT Grouse	12.9	111.2%
10	Champion	11.94	102.9%
16	LG Skyscraper	11.2	96.5%
19	Skyfall	11.06	95.3%
24	KWS Extase	10.7	92.2%
27	KWS Firefly	9.88	85.2%
28	RGT Saki	9.45	81.5%



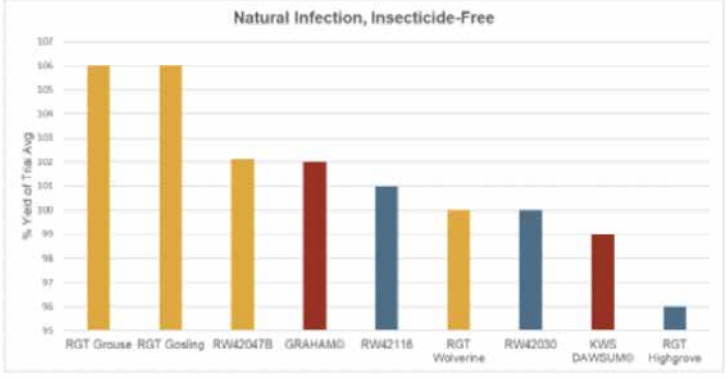
In BYDV-inoculated trials carried out at Ickleton, Cambridgeshire last season, seven Genserus varieties significantly outyielded their conventional counterparts. All plots received Recommended List-protocol fungicide and PGR treatments, but no aphicide.

RGT Grouse, RAGT's main commercial Genserus variety, yielded over 8% more than Champion and almost 15% more than Skyscraper (see graph). Similar results were achieved in the two preceding years.

A trial carried out in County Cork by Goldcrop using natural BYDV infection also clearly demonstrated the strength of the trait (see graph).

"Genserus varieties took the top three places, with RGT Grouse equal top at 106% of controls," says Jack.

Yield under BYDV pressure (2023, Natural)



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THE CHALLENGE OF WET, COMPACTED SOILS

Written by Steve Holloway

While spring brings a renewed sense of vitality to the soil, it also presents challenges, particularly following the level of rainfall seen in the UK this winter. Wet, compacted soils can impede the growth and development of crops, exerting a cascade of effects that ripple through the soil ecosystem and impact potential yields.

Rooting Constraints

Steve Holloway

Excess moisture and compaction create hostile conditions for plant roots, hindering their ability to penetrate the soil and access essential nutrients. In waterlogged soils, Oxygen levels plummet, leading to root suffocation and reduced nutrient uptake. Compaction further exacerbates this issue, restricting root elongation and lateral spread; limiting the plant's ability to anchor itself and extract resources from the soil.

Microbial Dynamics

The impact of wet, compacted soils extends beyond the realm of plant roots, profoundly affecting soil microbial communities. Anaerobic conditions prevail in water-logged soils, altering the composition and activity of microbial populations. Beneficial aerobic microbes give way to anaerobic species, leading to shifts in nutrient cycling and organic matter decomposition. As a result, soil health may deteriorate, further compromising plant resilience and productivity.

Residual Effects on Yields

The consequences of wet, compacted soils can linger long after the rains have subsided. Crop yields may suffer due to stunted root growth, nutrient deficiencies and increased susceptibility to pests and diseases. Compaction scars the soil, leaving behind physical barriers that impede root penetration and water infiltration, perpetuating the cycle of poor soil structure and reduced productivity.

Mitigation Strategies

In the face of these challenges, farmers can employ a range of mitigation strategies to alleviate the impact of wet, compacted soils on crop performance. Techniques such as selective subsoiling, considerate tillage, soil conditioning and the use of cover crops, can help break up compaction layers and improve soil structure, enhancing root penetration and water infiltration. Additionally, improving drainage systems can help alleviate waterlogging in low-lying areas, reducing the risk of yield losses.

Looking Ahead

As we navigate the complexities of springtime soil management, it is essential to recognise the interconnectedness of soil, crops, and microbial life. By adopting holistic approaches that prioritise soil health and resilience, farmers can mitigate the impact of wet, compacted soils on crop yields while fostering sustainable agricultural systems that endure for generations to come.

SOIL MATTERS! CORRECTIVE MEASURES

Using metals, can be counter intuitive.

Biology - NOT metal makes tilth. Optimising it's living conditions with bio-positive actions will promote structured aggregation; meaning that water ponds less, plant rooting is better and plant health improves.

Overtime, the weight of sitting water exacerbates compaction issues, creating cold, anaerobic conditions; bereft of life and sometimes corrective measures using metal can be counter-productive.

Collectively, the use of machinery at the wrong time and pulling metal through the ground, adds to compaction issues, destroying natural soil structures, decimating the homes of the living organisms. **A soil can be naturally resilient** but practices such as minimising tillage, building organic matter and **promoting biological activity** MUST be foremost in a growers mind.

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DRILL MANUFACTURERS IN FOCUS...

AMAZONE

TECH DEFINES HOW INPUTS ARE APPLIED

With Amazone notching up 140 years of machinery manufacturing last year, Tech Farmer takes a look at how its technology has developed.

Over one million fertiliser spreaders have been built by Amazone, and 2024 is the 75th anniversary seed drill production for the company. Based in Osnabrück, Germany and manufacturing at eight sites across the world, Amazone is owned by the Dreyer family and is now looked after by the fourth generation. The company has a long history in both crop establishment and crop care equipment and seeks to establish itself as the 'harvest to harvest specialist'.

Dr. Heinz Dreyer brought the first PTO-driven twin disc mounted spreader, the ZA, onto the market in 1958 putting Amazone firmly on the map in the world of spreaders. Nowadays, the flagship TS spreading system, in either a mounted 5000-litre or trailed 10,000-litre hopper format, offers up to 54m spreading widths and 128 section shut-off. The technology on board includes the TS border spreading system, ArgusTwin radar spread pattern monitoring and automatic adjustment of any wind influence through WindControl. Such advances were not even dreamed of back when the first ZA was put in the field.

As well as drills and fertiliser spreaders, there's been over 50 years of sprayer production. The S400 mounted sprayer started in 1969 with a 400-litre spray tank and 6m boom and now encompasses mounted sprayers up to 3500 litres, trailed up to 11,200 litres and the Pantera self-propelled including the all-new, self-levelling, 7000-litre Pantera 7004.

The last 75 years has seen huge changes in crop establishment methods. The D1 seed drill was introduced just after the second world war and was soon joined up to a cultivator with the development of the RE reciprocating harrow making the first drill combination. The following 75 years has seen both the level of technology and the breadth of the range multiply exponentially.

Those linkage- and harrow-mounted drills and drill combinations still form a significant part of the thousands of drills produced each year. But changing establishment methods have seen a diversification into trailed tine seeders, direct-tine seeders and solo trailed disc drills along with the multi-purpose Cirrus drills. The need to sow multiple seed varieties at different rates, and also at different planting depths, has led to drills with multiple hoppers and coulter systems. This can also be used to sow a mixture of seed and fertiliser either alongside the seed as a SingleShoot system, or at a different depth using the FerTeC coulters in a DoubleShoot set-up. An additional GreenDrill seeder box can be added for a third material including the application of micro-granular herbicides and slug pellets.

The renewed emphasis on direct and low-disturbance drilling has seen an increasing demand for tined drills that can direct drill into surface residues and cover crops and yet, as opposed to disc drills, still generate a clean seed slot to ensure good seed/soil content. The Primera DMC offers the

flexibility of being able to be used conventionally, in a min-till scenario or as a direct seeder. The relatively close row spacing of 18.75cm, set in a four-row opener lay-out, offers generous point-to-point clearance and allows the Primera to handle drilling in trashy conditions. And the same can be said of the 12m and 15m Condor seeders. The 7800-litre seed hopper is split into three sections to give maximum flexibility and the ConTeC pro openers in three stagger and a 25cm row spacing again give good throughput.

Fast forward to 2024 and one of the latest additions is the new Cirrus 9004 Grand trailed cultivator drill. Designed for high output, the Cirrus Grand comes in a 9m working width and with a split 5750-litre seed hopper that can supply both seed only or seed and fertiliser to the TwinTeC+ double disc coulters. The seed is distributed to the coulter via the new seed-on-demand, individual row shut off head.

Any tramline width or wheel track width can be set from the terminal. When a row is isolated, for tramlining or on headland ins and outs, the seed is kept circulating within the head until needed, this gives instant response to any situation leading to minimal misses and overlaps. The air flow to the coulter is always there and remains constant across the full drill width to avoid blowing the seed out of the seed row as more rows are isolated. The V-Compensation system means that on the way out of the headland, the longer pipe runs are started first to ensure even seed delivery across the whole working width or, on entering the headland, the longer pipe runs stop first giving a uniform emergence over the whole field.

Whatever the model of drill chosen, keeping that flexibility of drilling open is key to being able to cope with any upcoming political and environmental pressures that farming may face in the future.

ACHIEVING THE POTATO IMPOSSIBLE

A NUFFIELD ARTICLE BY HARRY BARNETT

I never dreamt that a soil disturbing potato farmer like myself would be writing an article for the Direct Driller magazine but I feel privileged to share some of my findings and views. I am based on the Holkham Estate in North Norfolk, where I run a potato growing enterprise growing salad, maincrop, processing and seed varieties. I am a millennial and a realist. On one hand, my millennial moral compass pushes me to make environmental and social improvement, whilst my realist values tell me that we must avoid risk and remain commercially competitive and profitable in business.

Planting

In 2023 I was fortunate enough to be awarded a Nuffield scholarship, kindly sponsored by McDonald's UK & Ireland and the Royal Norfolk Agricultural Association. I am researching how UK potato farmers can counteract the market and agronomic challenges they currently face. I have seen the great, the good and the downright ugly side of potato farming across the globe.

At the start of my journey, when pondering my title, the prospects of the UK potato sector looked bleak, with a steadily declining retail market, incredibly low margins and poor return on capital. Combine this with an unpredictable climate, pest and disease pressures, and as a result a UK grower exodus is underway. Across the globe some of these common themes exist, with countries and continents having their own solutions to overcome them.

Perspectives from abroad

Our European neighbours are the most aligned with their growing challenges, most notably with a scarcity of water during the growing season and an abundance during harvest

Potatoes in flower

– a familiar tale. They also face a political landscape which appears to be more authoritarian and restrictive than the UK. I visited farms in the Netherlands, who are battling the government on greening rules that restrict phosphate and nitrogen use, and French farmers who are having water use restrictions imposed on an annual basis. These challenges are making it harder to deliver marketable yields consistently.

North America is on a completely different path to our European counterparts. Washington state in the USA produces

An irrigation plant in Washington

some of the highest potato yields in the world. Their farmers make the most of long growing seasons, deep silty soils and the Columbia River. They tailor fertiliser and agronomy programmes to enhance yields and keep pests and diseases at bay.

Honestly, I was frightened by the input use and struggle to see how this is going to be maintained in a long-term sustainable farming strategy. Fumigating soils with 40 gallons an acre of an organophosphate whilst applying 30 inches of water to a crop annually cannot be good for the long-term health of the public and environment. This is certainly not something that can be mirrored in the UK.

Reflections

One thing that Nuffield has taught me is not to be judgemental. US farmers are asked to produce plentiful, cheap food, and their potato growers succeed at a scale and efficiency level that European farmers cannot begin to imagine. The US model of scale and inputs reduces risk, therefore allowing farmers to be successful at margins that would bankrupt UK producers.

In my opinion, change is required away from conventional

Three Mile Canyon Farms

high input systems as part of a long term sustainable food strategy, however, removing inputs reduces control and adds risk. If the UK and European consumer want nutritious, environmentally friendly produced food, they will have to pay more for it in the short term, either through increased prices on retail shelves or more indirectly through increased government support.

Making changes at home

This planting season, our business is striving to achieve what many around the world would perceive to be the potato-growing impossible. We will set out to grow a salad potato crop with no artificial fertiliser, no synthetic fungicides and no insecticides whilst achieving the same marketable yield as our conventional salad crops. Impossible? Five years ago, I would have said yes and told you it is commercial suicide.

The risks involved in the wrong growing season would see our business lose a six-figure number across a 10-hectare field if, and when, it goes horribly wrong. We will achieve this by:

- Growing a Dutch-bred salad variety with strong agronomic traits and very high blight resistance
- Applying a fertiliser that uses clever technology to recycle waste streams with a carbon footprint 80% lower than conventional fertilisers
- Using a keen eye from the agronomist (me) making sure that the crop remains healthy.

For context, on a conventional salad potato crop we would usually apply 8 prophylactic fungicides to keep blight away, a soil borne fungicide to control soil pathogens such as rhizoctonia and black dot and an artificial blend of fertiliser containing DAP, AN and MOP.

I am fully aware that this is a small step and only represents a tiny fraction of our growing area, but it is progress.

Better tools

There is a famous saying that a bad workman blames their tools, and there is definitely truth in this. However, farmers do need realistic tools to move in a sustainable, dare I say, regenerative direction. The tools slowly begin to emerge, and it is important to remember that these things take time – as a farmer you get one chance per year.

I have visited potato breeding companies on my travels who were quick to point out that up until five years ago, breeding programmes were completely focused on yield rather than resistance. Adding stronger agronomic traits that reduce the use of inputs is very new, and I came away excited as to what can be achieved, even with conventional breeding techniques. Strong plant genetics that can fight off pathogens are going to be essential for farmers to hit input reduction targets.

I come back to my opening gambit of being a millennial and a realist. Through my working life, I truly hope and believe that the move away from the artificial inputs that have propped up the world's food system is a real possibility rather than just a hippy pipe dream.

french fries matogues

One thing that has given me hope for the UK potato sector is the fact that demand for potato products is increasing across the globe. The 'french fry' and the 'potato chip' (crisp) are cemented in western diets and the growth around the world is huge as people trade into these products. Whether I should be commending this is for another day, but I truly believe the humble potato, a staple in UK diets for centuries, should be championed and embraced in our UK farming systems. After all, the potato in its unprocessed form is the most carbon efficient and the most nutritious carbohydrate on offer to consumers.

FARMER FOCUS
PHIL ROWBOTTOM

It feels like a very long time since my last ramblings in the October issue of Direct Driller magazine. I'm sure I'm not the only one that thought we'd never experience another winter like we had in 2019, the wettest on record at the time!

While winter 2023/24 may not have seen the surface water running through the yard we experienced in 2019, there are places on the farm that I've not seen water standing in all the years we've been here. We recorded the highest rainfall here at Mount Farm Woolley, a staggering 900mm for the year, almost double on the year before!

I felt quite fortunate back in October to have managed to get everything planted before the weather got really bad, the crops don't look quite as good now as they did back then!

Oilseed rape has for sometime been the biggest gamble on the farm, after a couple of good years, it's seems Cabbage Stem Flee Beetle has found its way back to this part of Yorkshire. Having twice drilled one field late last year, a combination CSFB, pigeons and the weather and after consultation with my agronomist, we decided the best course of action was to plant winter wheat into it, add into that the sheer costs and risk involved and the options with SFI, OSR's days may well be numbered here!

Miraculously, a weather window opened presented itself at the end of January, on the 2nd of February I was back out with the Sky Drill planting Skyscraper winter wheat, at 240kg to the ha, into what can only be described as almost perfect conditions.

Dry, sunny, a light breeze, if it hadn't been for the temperature you could have been lulled into thinking it was Spring!

Having seen the amount of water lying on neighbouring land, it was surprising just how well ground travelled.

As I write this its still raining, the forecast is for more rain, having managed to get 110kg per/ha of nitrogen applied, I'm estimating there is around 10% of the farm that won't produce a crop due to the weather, the biggest piece, around

15 acres has pretty much failed completely 3 years after potatoes will have a mix of wild flower, Facilia and buckwheat cover crop planted in it and left until the autumn.

With input costs continuing to be high and wheat prices as they are, costs will be focused on year more than they have ever been, if we can reduce inputs and not effect yields then we will push the limits as far as we can.

Having not sold anything out of the shed to date, like so many, we're waiting for the prices to creep up!

Now into the third year of Direct Drilling, the benefits are becoming more and more plain to see. Admittedly we farm some pretty easy, free draining light sandy land and the benefit of not disturbing the soil structure pays dividends in being able to access the ground sooner than the old plough based system.

By not disturbing the soil, leaving tramlines in the same place, keeping trailers on the headlands, chopping straw to add to organic matter all seem to help here. Planting cover crops between harvest and the next crop all help with soil health. It just seems to work here.

I'm sure many of my neighbours think I'm mad, but all I can say is come and have a look, the proof is there for everyone to see. We recently hosted a farm visit form West Yorkshire Combined Authorities, a mixture of academics and farmers to see what we are doing and how it can play a role in their future environmental policy. It was a very informative day listening to other farmers talk about how they can see the benefits and challenges on their farms, whilst sharing the wider environmental and ecological improvements we are seeing with a none farming audience. Just a pity the weather did'nt play ball, but that's farming!

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CROP NUTRITION AFTER THE STORM...

Written by James Warne from Soil First Farming

As the daylength increases we are all now waking up from what feels like the mildest 'winter' and longest wet spell ever experienced (since the last one anyhow!). It feels like it started raining in July and we haven't really had a respite since. Soils in most parts of the country have been permanently wet for over 7 months.

Some soil damage was done at harvest, due to the wet conditions. With soils wet to depth, any subsoiling or deep loosening will have had little to no beneficial effects. Like me, crops are responding to the spells of sunshine and warmth we are occasionally receiving. Some fields never fail to amaze me, where the crops looked awful to non-existent for months, the rows are now appearing. Although most parts of the country are still so wet so any thoughts of field work are still far from view, the question still remains what is the best way to pick up and manage these crops.

Undoubtably many crops will have limited root structures and architectures from being sat in continually wet conditions. Many soils have slumped and capped resulting in lost pore space and the resulting lack of drainage and gas exchange. In the worst situations I wonder if there is an argument for breaking this surface crust as it dries with a grass harrow or similar to allow the soil to breath again. The roots need access to oxygen to grow adequately, whilst they also 'exhale' carbon dioxide. If the oxygen levels within the soil fall too far this can impact the root growth and have a subsequent effect on biomass and yield.

So how do we manage these crops going forward? What is the best strategy to aid a crop produce a meaningful yield and return on investment. First thoughts turn to nitrogen applications and there is no doubt that nitrogen probably produces the best margin over input spend of any input providing you don't over step the yield response curve for each individual situation. The problem is we won't know the correct level of N-fertilisation with any accuracy until after harvest. Therefore we need to make sure all the other essential elements are in place to maximise the crops collection and utilisation of nitrogen.

In my opinion we need to focus on getting some early root growth to support the rapidly expanding biomass. Root and shoot growth needs phosphorus, supported primarily by manganese and zinc, and conducive soil conditions as described above. The plant also needs to be actively photosynthesising and this is where nitrogen plays a partial role, more on that later.

Adequate phosphorus we assume usually comes via the soil during the autumn as the root mass builds, explores and mines the soil of available forms of phosphorus. Plant available phosphorus is mostly attributable to soil organic matter and microbial activity. With soil being waterlogged and oxygen restricted for most of the autumn and winter, soil microbiology will have been dormant and phosphorus availability will have been reduced. We are told that solid phosphorus fertilisers don't move far in soils, so surface applying phosphate won't really have much effect, therefore foliar forms of phosphate are the most expedient application. Phosphites, in particular, combined with manganese and zinc are the most sensible and cost-effective route to applying spring phosphate to crops. There is some conjecture as to how phosphites actually work, but there can be no doubt that they do seem to encourage plants to fully express their rooting potential in the right conditions.

As I mentioned earlier the crop needs to be photosynthesising to expend energy in promoting root growth to support the increasing biomass and ultimately yield. Nitrogen is deemed to be the largest limiting factor in chlorophyll production and that is almost certainly correct, however without magnesium the plant can have access to all the nitrogen it wants but it cannot assimilate chlorophyll, the green pigment where the initial stages of photosynthesis occur. Each chlorophyll molecule has a magnesium atom at its centre surrounded by 4 atoms of nitrogen. As with phosphorous we generally assume that the soil will provide all the magnesium the crop requires. But again this is not as straightforward as it may sound. Restricted rooting will limit the crops' ability to take up magnesium. Magnesium is relatively tightly bound to clay particles in the soil and when in the soil solution likely to form salts with sulphates and nitrates which will leach readily taking magnesium deeper in the soil profile, out of reach of shallow rooted crops.

Manganese is also a critical element in the photosynthesis equation. Ironically manganese becomes more water soluble and plant available as the soil moisture increases. The problems may occur as the soil dries and manganese availability reduces, just the crop begins to increase biomass and photosynthetic potential probably with a limited root biomass to explore and take-up manganese. As with phosphorus the foliar application of regular magnesium and manganese is recommended.

Yes, I am suggesting some more spend on crops that at the moment do not look like they have potential. Nitrogen alone is not the answer to achieving yield, the crop needs to have access to the necessary nutrition to fully exploit the expensive nitrogen applications. Indeed, it could be argued that a 10-20kg nitrogen saving will pay for most of the above and return an equivalent, if not better yield. Whilst also reducing the crop stress, potential disease profile and carbon balance.

Knowledge grows

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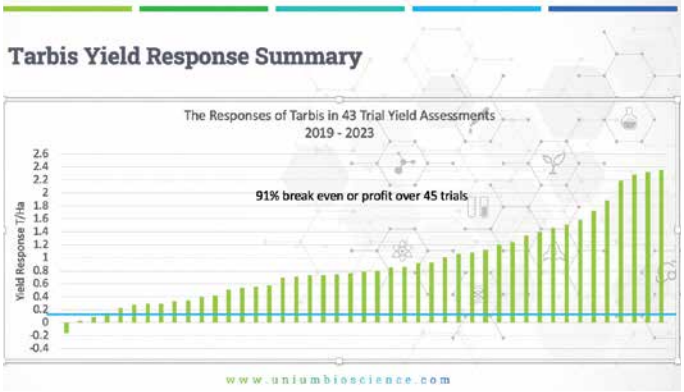
John Haywood, Unium Bioscience director

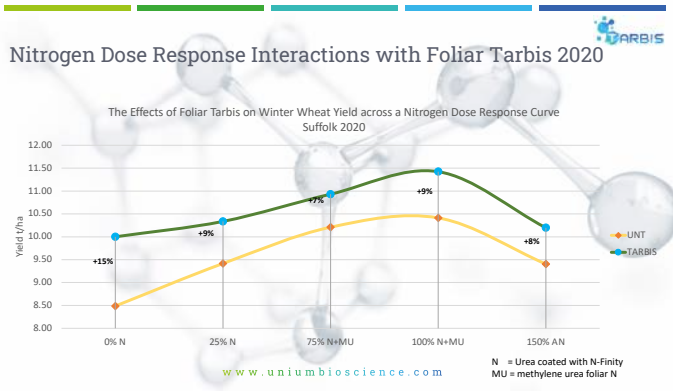
Launched to the market this spring by biologicals specialist, Unium Bioscience, TARBIS improves yield due to maximising biological nutrient availability and use efficiency, building more robust crops which can handle abiotic stress.

"The technology has undergone peer review at the University of Washington and NASA Ames Research Park, and it has been tested in trials on the International Space Station. Subsequently, independently conducted trials in the UK have consistently shown that treated crops require less artificial fertiliser. This is not only beneficial for the environment but also for a farmer's financial bottom line," explains John Haywood, Unium Bioscience director.

"It's a multi-functional, broad-spectrum product, that increases the availability and uptake of many nutrients, not just nitrogen and phosphorus, and it can be applied at any time of the year and at any temperature," says John.

"The foliar treatment, TARBIS, has a wide application opportunity and can assist where farmers were not able to get the seed treatment," he says.





"It contains microbes which contribute not only to nitrogen fixation but also in making other nutrients available to the seedling and plant by mineralising, solubilising, chelating, and supplying them to the plant in a highly efficient form for the plant to use e.g. phosphorus," adds John.

TARBIS has been tested alongside the major crop protection materials with no loss of active ingredient or effectiveness and is also approved for use in organic systems.

Unium Bioscience will be offering TARBIS across the UK in the coming months. Speak to your merchant to source it.

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DRILL MANUFACTURERS IN FOCUS...

COMMODITY PRICE ROLLERCOASTER IS MAKING PLANNING DIFFICULT

Global events and extremely wet weather mean that there's a lot to think about on the Claydon family's arable farm in Suffolk, says Jeff Claydon, inventor of the Opti-Till® direct seeding system.

Date: 26 February 2024

Since the start of 2024 it has become evident that farmers all over the world have been pushed to the point where rising costs, increasing legislation and governmental pressures have left them with little choice but to make their feelings known to politicians in no uncertain terms. As I write this, it seems as if farmers everywhere are protesting. In the UK, throughout Europe and as far afield as the USA, Canada and Australia, the slogan 'No Farmers, No Food, No Future' is being seen everywhere.

Something is obviously and seriously wrong in terms of how those who produce the world's food are being treated and compensated, or rather inadequately compensated for the considerable risks involved. The decision to participate in such protests is not one that is taken lightly because inevitably it involves additional cost and time spent away from the farm, which most can ill afford.

It's not difficult for those of us in the agricultural community to understand why things have reached a head. Farmers have always done everything that politicians have asked of them in terms of increasing production to ensure that sufficient food is available to the public at affordable prices. Yet, over the last two or three decades, our industry has come under increasing pressure and criticism. In some cases that has been from a public with little or no idea of what farmers do or what is involved in producing their food, in others from transient politicians who are often ill-informed and out of touch.

With geopolitical issues, international instability and global supply issues more pronounced than they have been for a very long time, one cannot help but wonder whether politicians from all nations have become complacent over food security and don't recognise the long-term implications of this.

Supply chain demographics have also changed markedly

This field of Skyscraper winter wheat was drilled on 15 October before the onset of relentless rain and looked good when this photograph was taken during the second week of February. The crop was significantly more advanced than where the farm experimented with slightly deeper drilling to avoid the emerging crop potentially being affected by pre-emergence herbicides. All it needs now is some warm, dry weather.

over the last few decades. Having recently celebrated my 70th birthday I am old enough to remember when the UK was characterised by its small farms and local, independent shops. In the 1960s and 70s one could buy almost anything from the weekly market in my local town, Bury St Edmunds. All of it was locally produced or locally sourced, but now the market is much like any other, selling products which have been brought in from who knows where. That is sad to see.

Neither has the transition from having numerous local mixed farms and mills to a handful of large feed manufacturers, food groups and intermediaries who dominate the market been good for those of us who produce food, or indeed the consumers who ultimately buy it. One can only hope that common sense will ultimately prevail, bringing a return to more local suppliers with lower overheads and a greater personal stake in their local community.

The big question for the farming industry going forward is whether we will see a major swing away from the globalists' agenda favouring lower quality, factory-produced/artificial foods so that we can remain a nation of farmers, or will we be economically forced to become park keepers? Some farmers

The Claydon farm continues to experiment with cover crops to assess whether they provide any benefits. Areas where cover crops were sprayed off in January contained much higher numbers of weeds and are clearly visible next to land which received multiple passes with the Claydon straw Harrow in the autumn.

on less-productive land have already decided to take part of their land out of production and put it into one of the schemes currently being offered, such as the Sustainable Farming Incentive (SFI) or Biodiversity Net Gain (BNG).

At this stage it's difficult to answer that question, but if a significant amount of productive farm land is tied up in non-productive schemes, some lasting up to 30 years, where will the nation's food come from in the future? That should concern everyone in the UK as it will affect food availability, price and quality.

As farmers, we can only make our feelings known and do our bit to educate the public and make them more aware of the consequences. However, at the end of the day as business owners we must work within the framework set out by politicians, which puts us in the position of being price takers. Our primary focus must therefore be on controlling costs and generating a realistic margin, one of the many areas in which using the Claydon Opti-Till® System can help.

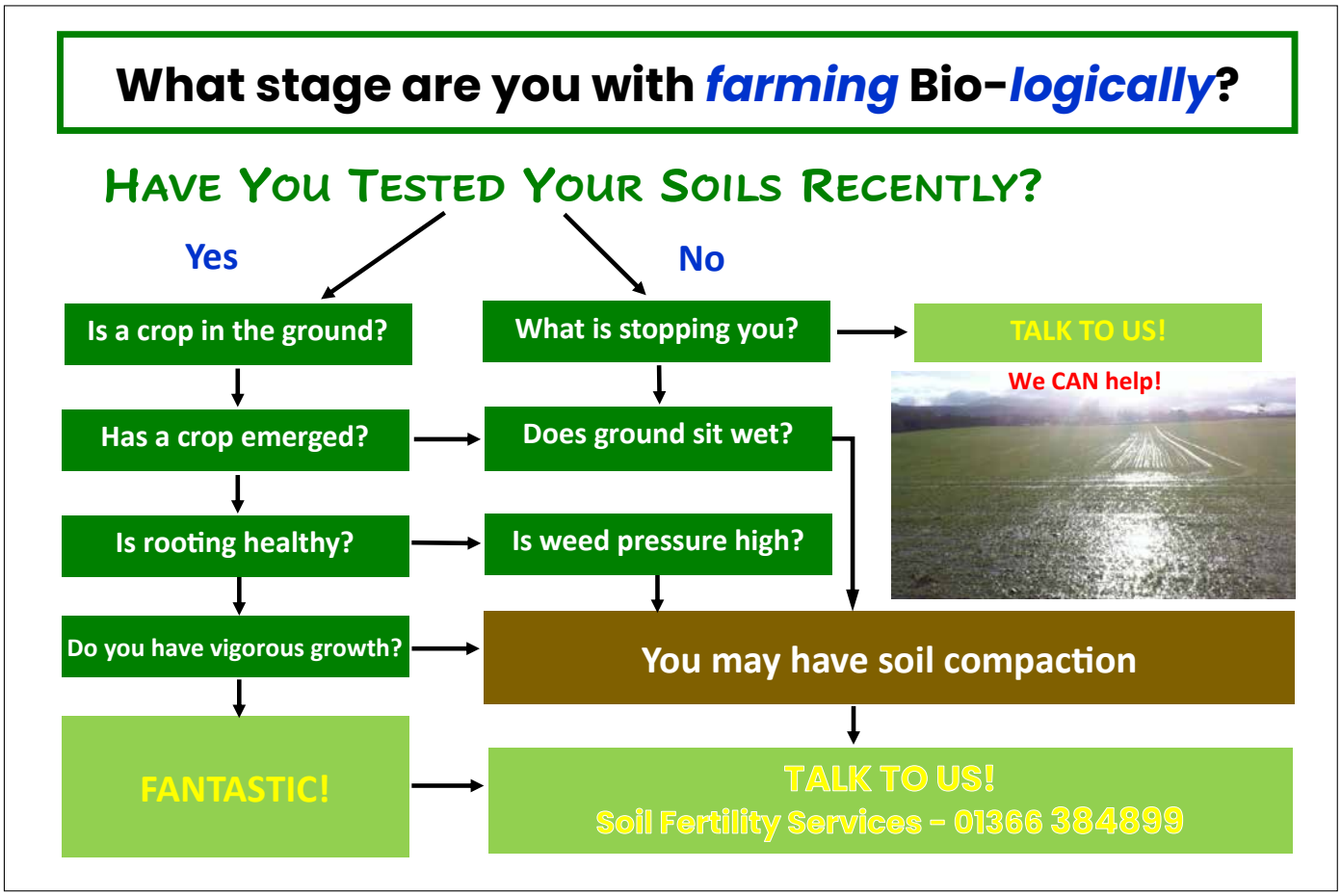
Prices for farming inputs are constantly rising and even though fertiliser is now half what it was a year or so ago, it's still double what we were paying three years ago. In contrast, prices for what we produce have fallen back to little more than half what they were last year when wheat spiked to £250 - £300 per tonne, while interest rates have skyrocketed from 3% to 8%.

Crop prices at current levels raise the question whether, at least in some cases, they justify the financial risks involved and could capital be better employed elsewhere? Currently, on the Claydon farm we grow winter wheat, all first wheats, oilseed rape and spring oats. The former is the mainstay in economic terms, accounting for half of the cropped area, while spring oats have increasingly featured in our rotation because they spread the workload and are fantastic for cleaning up any grassweeds. Currently, we have a substantial area of oilseed rape, but given the high up-front costs and increasing potential risks involved in growing it the price needs to be at least £400/t for it to be viable

What's happening on the Claydon Farm?

During the first week of February our weather station recorded 60mm of rain, adding to the extremely high levels of precipitation since mid-October. Even the worms which are normally evident in high numbers appear to have gone into hiding, but hopefully warmer weather will see them come out to play.

Starting on 15 October, we established the planned winter wheat area, albeit under slightly damp conditions, using our 6m



Claydon Evolution M6 drill. After that went in we recorded an average 1cm of rain per day for the next three weeks. To provide some context, that's equivalent to a staggering 2100 tonnes of water per hectare.

That much rain falling on our very heavy Hanslope series soils made it more difficult to apply post-emergence herbicides, but the firm, supportive soil structure left behind the Claydon drill meant that our self-propelled sprayer had no issues travelling and barely left a mark. However, looking at the levels of weed control in the crops earlier today it appears that prolonged adverse conditions during the autumn and winter reduced the efficacy of the products which were applied.

A close-up of the Straw Harrowed area shows that it is in excellent condition and will be ideal for drilling as soon as the weather allows.

The very wet soils have prevented crops from developing as quickly as they should, so plants are generally quite small relative to this time last year. Once the weather improves, they will need pushing to reach their full potential.

At the time of writing (26 February) some nitrogen has been applied. We took advantage of a short weather window last week to apply 150l/ha of N35 to our oilseed rape, but in the wheat fields where we were unable to achieve good control of grassweeds it was a question of do we apply nitrogen or sort out the grassweeds first?

The rain which fell just after harvest created ideal conditions for the Claydon Straw Harrow and we carried out multiple passes across the farm. That knocked out huge numbers of weeds, volunteers and any slugs which were present in the chopped straw. In October we applied glyphosate to kill any remaining green material, but almost immediately the heavens opened.

Given the wet conditions which have prevailed since then we are currently considering our weed control strategy. I recall that in 2012, another very wet season, the weeds that we thought had been well controlled in the autumn came back with gusto due to thinner crops and chemicals not working as well as they should have.

Given the lower levels of chemical control due to adverse weather I am feel much more secure knowing that we have our 6m TerraBlade inter-row hoe to call upon. This will be used to take out weeds growing between the rows, thereby protecting yields, increasing returns and preventing weed seeds from being carried over to the following crop. Independent research shows that using the TerraBlade reduces grassweed numbers by an average of 60%, which with wheat at £200/t has improved the yield and gross margin by £257/ha.

Drilling OSR late was unsuccessful

Painful experiences with cabbage stem flea beetle damage in recent years have made me nervous about sowing oilseed rape immediately after harvest, so as an experiment we drilled some in mid-September. A small amount of pest damage was evident in December, but by then the crop has fallen way behind that sown in August. Despite applying Centurion Max to take out any grassweeds it looked very vulnerable, and the weak plants ultimately fell victim to wet conditions and slugs. When conditions allow this area will be redrilled with spring oats, a crop we will be growing more of this year.

Normally, 50% of the farm is into first wheats and the remainder divided equally between oilseed rape and spring oats. The reason for majoring on first wheats is to keep on top of grassweeds, and with oilseed rape at significant risk from cabbage stem flea beetle we have drilled a higher percentage of spring oats this season as part of our block rotation system.

Land destined for spring oats was Straw Harrowed up to six times during the autumn to take out germinating volunteers and weeds at the cotyledon stage. Any green material remaining was planned to be sprayed off before Christmas. Windy weather meant only 30ha were sprayed and it was 9 January before we were able to spray off the remaining 120ha. This helps to reduce the toxic effect of over-wintering blackgrass and the land rested over the winter. Another dose of glyphosate will go on just before drilling.

As soon as the weather allows, we will drill the spring oats, any surface compaction caused by the extended wet weather being removed by the leading tines on our 6m Evolution drill. It will be interesting to see how those areas where we grew cover crops perform, and whether there is a sufficient increase in yield to justify the significant cost of growing them. The jury is still out on that one.

The exceptionally wet weather has also highlighted small areas of fields where drainage is sub-optimal. The leading tines on our drill are enormously beneficial in terms of allowing water to move from the surface down through the soil, but in some areas the laterals have been at capacity and unable to take any more water. We have identified areas where drains have reached the end of their working life, and others where more capacity is needed so, conditions allowing, we will install those new drains and mole other areas after harvest.

With the dark, wet days of winter hopefully behind us, spring should be a period for optimism, so I'm looking forward to some warm, dry weather to get crops growing and ensure that they develop their full potential.

On a final note, I would like to thank the Suffolk Farming and Wildlife Advisory Group for presenting Claydon with their Peewit Award for Excellence in Ecological Farming. I was delighted to be presented with the award at their annual presentation event in January, an event made even more special because my sons Oliver (Claydon's Operations Director) and Spencer (Commercial Director) were there with me to share the experience.

The Claydon website **(claydondrill.com)** galleries contain numerous videos on soil health and resilience, as well as showing the Claydon Opti-Till® System being used to establish all types of crops, in all situations, both in the UK and overseas. You can also keep up with the latest posts, photographs, and videos from Claydon and its customers through the Claydon Facebook page **www.facebook.com/Claydondrill**

FARMER FOCUS
JOHN FARRINGTON

No one wants to talk about the recent weather over the last 5-6 months. In summary, it has been bloody awful and relentless for farmers and non-farmers alike and I expect most farm records have all been smashed for the wrong reasons. The topic and the big consequences that farmers have endured and suffered has certainly been one way to get people feeling pretty down, with plenty of stress and worry added into the job.

Precision Grazing Group looking at new Herbal Ley

Top of picture 6th March, Bottom of picture 22nd January after sheep grazing, taken from same spot.

It has been good to get off farm and visit a couple of other farms over the last month or so; I visited David White and Ben Martin in Cambridgeshire and Regen Ben in Herefordshire. It was great to get off farm for the day with a change of scenery and see what others are up to. You always come back with ideas, possible improvements you can implement and confidence that others are making it work, so crack on and have a go. It is great for your mind to have a break from the home farm and chat to others, so I encourage you to all get off your own farm for a day, whether that be visiting another farmer or spending the day with the family, it will lift your spirits.

With our sheep enterprise we are part of a beef and sheep grazing group and we hosted the Southwest late winter farm walk (it certainly wasn't early spring!). We are only coming into our 3rd season with sheep on the farm, so it was great to show some more experienced minds what we get up to and get some external feedback. The day was led by James Daniel, from Precision Grazing, who

has been brilliant in helping my brother, Charlie, get the sheep enterprise set up. There were plenty of interesting discussions in the shed (to keep dry) and then out in the field visiting herbal leys, cover crops, arable reversion and ewes in a field of muddy turnips. We took a lot away from the day and found it very useful.

We have started a straw for muck arrangement with a neighbour, he bales and hauls the straw behind the combine at harvest, we then put 2 tractors and trailers on when he is clearing out the sheds during the winter, he loads with his handler. There is no money changing hands, but they are roughly counting bales into the cattle shed when bedding up. It has worked well so far, even though it has been very wet we have not made too much mess considering the rainfall... One trailer is on flotation tyres and the other is on super singles. One hardly leaves a mark and the other leaves a nice rut when loaded (this trailer is borrowed) so amazing to see the benefit of flotations.

It will be spread on growing wheat (all of which has been grazed during Jan/Feb) if the ground conditions allow and the rest will be going on in front of maize. We have had the FYM analysed and now just working out the rates per Ha. A good load or two an acre should do!

The wheat is generally ok after the horrendous weather, some heavier areas and odd headlands of fields have not survived and will need to be dealt with in the spring. Grazing the wheat has been closely managed with the sheep moving every 2-3 days so they don't make a mess... Other than one Sunday evening when a storm and heavy rain came through! I thought someone had been out with the plough overnight when we checked them Monday 7am. You would not be able to spot that area from the rest of the field now. See pictures. This is not our normal practice; it will be a good on farm trial.

One of the big farming buzz words flying around is "SFI". We have recently spent time in the office going through the various options available in addition to our Mid-Tier agreement. I have spoken to a few farmers who don't want to be involved and can't see the benefit, but for us and the way we are farming, it is a no brainer and it will benefit the business. We are doing quite a lot of the options already off our own back so the payment is a welcome bonus. We are certainly not putting the whole farm down to SFI and stopping farming. We will be integrating SFI into the farm business to compliment what we are already doing on the arable, sheep and environmental sides of the business and the extra income (including taking account of income foregone) will certainly help the bottom line with BPS reducing rapidly.

Last summer we started a project that had been simmering in my mind for a number of years. The council lane that leads into our main farmyard has got very poor access, sharp bends, neighbours, narrow width, fields either side higher than the road, so altering the existing lane on a dark winters night when no one was looking was not an option. We could only take a rigid lorry, no artics, the combine and large machines had to go along a soil track through a number of fields. Planning permission was approved and work started to open up a new access out onto the road, a site for a shed, and a track leading down to the farm to bypass the

Flotation tyre on left, super single on right

council lane. It is one of those projects you wish you had done 10 years ago. It was a fantastic feeling when we had the first artic grain lorry arrive at the farm in the autumn, and not having to worry what size lorry the deliveries were coming on. Never under estimate how much soil there is to move when you start digging, we certainly did!

Now we are a mixed farm rather than straight arable, we can and need to be more flexible on cropping rotation etc. We have persevered with under performing arable fields for a while now and these wet years have highlighted this even more, so now we have got the sheep we have decided to take them out of arable and put them down with herbal leys and make better use of them, they will hopefully be in a better state when arable crops return to them in 4-5 years time. We don't necessarily need the extra grass around in May time when the herbal ley will be at its most productive, so we are planning to sell a 1st cut of silage to a neighbour to get the main bulk away and then we can make use out of it for the rest of the year with the ewes and lambs. It will also mean that the lambing paddocks can have a good rest from sheep to help with grass recovery rest period and any worm burdens that might have built up during lambing. Once the silage has been cut, within a couple of weeks we will then have lovely fresh grazing for the lambs all through summer and autumn.

I hope the weather improves so we can all get back on the land and make some progress, a bit of sun will also lift the spirits of everyone. Its amazing just what a couple of sunny days can do.

BASE-UK - CONFERENCE 2024
LEARNING FROM EXPERIENCE!

International expertise, as well as UK-based knowledge and practical experience, was on the agenda at this year's BASE-UK conference, which took place in Nottingham in early February. A wide variety of topics were covered over the two days, from soil health, cover cropping and intercropping, to integrating livestock and the nutrient density of our food.

There was also an insight into Landscape Enterprise Networks (LENS) – a network of commercial organisations seeking outcomes from the farmed environment in return for payment for the implementation of agreed practices.

The conference kicked off with Dr Ademir Calegari from Brazil, who shared his 47 years of experience with cover crops with great energy and enthusiasm. He emphasised the importance of cover cropping in a sustainable farming system, with its contribution to soil carbon from root exudates, soil surface cover, soil aggregation, soil stability and water handling/storage.

While much of his work has taken place in South America, in crops such as coffee, sugar cane and soya, Ademir applied the principles of feeding the soil to feed the crop more widely.

The messages for BASE-UK members were to find the right cover crop solutions for their particular farm problems or constraints, to make best use of multi-species cover crop mixes to bioactivate the soil and to exploit the nutrient cycling benefits that cover crops provide. "If you get this right, the soil will feed the crop. And if you add livestock to the system, the results are almost unbelievable," he said.

The first day also saw David Purdy give an update on the work done at Project Lamport, where heavy high magnesium soils present their own challenges and a long-term approach to building resilience into the system has been taken.

He was followed by first generation organic farmer Alex Fraser, who combines running a new farming business with his work as an A&E doctor in Yorkshire. He outlined progress to date and was honest about the challenges he has encountered as a new entrant.

The last two speakers were farmer members, Toby Simpson, and Ben

Adams. Toby reported on the findings from his Nuffield scholarship on catch and cover cropping opportunities while Ben gave an update on his three-year intercropping trial.

The second day began with soil health guru, Jay Fuhrer (see panel), who's reputation precedes him. His presentation on moving the carbon dial was very well received by members.

Next up was Northamptonshire farmer David Goodwin, who spoke about how he had integrated livestock into an established arable business, outlining the barriers as well as the benefits.

Richard Jenner of Openfield then gave an update on LENS, explaining that it is just one of a suite of natural capital income streams for farmers. "Every farming business is different and there is no right or wrong model," he stressed. "Farmers have the option to do nothing when it comes to natural capital opportunities, or they can implement the SFI, trade carbon, get rewarded for insetting carbon reductions in the supply chain or provide ecosystem services to a network, such as LENS." Most will opt for a hybrid approach, he predicted.

The last speaker was Dr Hannah Fraser, a Nuffield scholar and wife of Alex. Hannah updated the conference on her findings on the role of farming in providing nutrient dense food, emphasising that the way we farm impacts nutritional quality. Against a backdrop of declining life expectancy in the UK, Hannah's message was that a healthy soil is the starting point for better foodstuffs.

Panel – Jay Fuhrer

Soil carbon levels can be moved in the right direction by applying a set of five soil health principles, US-based international soils expert Jay Fuhrer told the conference on the second morning.

Putting carbon back into soil helps with its ability to cope with future climate challenges by improving its resilience, he said, giving it a more stable structure and helping with water retention and infiltration, as well as making it less prone to erosion, increasing biological activity and improving its nutrient supply characteristics. "That's why farmers who increase soil organic carbon have better soil health."

Left to right - Edwin Taylor (Chairman). Jay Fuhrer, Ademir Calegari, Steve Townsend (Treasurer) and Stephen Goodwin (Vice-Chair).

Old Sunshine

Jay pointed out that soil organic matter was built long ago when there was abundant plant diversity with numerous species and large populations of herbivores. Having many species growing meant that the soils used to get root exudates from a diversity of plants, which fed the soil microbes and resulted in soil aggregates being built.

In contrast, today's cropping systems based on monocultures can't build soils in the same way, as the soil biology receives exudates from just one annual plant at a time, he added. "Soil carbon has been lost by agricultural systems which took this species complexity away in the drive to become more efficient. Carbon leaves the field in the grain, so unless you are taking action to slow these losses and put carbon back into the ground, you are going to keep on degrading your soils," he warned.

New Sunshine

Jay said that farmers can use new sunshine to drive biological carbon capture, by harnessing plant diversity and using animals to do some of the decomposition or recycling required. Carbon enters the soil as living, dead and decaying material, and the nature of soil carbon means that farmers need to appreciate the role played by plants and the importance of cover crops, he adds.

"The exudates they give off are consumed by soil microbes, which build aggregates and make the glue that helps to limit soil erosion and get water and oxygen into the soil."

Put into a system, they mimic the scenarios from years ago, eventually helping to restore landscapes and build back what's been lost. He likened the process to accelerating biological time – as it shortens the window in which change can take place. "Multi-species cover crops make something happen in a shorter time period than if there had been monocultures there."

Five Soil Health Principles

Jay Fuhrer emphasised that these are principles, not practices, which can be used in a systems approach.

1. Provide Soil Armour/Cover
2. Minimise Soil Disturbance
3. Include Plant Diversity
4. Maintain Living Roots/Plants
5. Integrate Livestock

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HOW FARMDEALS IS CHANGING THE GAME FOR UK FARMERS

In the evolving landscape of agricultural technology, a new player, Farmdeals, is making significant waves by transforming the way farmers purchase their supplies. As one of the UK's only digital buying groups, Farmdeals is leveraging cutting-edge technology to streamline the procurement process, reduce costs for farmers, and enhance efficiency for suppliers. Our revolutionary app and web-based platform is not just a marketplace, but a comprehensive solution designed to meet the unique needs of farmers. There are **no membership fees** and **no minimum spend** required to join.

The Technology Behind Farmdeals

At the heart of Farmdeals success is its robust technological framework, which is tailored to simplify the purchasing process. The platform employs a user-friendly interface that allows farmers to navigate through various product categories effortlessly, from seeds and fertilizers to fuel and animal health products. What sets Farmdeals apart is its intelligent matching algorithm that connects farmers with the best deals and suppliers that meet their specific requirements and their location.

The app integrates advanced unique features such as price comparison, collectives that allow for group buying and bulk purchasing discounts, personalised deal recommendations, and a secure checkout process. This ensures that farmers not only find what they are looking for but also make informed purchasing decisions. Furthermore, Farmdeals uses technology to ensure real-time data synchronization, which means that the inventory and pricing information farmers see are always up to date 24/7.

Ease of Use and On-the-Go Purchasing

Understanding the busy schedule of farmers, Farmdeals has prioritised convenience and accessibility. The platform is designed for on-the-go purchasing, allowing farmers to buy products anytime, anywhere, from their smartphones or tablets. This mobile-centric approach means that farmers can manage their purchasing needs in the field, during a break, or while on the move, without needing to be tethered to a phone or desktop computer as per traditional buying group methods.

Cutting Costs and Enhancing Efficiency

One of the primary benefits of Farmdeals is its ability to reduce costs for farmers. By aggregating demand, the platform enables farmers to access group prices and exclusive deals that would otherwise be unavailable to individual buyers. This collective buying power results in significant savings on essential products and services.

In an industry where efficiency and cost-effectiveness are paramount, UK arable farmer Chris Hollingsworth's experience with Farmdeals' Urea collective deal is a testament to the innovative approach Farmdeals is bringing to agricultural purchasing. As a first-time user of Farmdeals' collective buying service, Chris was astounded by the exceptional value and convenience offered, highlighting the significant savings, and streamlined process.

"In June, I tapped into Farmdeals Urea collective and was astounded to find the prices 14% lower than other suppliers - a significant saving in our farm business input costs.

I've previously relied on various buying groups in the past, but none have matched the cost-effectiveness that Farmdeals offers. The 14% cheaper rate really made a difference to our bottom line. The ordering and delivery process impressed me the most. It was incredibly easy and stress-free, which is a rarity inside farming".

For suppliers, Farmdeals offers an efficient channel to reach a broad audience of farmers, reducing marketing and distribution costs. The platform provides suppliers with data-driven insights into market trends and buyer behaviour, allowing them to tailor their offerings and pricing strategies accordingly. This symbiotic relationship between farmers and suppliers fosters a more efficient and responsive agricultural supply chain.

A Pioneer in Digital Buying Groups

Farmdeals digital buying group model is a pioneering approach in the UK, offering unparalleled agility and flexibility compared to traditional purchasing cooperatives. The platform's digital nature allows for rapid scaling, easy onboarding of new suppliers, and the introduction of new product lines. This agility ensures that Farmdeals can quickly adapt to changing market conditions and farmer needs, providing a dynamic and responsive service.

For anyone wishing to join Farmdeals you can join at **www.farmdeals.ag** or via the **Future Farm app** in the app store.

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SUSTAINABLE DAIRY: THE KEY ROLE OF SOIL CARBON

Dairy farmers and the wider supply chain are under huge pressure to reduce their emissions and reach net zero targets.

Sustainable Dairy Can Sequester Carbon in Soils

But carbon accounting tools only capture half of the picture if they solely focus on emissions – and farmers have a hidden ally under their feet which is already delivering incredible benefits.

When you add soil carbon into the equation, farmers become part of the solution – not the problem. And some simple land management changes can yield significant benefits, including improved productivity and biodiversity, soil health, and carbon sequestration.

"There is a big opportunity directly under our feet," says Dr Harry Kamilaris, senior business development consultant at Agricarbon.

"Farmers can go from reducing emissions to actually removing CO2 from the atmosphere. Soil has the potential to sequester billions of tonnes of CO2."

Soil health plays an important role in food security – it enhances productivity and improves water and nutrient holding capacity, thus improving potential grass growth, he adds.

However, for the dairy supply chain to tap into the benefits of soil carbon, it's vital to have an accurate and cost-effective way to measure what's already there on which to build.

"There are two parts to this solution – understanding carbon stocks, and improving them," says Dr Kamilaris. "What gets measured, gets managed, and we need robust and auditable data."

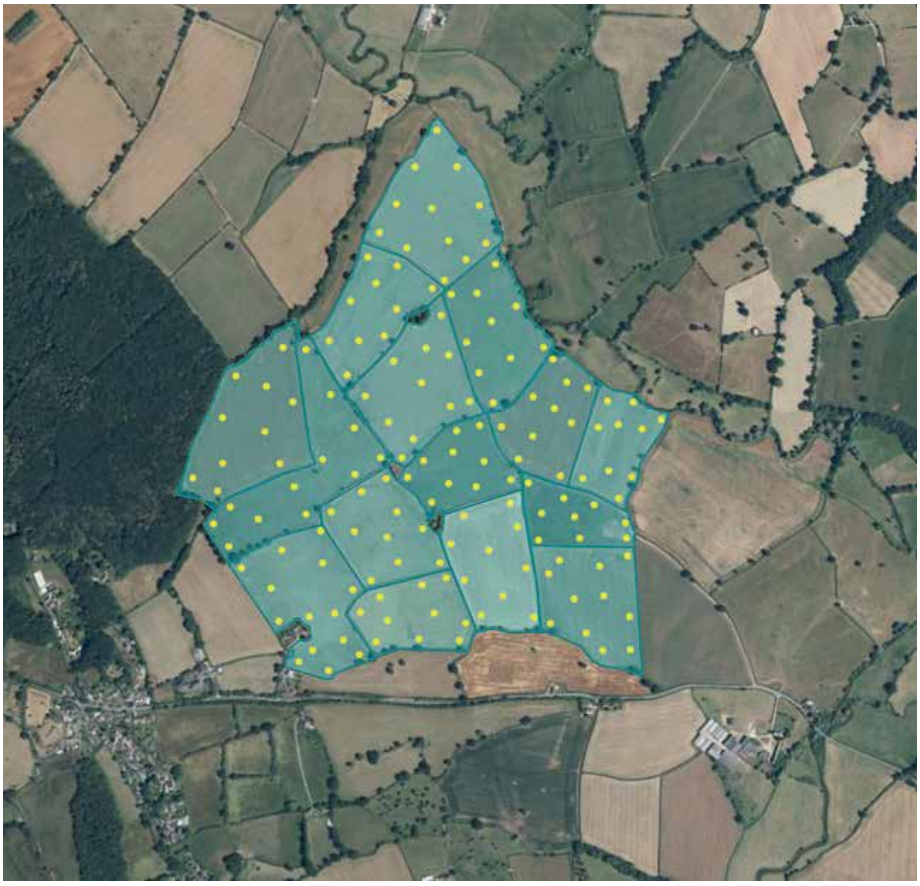
Agricarbon has developed a robust system of soil sampling, analysis and reporting, which enables producers to measure and monitor their soil carbon stocks with incredible accuracy.

"We need to make it easier for farm businesses to report the good work they're doing to meet net zero," he explains. "It's about the strength and quality of data – being able to prove what you're doing."

Farm-scale Sampling Strategy

Work in Northern Ireland on the ARC Zero project used Agricarbon to

An extracted soil core



Farm-scale Sampling Strategy

baseline seven farms' emissions and carbon stocks and found that some farms were already sequestering more than they were emitting.

"Farmers are custodians of much of the nation's carbon, and that's not recognised by customers, consumers, and others. It's a key message that we need to get out," says Delyth Lewis-Jones, head of environment at the AHDB.

One difficulty is the way that governments report against agreed international greenhouse gas reduction targets; farm emissions fall under agriculture, but the carbon sequestration in soils and trees falls under the 'land use' umbrella.

"This means that farming is often not recognised for its positive impacts," says Ms Lewis-Jones. "Farmers are being asked to deliver multiple public goods on behalf of the nation – and soil carbon is a win-win for both profitability and efficiency."

Some 80% of UK dairy farmers now know their carbon footprint, and the next steps are to reduce emissions and assess their sequestration and carbon storage, says Emma Gregson, environment manager at Dairy UK.

"Processors want to support their farms and are extremely engaged with the Dairy Roadmap (under which the whole supply chain has committed to reach net zero by 2050).

"Our role is to support the industry and show to government and the public that it's going in the right direction."

Dr. Harry Kamilaris

To find out more about how we can help your sustainable dairy strategy by measuring soil carbon, visit **www.agricarbon.co.uk** or alternatively, please email Agricarbon's Dr. Harry Kamilaris (**hkamilaris@agricarbon.co.uk**)

FARMER FOCUS
BILLY LEWIS

The good, the bad and the downright ugly is the only way I can describe the state of our autumn drilled crops as we head into the spring. Throughout the later stages of 2023, as a result of the unrelenting rain, I was pitifully watching our area of cereals for next harvest diminishing by the day.

Broadcasting Clover/Trefoil with Kuhn Aero

The rain didn't cease. In the time period between October and February we received 621mm of rainfall, an astronomical amount considering the average for this period over the previous ten years is 346mm. However, the winter went on and thankfully something did muster the strength to grow. At a conservative estimate I would say 80% of our wheat has pulled through and is now, on the most part looking quite well. It's very encouraging to see our direct drilled crops on the whole faring quite well in the face of uncompromising weather conditions. However, we can't have it all and the thorn in my side currently is the two fields of direct drilled oats, adjacent to the main road that have completely failed. This is sure to keep the passing combi drill enthusiasts happy for the time being.

Harvest 2023 was one that I would happily not repeat. Wet grain, wet straw and wet ground conditions. You might be sensing a recuring theme here. Aside from the moisture there were wins to be taken.

The wheat variety of choice was primarily Extase with some areas down to a three-way blend of Extase, Costello & Graham. There was no real yield difference between the areas. There was however a markable difference in disease levels in the crop. Contrary to conventional wisdom the straight Extase was a lot cleaner than the areas planted with the mix of the three varieties. I think perhaps the contents of my blend could do with a bit of refining. The average farm yield came in at 8.29t/ha. No records broken here. However, that's not what I'm going for. Fungicide use was kept to a minimum; some fields not receiving anything, some just a T2 and others a T1 &T2. N rates were kept down, ranging from 70kg N/ha to 115kg N/ha, and everything was direct drilled either with a Weaving Sabre Tine or John Deere 750A with the exception of one field that needed a reset with a sumo and combi drill. The cost of production for 2022/23, all in, was £139/ton. I have now sold everything (bar 20tons that I forgot about, still in central storage) for an average price of £197/ton ex farm, leaving plenty of meat on the bone. Whether this will be the case for the 2023/24 season? I am really not sure.

Direct drilled Extase

I was satisfied with the spring beans. Drilled in the last week of February, delivering a yield of 3.81t/ha and thanks to a spell of balmy weather in September we managed to cut them dry. It's a good job that it was dry as the clover and trefoil mix that was under sown in the beans had done rather well by the time harvest came around. In the areas it wasn't stunted by drought it had ended up level with or higher than the lowest bean pods which displeased my combining contractor. The clover/trefoil was broadcast into the bean crop using a Kuhn Aero in the last week of April. A reasonable amount has persisted into the following wheat crop and the ground walks absolutely beautifully because of it. However, due to the previously mentioned harvesting complications it's an experiment I probably won't try again.

Our area of Mascani winter oats did well, yielding 7.49t/ha. Didn't have a sprayer through it over the growing season and received just 65kg N/ha. There was a lot of straw, all of which got absolutely soaked the day after it was cut and required turning two or

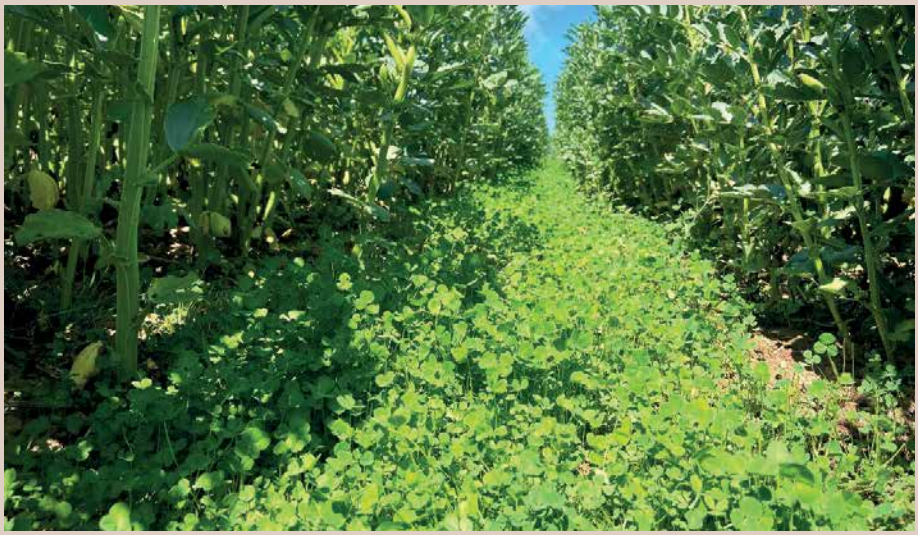
Cover crop

three times, which was fun.

The Tardis winter barley was a complete waste of time. Having never grown any barley in my farming career I decided to put a few fields in. This went in place of where we would normally grow a second wheat in the rotation. It yielded 7.64t/ha, cost about the same amount to grow as a wheat crop, we cut it all at 18% and it was sold for a considerable amount less than the wheat. Never again.

Despite the aforesaid pitfalls of farming in the wet old west, there are a few benefits. Our cover crops once again absolutely flew out the ground with no shortage of soil moisture to get them going nicely. The eight-way mix of Mustard, Kale, Phacelia, Forage Rape, Linseed, Vetch, Sunflowers & Fenugreek has kept our biomass reduction team AKA replacement ewe lambs well fed over the winter. I make sure to graze the cover crops in a very similar manner to how I graze our grassland. Graze a third, trample a third, leave a third behind. That way the lambs are always being kept full but never wading around in mud, making a mess of the field. The proportion of the cover crop that is trampled into the ground helps protect the soil from heavy rain which has proven to be very important this winter. The more conventionally minded onlookers probably titter about how much of the crop I am 'wasting'. The lambs have finished grazing the cover crops now and if we could manage just a week without rain, I might be able to get the wheels in motion establishing some spring beans. This I know is wishful thinking.

Lambs Grazing Cover Crops



Clover/Trefoil Mix Under sown in Beans

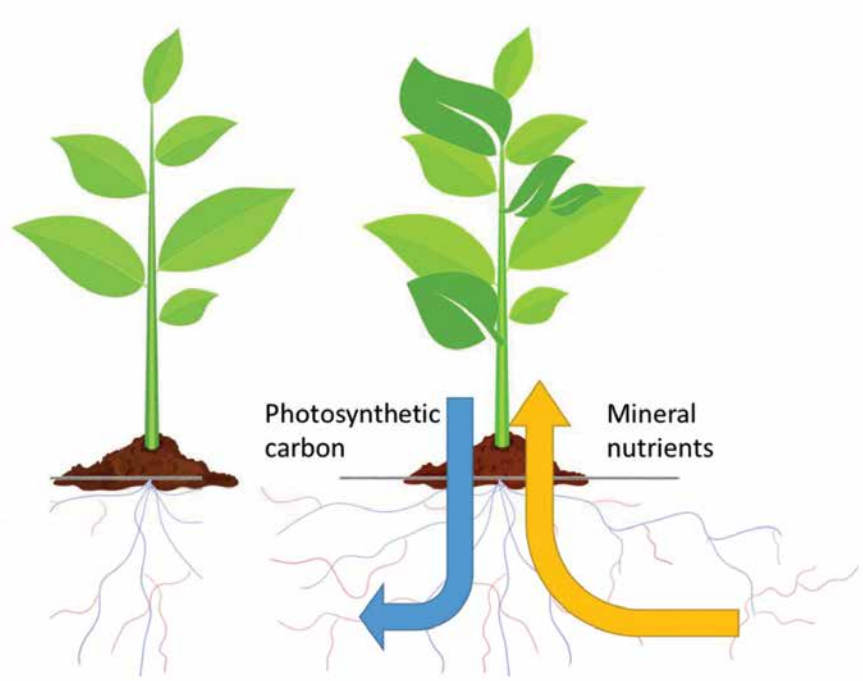
At the time of writing this piece (1st March) my attention is turning towards lambing, calving, the beginning of the grazing season and all the work that comes with it. I think 2024 could be the year for Horn rather than Corn. The beef and lamb trade are absolutely flying at the moment, making the current value of cereal commodities look rather pathetic. I'm hoping for an early turn out this spring so that we can carry some straw over to next winter. Due to the failed oats and areas of dodgy wheat we're at risk of being in a straw deficit. As well as an early turn out it would also be good if we could receive nice steady rainfall at regular intervals throughout the summer. It would be lovely to have some decent growing conditions, meaning I could drop a few fields out of the rotation to stockpile grass for the cows to come back to in November/December time, extending the grazing season. Anyway, I'm tempting fate now, the nice steady rain is probably a pipe dream as I expect once the current deluge ends we'll immediately be thrust into months of extreme drought!

I wish all the readers good luck with the coming growing season. I think it's acceptable to say that we're all starting it on the back foot this year due to an assortment of reasons. As I look out the window beside me it is currently snowing, so here's hoping for little bit of sunshine soon to make our lives just that bit easier!

FARMING'S FUNGI FOCUS: CONSIDERING BELOWGROUND TO BENEFIT ABOVEGROUND

Written by Dr David Cutress: IBERS, Aberystwyth University.

- Symbiotic fungi mycorrhiza have important interactions with many plant species
- Mycorrhiza, in optimal conditions, can improve plant growth with fewer inputs, improve soils and protect from weeds, insects, contamination and climate changes
- Mycorrhiza focused systems as such could act as a promising future tool to combat the increasing economic instability surrounding fertiliser costs in farming
- Optimising future systems should consider practices, and crops, which integrate well with mycorrhiza towards providing more environmentally sustainable production



Adapted from Thirkell et al. (2017)

Fungi, plants and soil

Most farming systems, whether they are crops, livestock or of a mixed focus are impacted by the soil health of the surrounding environment. Soil health is vital for the optimum growth of all species of plants including those involved in different pasture systems for direct grazing or silage production. The Knowledge Exchange Hub has previously produced several articles on the importance of soil health and practices which impact this, but one area that hasn't been fully expanded is how important the interaction is between soil health and soil fungal species.

Soil fungal species which interact with plants are termed mycorrhiza and these are essentially universal across all soils, other than those which are severely degraded. These form relationships with around 80% of all terrestrial plant species. They evolved millions of years ago to interact symbiotically with plant species where they can act to essentially extend the root networks of a plant, enhancing the uptake of micro and macro-nutrients as well as water. Some species interact inside the plant root tissues themselves and are called arbuscular mycorrhizal fungi (AMF) whilst other species have an external interaction where they surround the roots (more common in woody plants) and are called ectomycorrhiza (EcM).

Whilst there are some noted interactions which can be considered detrimental to plants, the general consensus is that the abundance of mycorrhizae species are either neutral or beneficial in their interactions. Along with these largely beneficial effects on plants, the networks of hyphae (root-like structures of fungi), referred to as mycelia networks, play roles in improving soil health as these structures act to hold soil particles together (reducing erosion) as well as secreting protein-rich substances such as glomalin which can boost the soils organic matter content (SOM) and store nitrogen for up to 40 years. The mechanisms for some of these key beneficial activities are highlighted below along with visual representations.

Nutrient uptake

Root structures of plants are essentially improved and extended due to the symbiotic relationship with AMF/EcM systems as can be seen in the above and all following diagrams where plant roots (in blue) are extended via fungi hyphae structures (in red). This gives the plants access to a wider area from which they can take up nutrients and that the carbon produced by the plant can be distributed out into the soil. Above a widespread mycelial network leads to extra leaf production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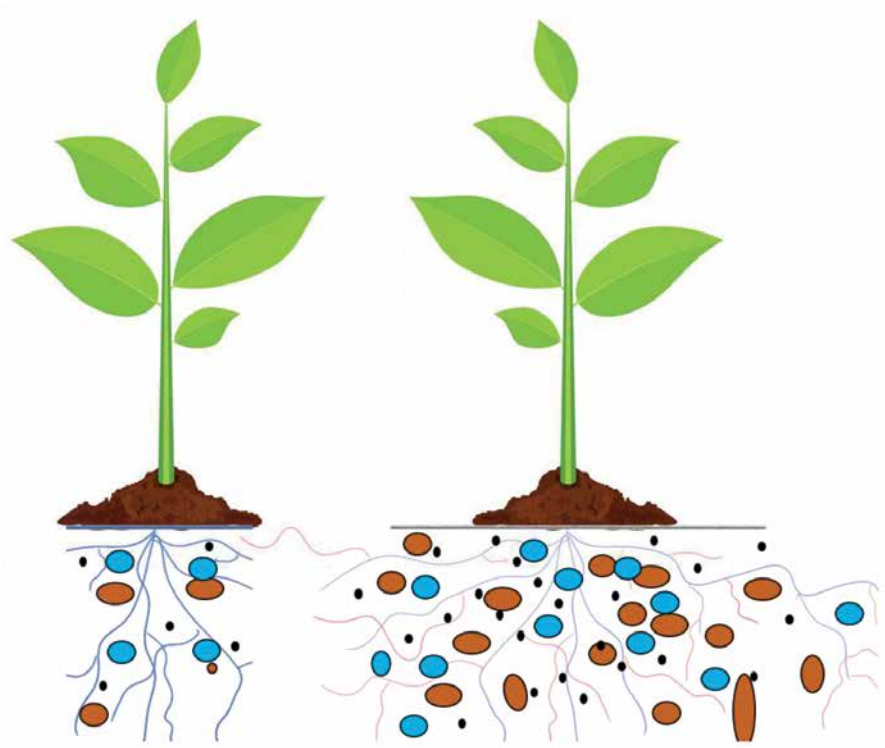


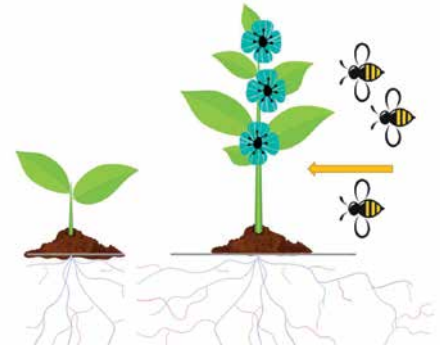
Adapted from Thirkell et al. (2017)

and biomass in the plant on the right compared to the left.

One key nutrient with which mycorrhiza are associated with improving uptake is phosphorous (P). Whilst this is a complex situation dependent on the specific fungi and plant species, the root structures, and the available resources in the soil (naturally or due to fertiliser addition), generally, mycorrhizal interaction allows much better plant growth rates in P depleted soils and has been noted to play roles in nitrogen (N) uptake too.

Soil health

Soil health benefits due to the extensive root/hyphae structures allow for higher water retention (shown as blue dots) which is essential for plant growth and can boost survival in drought conditions and general stress tolerance. Also, when compared to plants without mycorrhizal relationships far more organic carbon (C) input and sequestration is present (black dots) whilst also better soil aggregation properties are achieved (brown shapes) which can play roles in the reduction of erosion amongst other things. Importantly these mycorrhizae act as an extremely rapid route for C transfer into the surrounding soils, with estimates that they account for 5 – 10% of the photosynthesised C in plant interactions.



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Yield and growth benefits

Improved growth and yield impacts are suggested to be linked with fungal interactions in many situations as represented below. In these instances, the more extensive network of interaction leads to better growth. This can also impact the interactions with pollinating insects as healthier plants will have more energy available to produce more flowers and more nectar and in crops reliant on pollination for production this can be extremely important.

Plant competition and natural weed suppression are other areas where mycorrhizal symbiosis has roles with studies finding that weed growth could be reduced between 20-66%, essentially acting as a biological control strategy reducing the need for herbicides and ploughing. Mycorrhiza may also play a direct role in increasing food safety as they improve plant tolerance to organic contaminants, heavy metals and agrochemicals and act to concentrate these in the roots (and in some instances reduce their availability in soils) reducing the unsafe build-up in the aboveground human/animal edible components of plants.

Plant defence roles are also noted in literature through mycorrhizal interactions with plants causing the production of different volatile organic compounds (VOCs) to be released. This can be thought of as 'signals' to different herbivorous pest species to keep them away or potentially to encourage natural biological pest management, as signals that can encourage insect species that eat herbivorous species which would otherwise eat plant biomass, can also be released. In the figure below, you can see the movement (via green arrows) of groups of insects impacted by signalling from plants, boosted by mycorrhiza facilitating signal transfer between plants (blue arrows). More specifically EcM hyphae surround plant roots so they can add a layer of protection from pathogens physically and through their action to acidify the surrounding soils. Generally, these symbiotic relationships have also been shown to help plants be more stable to both biotic and abiotic stresses which are increasingly a risk in the changing environment due to climate impacts.

Finally, it is worth noting there is a significant level of complexity of interactions found with mycorrhiza and plant activities. For example, the lack of mycorrhiza can have strong negative impact on the competition between plant species as well as the establishment of seedlings to young plants along with a slightly less negative impact on overall plant diversity. Whilst AMF and EcM species have similar impacts on soils and plant competition they can act opposingly on plant establishment

and plant diversity.

Practices that impact mycorrhizae

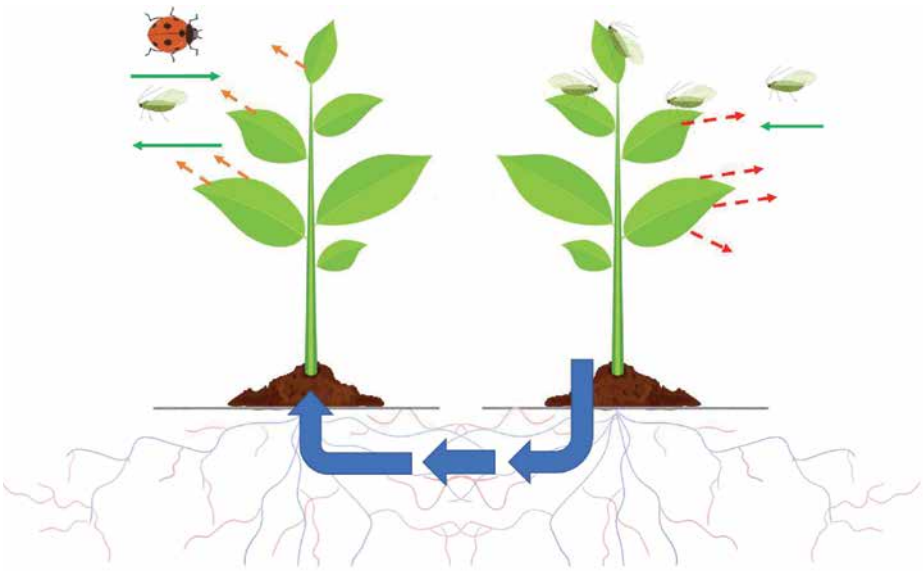
Many farm and land management strategies will impact mycorrhiza populations as they are integral within ecosystems. A breakdown of actions and impacts towards boosting symbiotic positive relationships are outlined in the following table and explained further in the section that follows.

Action	Impact
Consider if your production system's crops are mycorrhizae dependent	If they are mycorrhizal dependent consider the advice in this table. If not it might be worth seeing if there are benefits to switching to more dependent crop species
Increase plant diversity through species-rich grasses and mixed crop systems such as intercropping and polycultures	Increased species of plants present increases the diversity of mycorrhizae which is linked with improved plant growth and productivity
Reduce and optimise fertiliser levels considering targeting application based on accurate soil analysis	Saves money and can lead to similar productivity as mycorrhizae work more efficiently if performed optimally
Include root crops in rotations to reduce compaction issues	Reduces anaerobic environments which would otherwise reduce the beneficial effects of mycorrhiza fungi
Reduce soil compaction via optimised machinery and controlled traffic	
Use min or zero-till strategies	Reduces disruption of root/ hyphae networks maintaining soil carbon and aggregate structures of soils
Use permanent or longer-term perennial rotation systems	

Nutrient uptake

As noted there are suggested nutrient uptake benefits provided by mycorrhizal fungi, however, these are known to be impacted by the available soil nutrient levels. In situations where high fertiliser levels are applied to soils, this can make the interactions with mycorrhizae less efficient or potentially even negative in some cases. As such, there needs to be more consideration towards planning the levels of fertiliser applied to fields as getting this balance right could provide similar growth benefits to plants with lower quantities (and therefore costs) associated with organic or synthetic fertilisers.

Importantly, however, data suggests a significant amount of time is needed for soil conditions to recover following fertiliser addition and ploughing practices. In a study of farmed sloped areas in China it was found that it took between 12 and 32 years for species richness (of both plants and fungi) and soil carbon and nitrogen levels to equate to those found in natural



Adapted from Thirkell et al. (2017)

unmanaged grasslands.

Furthermore, mycorrhiza tend to be obligate symbionts with a degree of host specificity, either to a group of plant species or in some instances singular plant species. As such in historic sites where particular crops have been grown over a long time, particularly monocultures, there may be a lack of available fungal species present (as these have had no hosts), meaning that attempts to change such systems to polyculture will take time for host fungal species to re-establish. This suggests that practices such as those present in organic (provided tillage is reduced) and regenerative farming systems should factor in well with improving mycorrhiza fungi networks and functionality.

Soil health

Practices that affect the structure of the root and hyphae networks are known to play roles in impacting the potential beneficial effects of mycorrhiza species. For example, tillage breaks up the soil and root structures and has been found to reduce the water-stable aggregates within soils as well as having roles in reducing SOM and decreasing the presence and diversity of fungi in soils. As such min and zero tillage strategies along with permanent or rotational perennial systems show considerable benefits in this area along with their suggested roles in climate mitigation strategies.

Yield and growth benefits

In pasture systems, one aspect that has been demonstrated to impact mycorrhizal levels is the level of species diversity present within a given grassland system. The higher the species richness of a grass system the more diverse the mycorrhizal population, and increasing the diversity of mycorrhizae has been linked with significant above-ground increases in biomass production. This has equally been presented from the perspective of crop diversity as well as grassland systems.

Plant defence

Whilst there are no specific examples of practices which act towards boosting the plant defence specific impacts of mycorrhiza, all of the elements discussed will improve fungal networks and health and therefore act to improve the plant defence aspects of mycorrhizal symbiosis.

Future considerations

Due to modern crops being dominated by breeds adapted to give higher growth and yield rates by utilising applied agrochemicals most efficiently, many of these crops (particularly cereals) have shown reduced interactions with mycorrhiza fungi. Looking to the future this may give added reasoning (aside from stress adaptation and nutritional benefits) to consider re-introducing more heritage crop varieties which will likely be less reluctant to form mycorrhizal interactions and perform better in lower input environmental focused farming practices. Similarly, there is debate surrounding the specific breeding of crops to waste less energy in developing extensive root systems. These plants would work beneficially with soils managed to preserve complex mycelial networks as the smaller roots would be offset by the nutrient gather and retention potential present within these networks. Essentially this could let plants focus more energy on above-ground biomass production.

There appears to be a complex level of interaction between mycorrhiza fungi and pesticides as well as other agrochemicals such as herbicides and insecticides. In some instances, these can be detrimental, neutral or even positive. As such, future research needs to determine how much these compounds factor into any upcoming strategies which might hope to bolster symbiotic fungal benefits.

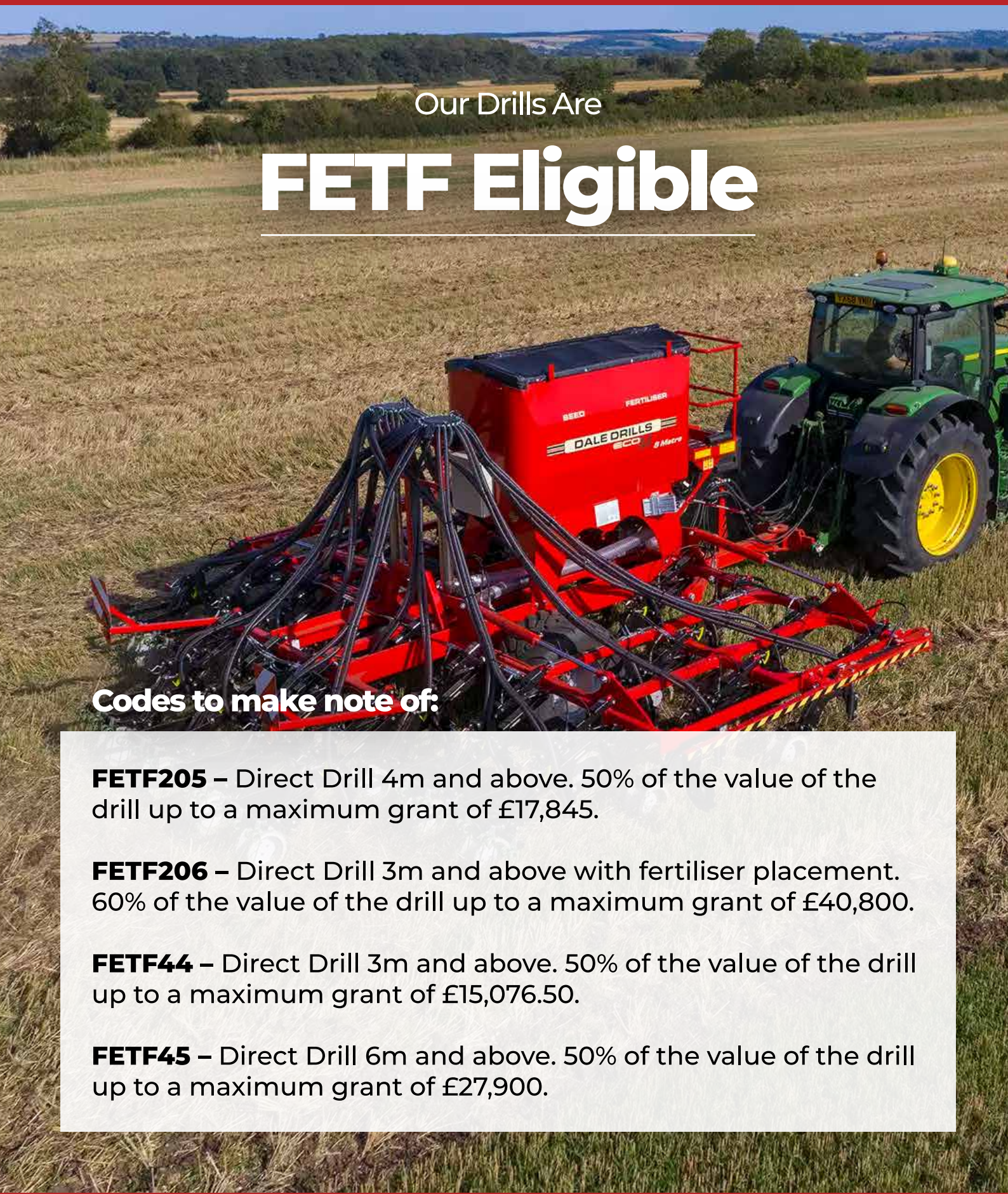
Finally, there are already many commercially available "biofertilizers" inclusive of fungal inoculant species which attempt to boost the fungal biodiversity of soils through their artificial application. We will look to evaluate the function and effectiveness of these in a future article.

Summary

Mycorrhizae symbiosis within pasture and crop plants could play an important role in shifting agriculture towards environmentally-focused farming. Soils with established healthy mycelial networks are more adaptable to changing environments including droughts and floods which are more likely to occur due to climate change impacts. Also, they can play important roles in sequestering C long-term within soils and good maintenance of fungal networks will help to avoid losses of C due to factors such as soil erosion. As such, farming practices and systems should increasingly be considering our understanding of how activities can impact on mycorrhiza, towards improved holistic ecosystem functionality.

DALE DRILLS

Farm Equipment & Technology Fund Grant 2024



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FETF45 – Direct Drill 6m and above. 50% of the value of the drill up to a maximum grant of £27,900.

For further details, visit **daledrills.com/FETF**

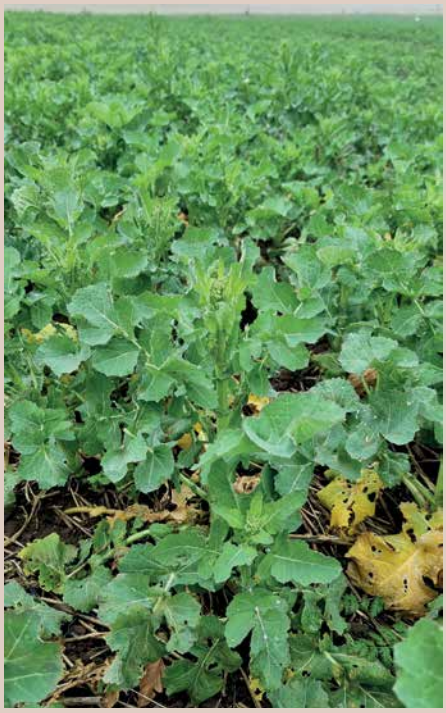
FARMER FOCUS
NEIL WHITE

I'm not going to dwell on the weather but as it is a major factor in what we do, I will say, despite having constant downpours of around 40-50mm we have fared better than most. My rain gauge filled so many times I must admit I gave up emptying it. Colin McGregor, 4 miles away, didn't give up, and tells me that we had 45% of our annual rainfall in the last 3 months of 2023. We both agreed that once again we have been very fortunate in this area compared to large parts of the country both North and South. The SFI scheme has maybe become more appealing in a year with so many challenges, and stories about 27% of ground already being taken out of production is a big concern. I don't blame anyone for making that judgment based on the prospects short term. We don't have that scheme north of the border so its more of the same for us, which means very little opportunity to enter any scheme for me.

Crops in the area, overall, look good. Some late sown crops, ploughed, power harrowed or heavily worked have really struggled and to use a Scottish comparison they look like porridge, with a shimmering top layer. We have the advantage of still being able to sow early in SE Scotland and that has mostly been the difference between good and bad establishment this year. I made a point of going 10 days earlier this year with my Pearl winter barley after wheat. I raked the field and felt I had achieved a chit this year before spraying off and direct sowing. The crop looks good so far and hopefully with the nitrogen it won't drop any tillers going forward. I sowed cover in mid-august which established well, whereas the mid-September sown cover struggled at every stage and was very disappointing. The later crop was hit with flea beetle, then slugs which didn't seem to be around when the first cover went in. The OSR established well except for one late field which flooded and some of that crop is gone. I may sow some spring beans into the patch but I'm not sure if they will make it to harvest or not. The other fields had strong crops of Resort OSR coming into the new year but the pigeons have now made their mark eating every leaf on every plant in one field and a part of another, the rest is untouched. I will use this as a grazing trial as the best OSR crop I've had came after heavy pigeon grazing and a good spring.

I am doing some trials for Simpsons Malt on my direct sown Diablo spring barley following cover crop. We have soil tested and will tissue test and finally analyse the harvested barley following cover and non-cover establishment to see any differences or benefits between them. The barley after winter grazed cover last year had a similar yield to ones after overwintered stubble but had almost twice the straw. I hope in a more forgiving growing season that would have been yield. I have been walking the desiccated cover crops and noticed, when crumbling the top layer there seems to be a large amount of slug eggs. I will need to keep a close eye on that prior to sowing in case pellets are required.

One problem I have noticed which is new, is high tide marks. I have fields which gather water in low points, one right outside my kitchen window. The water came up a few times but always went away a few days later saving the crop. The only problem is, now that I



have more residue in the top layer the extremities of the water are marked with high tide marks which have rotted out the crop. It's not a big problem I know, but it is a new one.

I used my penetrometer last autumn to decide the depth of the leading leg on the drill and it has been very interesting. Previously I would have made a decision based on soil conditions, and the fact I have plenty horsepower, this led me to run the leg deeper than required, but I didn't know that until I started testing for compacted layers in my soil. The biodiversity and profitability group I am part of used the meter to check my soils and the absence of compaction was a refreshing discovery. I subsoiled 2Ha of my farm in 2015 and haven't done any since. I put the lack of compaction down to a combination of many things. Firstly, and most importantly, the improvement in my soils. This has increased carrying capacity and water infiltration, meaning I am causing less problems from the very beginning. During the season I run my 650 tyres until the crop is well developed and run wide row crops after that, and finally I am careful to control the traffic, where possible sticking to tramlines and chopping straw and finally the tracked combine is very light on its feet. All these things have allowed me to travel on my winter crops earlier and give them the nutrition they require. This has been another bonus, spreading the workload.

Farmers in the area are putting on muck and some of the conditions have been far from ideal causing visible soil

damage. I'm often asked why I don't use a straw for muck deal in my system and it is for that very reason. I do use some hen muck, early season, onto WB stubbles ahead of OSR and some to go on the high N barley but the rest gets chopped cereal, legume and osr straw to help the OM. Conditions have not dried up enough yet to consider drilling beans or barley so I will just have to wait. The spring beans were sown on March 23rd last year and did well, and it looks like it may be a similar sowing date again this year.

In my last piece in the magazine I wrote that I was in the final 3 of the FW arable farmer of the year and we were heading to London for the awards night that week, unbelievably I won! Everyone in the category were using reduced tillage, trying to reduce inputs and increasing their margins, all things discussed at length in this magazine. The whole experience has been very rewarding and has made me look again at my system, and what the changes have brought to my farm and my bank balance. Regarding this year's competition, I would recommend nominating someone, or entering as it has been a very positive experience for me, I have spoken at many meetings and met lots of very interesting people, and I will be one of the judges this year and would love a look around your farms. Good luck.

AGRICULTURE HAS LANDED AT AN INTERESTING TURNING POINT - WHERE DO WE GO NOW?

Written by Grant James - Business Development Manager, Sea2Soil

Signs of Spring are everywhere, and while work in the world of agriculture never stops, this month we will see efforts ramp up - from the drilling, or sowing, of the sugar beet to fertilising and crop spraying.

At a local level, we may still only be seeing the seeds of regenerative agriculture taking hold, but as reported in the Financial Times recently, at a global level, the well-coined phrase is now 'firmly cemented in corporate parlance' as well as across some of 'the sustainability plans of big food companies such as Nestlé, Unilever and Danone'.

With leaps being made 'up there' in the grander scheme of things, for us on a day-to-day basis it's been positive to see regenerative agriculture gaining increased interest and traction as growers look to find new ways of reducing inputs while increasing their ROI.

Sea2Soil, for example, with its biostimulant activity as a soil improver, plus added nutrients, will increase microbial activity, root growth root diameter and soil water holding capacity. This leads to increased nutrient availability, higher quality and double-digit yield increases because it stimulates the uptake of fertilisers and nutrients with no negative effects on a range of crops.

The soil improver market has the potential to grow considerably bigger than the current pesticide supply industry, given time.

With all the interests in regenerative agriculture, carbon footprints, reduced fertiliser usage, recent legislation shifts and sustainable farming, is this the time for soil improvers to move forward into mainstream agricultural product usage? We think so.

There is a clear trend developing that shows farmers are growing tired of the regenerative market having no clear definition too, with almost anyone technically being able to label themselves 'regenerative' under a green-washed label.

Because of this, we're seeing growers looking to invest in products such as Sea2Soil, where results are being driven by ongoing trials, in turn, providing firm foundations upon which they can then qualify themselves regenerative.

If the 20th century was the era of biochemistry, the 21st could easily be described as the era of biology. As an industry, we are realising that our actions matter; we cannot continue to ignore the health of the soil and our wellbeing.

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DRILL MANUFACTURERS IN FOCUS...

DALE DRILLS

The press wheels keep on turning here at Dale Drills, as we give you the lowdown on our latest product innovations, as well as our eligibility regarding the FETF grant scheme.

Introducing Dale Drills Latest Innovations

To match our Eco range of seed drills, our Mounted Tine Drill (MTD) range has been upgraded to include a split tank option, allowing for simultaneous sowing of two different seeds or products. The narrow double coulters place the two products, one beneath the other, behind the 12mm wide tungsten tipped tines as they penetrate the soil. The 1500-liter hopper, divided evenly, integrates two Accord seed metering units (one of which is a heavier duty Fertiliser metering unit) managed through an RDS Isocan control system.

Available in working widths from 3 to 8 meters and with row spacing options of 12.5, 16.6, 18.75, 20, or 25 centimetres, the MTD meets the increasing demand among farmers to diversify their seeding techniques.

James Dale notes, "We've noticed more farmers looking to incorporate multiple seeds or products with the drill. This split hopper feature, a novelty for mounted tine drills, offers farmers significant versatility at a competitive price. Making the drill eligible for FETF206 grant (the best paying option for direct drills) is an added benefit for farmers at the moment."

Additionally, Dale Drills' premier Eco Drill range has had its options list improved. One enhancement is a rubber semi-pneumatic press wheel designed for customers only looking at using the 10" row spacing configuration. This press wheel effectively compacts soil around the seed, utilizing its flexible rubber material and an optional scraper to prevent soil adherence.

Another new option for the Eco range is the Scorpion drilling assembly. Also aimed at farmers wanting to drill at 25cm row spacing, the scorpion utilises a single narrow tine fitted with a double seed boot (for multiple product application). This tine is followed up by a pair of Guttler rings attached to a tandem axle. Strategically angled, the Guttlers redistribute soil over the seeded row, efficiently compacting it around the seed for improved germination conditions.

Dale Drills and FETF Eligibility

In a recent announcement, DEFRA has disclosed the opening round of a

new phase for the Farming Equipment and Technology Fund (FETF) grant applications. This funding initiative serves as a valuable resource for farmers looking to invest in cutting-edge equipment and technology, with the aim of enhancing productivity and promoting environmental sustainability.

Dale Drills is delighted to confirm that once again, its range of No Till Seed Drills qualifies for inclusion in this funding program. In the previous cycle, numerous customers successfully secured FETF grants to support their investment in a new machine from our ECO and MTD range.

Dale Drills remains committed to assisting farmers in optimizing their operations through innovative equipment, and the FETF presents a valuable opportunity for those seeking to integrate our seed drills into their farming practices. Don't miss the chance to enhance your productivity and contribute to a more sustainable agricultural landscape. Contact us today to explore how Dale Drills can be a strategic partner in your journey towards efficient and environmentally conscious farming.

NAVIGATING THE STORM: CHALLENGES IN AGRICULTURE

Written by Joe Stanley, Head of Sustainable Farming, at The Allerton Project

As I write this in the third week of March, I can reflect on challenging times both behind and ahead. On the heavy Hanslope-Denchworth series clays of the Allerton Project, we are yet to get so far even as to have terminated our cover crops, let alone apply any spring inputs to those autumn-sown crops which have survived the onslaught of one of the wettest winters on record - though we judge that only some 35% of our winter wheat area is even salvageable. Even were the incessant rains to cease today, we are likely looking at planting our wheat, beans, oats and barley well into the middle of April, significantly compromising potential.

In my view, extreme weather has been persistently afflicting agricultural operations in the UK since at least the summer of 2018; initially whole seasons began to oscillate to extremes, but more recently seemingly every month brings new weather records of one sort or another. From September 2023-February 2024, Allerton has recorded 626mm of rainfall (including the wettest February since records began in 1836) which already takes us to our median average annual total. I've no doubt that come May and June, we'll be experiencing another extended hot, dry spell.

Here at Loddington, we have been focussing on soil health and resilience for two decades, undertaking the transition from inversion to reduced tillage, and finally to pure 'direct drilling' (where appropriate) culminating in the purchase of a Horsch Avatar for our autumn campaign last year (a journey outlined by our director, Dr Alastair Leake, in Direct Driller issue * last year). We have ample data to demonstrate the benefits (all things being equal) of this transition, both economic and environmental. However, despite the enthusiasm with which he have embraced this journey, our experience of recent years – and especially the last twelve months – is leading me to question whether the climate mitigation measures which I expounded in the last issue of DD are any longer sufficient to build the levels of field and soil resilience required to endure the extremes of weather with which we are now faced.

In spring 2023, central and southern England experienced some 200% of normal rainfall, which delayed our own drilling campaign (interrupted the previous October by rain) until the final week of April and into early May. Clearly, beans and wheat planted so late in the season were always going to need a fair wind behind them to turn a profit; alas, May and June saw some 20% of normal rainfall and it was not to be. Final yield was correspondingly disappointing, with the anaemic spring beans not being cleared until the second week of October. Wheat subsequently direct drilled mere days ahead of Storm Babet (which dropped 65mm of rain in 24 hours) and the eight subsequent named storms to date has, as reported above, not thrived.

Twelve months on, we look to be facing the same situation once more: the prospect of late-drilled, thin crops with poor agronomic performance and negative gross margins. However, for the ground originally earmarked for winter (then spring) beans, this season we don't intend to take the same risk again, instead planning to plant a summer fallow allowing us a good entry into wheat this coming autumn. Working alongside our seed partner, Kings Crops, this will also give us good insight into the potential for the new SFI summer fallow option to be available from next year.

Another aspect of last winter's extreme rainfall has been unprecedented levels of soil erosion across the estate. Once again, despite a long focus on conservation (and more recently regenerative) agriculture and measurable improvements in soil health, the level of soil damage (exacerbated by late-planted, unplanted or failed winter crops) has been terrible to see – and the value of well-established cover crops never been better demonstrated. In a ghoulish way, I am looking forward to seeing the results of lidar scans and soil sampling undertaken on our most impacted fields which will give us a monetary value of the soil and nutrients lost over the course of the winter, data which we will share with our 2,000 or so annual visitors to help focus minds on the importance of soil protection.

Yet the question remains – on our rolling slopes and grade 3 marginal land, and in the absence of direct payments, can we continue to weather the extreme conditions which are likely only to intensify in their effects? Or might more dramatic resilience-building measures be required?

The Allerton Project has commissioned work looking at what might be necessary

Beetle Bank Erosion

in our wider catchment to meet government targets under the 25 Year Environment Plan to reduce nitrogen, phosphorous and sediment pollution from agriculture into water by 40% by 2037. The modelling suggests that (in a silty-clay/silty-clay loam landscape with relatively steep topography) some 47% of land currently in arable production would need to be put to other land uses to meet those targets (a retasking of some 1300ha). This would include afforestation, arable reversion to grassland and much more extensive use of buffer strips. The modelled production loss would be some 10,500t of wheat/year.

These targets are, of course, national and not on the individual farm or catchment level, but nevertheless our figures indicate the potential scale of the transition required in a challenging landscape such as ours – especially as winter rainfall becomes ever more intense. As financial options to enact such land use change become more attractive – whether from public or private coffers, or a combination of the two – farmers can hardly be forgiven for considering them, given the experience of recent years of trying to grow profitable commodity crops traded at wildly fluctuating global prices with stubbornly escalating input costs.

Indeed, at my own home farm near Loughborough in Leicestershire, the driving motivation behind entering a Mid-Tier stewardship agreement in 2021 was climate change: I had had enough of seeing arable soils disappear downslope during wet winters, and crops wilting and dying on our lightest land. Fields that had happily been in arable production for decades were placed in a mixture of legume fallow (AB15) and diverse herbal leys (GS4). I have seen nothing since to make me think I made a poor choice in so doing.

I think that many farmers will be facing an increasingly difficult choice in the coming years as to whether they persist with their current methods of production, or take advantage of novel income streams to significantly alter the

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Cabins South (plough vs DD) spring 2024

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TIMETABLE AND WHAT TO EXPECT

Each session will have a main guest speaker who will speak for roughly 20 minutes followed by a 20 minute panel question and answer session. The panel will consist of a farmer, an agronomist, a person from the trade and the host.

Topic 1: SFI, what to claim and how to profit from regen ag.

9:30 – 10:30

What SFI options are you claiming? SAM1, HRW3, AHL1, AHL2, AB1, AB8 and others all work in combination with regen ag farming. What's better than getting paid once? Getting paid twice and improving your soils at the same time. But what are the best combinations for different soils types and farms…?

Topic 2: Machinery and regen ag.

11:00 – 12 noon

Many say that the more you embrace regen ag then the less machinery you need. With the new SFI requirements, things like toppers are becoming as essential as the direct drills themselves, but what are the easy wins? To decrease your fuel spend each year and release the capital expenditure on machinery…

Topic 3: Cover crops; What they do to your soils and how they deliver profit into your business.

13:00 – 14:00

Firstly, there are cover crops and then there are cover crops! With so many different mixes and so many different options, cheap mixes might meet the needs of a scheme, but if you want to double the benefit of better rooting, soils and biomass, then spending a bit more on the right mix for your farm will see an increased benefit!

Topics 4: Nutritional benefits from regen farming.

14:30 – 15:30

SAM1 is paying farmers to better understand their soils and have a plan, but do you know how the various indices interact and how getting them right leads to increased yield? We look into how the right nutrition leads to higher profits and better soil.

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CONFERENCE SPEAKERS

CONFERENCE HOST - Edwin Taylor, Chairman of BASE UK

Edwin farms 800ha of combinable crops and 250ha of grassland, supporting 180 suckler cows plus followers in partnership with his father at 230m above sea level, in south Northumberland which is always going to bring its challenges! The journey into conservation/Regen Ag started back in the late nineties unknowingly, as the drive back then was more cost driven but that was definitely one of the first steps that changed his approach to the way he farms, and it has been and still is a "journey" (every day's a school day). Back in 2012, he was asked to join a meeting which unknown to him turned out to be the launch of BASE-UK. He was later asked to join the committee, never thinking he would be sitting here today as Chairman, which he says is "a great honour and privilege." He continues "The organisation has grown beyond expectations because I think there is nothing else out there that offers what BASE can. But its real strength comes from you the members, the committee and administrators, which we all owe a great thanks to. The team do a great job of keeping us all entertained and educated throughout the year." **See Edwin on both the 11th & 12th June for Direct Driller at Cereals**

SFI: WHAT TO CLAIM AND HOW TO PROFIT 9:30 – 10:30

Georgie Bray, Farm Manager at RSPB for Hope Farm

Georgie has worked as manager at Hope Farm for 6 years, an 181ha arable farm in South Cambridgeshire working on heavy clay soils. She works with the team to research and demonstrate nature and climate friendly practices. That includes working on an agroforestry trial, soil monitoring, CSS and now SFI management, regenerative trials, running under the Fair to Nature scheme, and feeding into practical advice for the Farm Wildlife partnership. She also works back at home in Essex, with farmers in the local cluster and the family farm on stewardship work. Georgie has a 1st Class Masters degree in Zoology, and holds the BASIS certificate in Crop Protection. **See Georgie Bray on the 12th June for Direct Driller at Cereals**

Clive Bailye, Farm Manager and Founder of The Farming Forum

Managing partner of TWB Farms Clive Bailye is a zerotill arable farmer from Staffordshire, and founder and owner of digital media company Agri Web Media Ltd which operates The Farming Forum , Farm Classifieds, Farm Marketplace websites and publisher of the very popular Direct Driller Magazine . Clive was awarded FCCT's first ever Soil Farmer of the Year in 2016 is a 2019 Oxford Farming Conference Emerging leader and now regularly speaks internationally to groups interested in his innovative approach to his farming business and the environment. **See Clive on both 11th & 12th June for Direct Driller at Cereals**

Elliot Taylor, Partner at George F White LLP

Elliot Taylor is an Equity Partner at George F. White LLP leading a rural team of highly skilled Rural Surveyors and Farm Consultants, delivering property and business consultancy advice across the North of England. Elliot is a Member of the British Institute of Agricultural Consultants with over 20 years' experience in the academic and commercial sectors. Elliot provides professional advice covering all areas of strategic business management. His areas of expertise include farm and estate management, strategic business planning, whole farm appraisals and business restructuring. Other areas of expertise include advising farmers on all aspects of environmental land use through the Environmental Land Management Schemes. **See Elliott on both the 11th & 12th June for Direct Driller at Cereals**

Martin Lines, Farmer and Contractor

Martin is a farmer and contractor in South Cambridgeshire, growing mainly arable crops on his family farm and rented land. He has a special interest in farm conservation management, currently running a Sustainable Farming Incentive agreement and has Countryside Stewardship schemes on land he rents and manages. He also supports the delivery of Stewardship schemes for a number of other farmers. Martin is the NFFN CEO and hopes to see the network grow with like-minded farmers and land managers who will work together, sharing best practices and demonstrating what can be accomplished for nature and the environment while producing great produce. **See Martin on both the 11th & 12th June for Direct Driller at Cereals**

Ben Adams, Arable Farmer and Farm Consultant

Passionate about removing the family arable farm in Oxfordshire from the input treadmill, Ben Adams has recently left the Sustainable Farming Incentive Pilot scheme to make the most out of the full Sustainable Farming Incentive 2023 offer. Ben also works as a farming consultant so understands the balance between profitability, regenerative agriculture and getting the most out of schemes and grants.

See Ben on both the 11th & 12th June for Direct Driller at Cereals

Emily Pope

Emily has over 10 years' experience working in knowledge exchange within the agricultural industry, including at the AHDB. She has a PhD in Soil Sciences from Harper Adams University.

See Emily on both the 11th & 12th June for Direct Driller at Cereals

Gary Willoughby, Famer and "Have a go" Drill Builder

Gary started out with a direct disc drill and soon found that this wasn't going to do everything he wanted it to do. He needed a tine drill to complement this, and whilst looking around at affordable used tine drills, nothing took his fancy. So, Gary set about making a simple 3m tine drill utilising a seed hopper from a combi drill already on the farm. The concept worked so well, he's now made an 8m tine drill with 4 seed hoppers and a liquid applicator. **See Gary on both the 11th & 12th June for Direct Driller at Cereals**

Joe Fisher, Arable Farmer from Nottinghamshire

Joe is an arable farmer in Nottinghamshire, growing 560ha of crops across medium-clay loams. He began transitioning the family farm in 2016 towards a more sustainable way of operating, starting with direct drilling but soon taking a wider approach to utilising cover and catch crops, widening rotations and reducing synthetic inputs. Field scale trials are undertaken to test new techniques or products, ensuring profitability is at the centre of the decision making process.

See Joe on both the 11th & 12th June for Direct Driller at Cereals

Mike Metcalfe, Managing Director of JJ Metcalfe & Sons

Mike has built the business up into a renowned Agricultural Manufacturing Business, designing, testing, and manufacturing durable, soil dynamic parts for Direct Drilling, Minimum Tillage, Strip Till and other soil engagement systems. Mike has designed innovative parts for many agricultural manufactures, as well as parts that are sold for self-build direct drills and conversions for subsoilers into min till, or low draft. **See Mike on both the 11th & 12th June for Direct Driller at Cereals**

Stephen Goodwin, Mixed Farmer from Northamptonshire

Stephen is the third generation in his family farming in South Northamptonshire and started his journey into regenerative agriculture in 2000. As one of the founder members of BASE-UK, Stephen joined because he wanted to meet with likeminded people who would give him the confidence to continue with the system. He now farms with his wife Rebecca, son David, and daughter-in-law Jess. They have re-introduced livestock into the arable system to enhance the soil even further by mob-grazing cattle and over-winter grazing of cover crops. They are using schemes to help pay for proper fencing of fields to ringfence the land. **See Stephen on the 12th June for Direct Driller at Cereals**

COVER CROPS AND INTEGRATING LIVESTOCK 13:00 – 14:00

James Bucher, Famer from Suffolk

James farms 550ha in Suffolk. After years of intensive root and cereal cropping which resulted in severe degradation of soils, he started focusing on soil health from 2018, initially with the use of multi-species cover crops. He soon realised that more was needed and from 2021, he developed a more diverse rotation, began experimenting with companion cropping, introduced livestock into the rotation, adopted min-till practices and massively reduced the farms' reliance on pesticides and artificial fertiliser.

See James on the 12th June for Direct Driller at Cereals

Toby Simpson, Arable Farmer

Toby is an arable farmer from Cambridgeshire where he farms in partnership with his family. The farm has been focused on soils for over 20 years, more recently moving into a direct drill establishment system. Toby is a 2022 Nuffield Farming Scholar where he travelled to different countries looking at 'Catch and cover cropping opportunities in UK arable agriculture'. He has a passion for all things soil health and is always exploring new ideas and trials on the farm.

See Toby on the 12th June for Direct Driller at Cereals

Kate Smith, Senior Soil Scientist at ADAS

Tate is a senior soil scientist at ADAS with specialist knowledge of soil and nutrient management and diffuse pollution of air and water from agricultural systems. Kate is FACTS (Fertiliser Advisors Certification and Training Scheme) qualified and a member of the British Society of Soil Science and a member of the Association of Applied Biologists CATE committee group. Her current research focuses upon cover cropping, sustainable grassland systems, improved nutrient management and efficacy testing of enhanced efficiency fertilisers. Research involves both experiments carried out on commercial farms and evidence reviews. Kate frequently presents at farmer workshops/ meetings and at national and international conferences.

See Kate on the 12th June for Direct Driller at Cereals

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NUTRITIONAL BENEFITS FROM REGEN AG FARMING

14:30 – 15:30

James Warne, Agronomist for Soil First Farming

James is from a farming family in South Devon. He studied agriculture at Seale-Hayne college before moving into farm management roles and as a technical specialist in an organic recycling business, and as an advisor for the Farming and Wildlife Advisory Group. He now delivers practical advice on farms across the country on Regen & Conservation Agriculture techniques. He's a firm believer in no-till establishment techniques combined with soil management and crop nutrition techniques for lower-cost crop production. James believes Conservation Agriculture has the potential to deliver tangible social and economic benefits to farming communities, enhance and improve the local and wider environment through cleaner air, water, and greater biodiversity. These beliefs are derived from practical experience gained working with farmers nationwide.

See James on both the 11th & 12th June for Direct Driller at Cereals.

Steve Townsend, Consultant for First Soil Farming

Steve studied at Hartpury and Brackenhurst Agricultural Colleges and spent 44 years working in agriculture, ex RHM, Kenneth Wilson & Monsanto. He headed up Monsanto's UK Ecotillage team for 4 years. For the last 25 years Steve has been working with farmers advising them on conservation agriculture systems in the UK, Ireland & Europe. He started Soil First Farming which is a company dedicated to making farmer's more profit by improving their soil's structure and fertility. Steve is a founder member of BASE-UK. Steve is also a hobby farmer keeping sheep and occasionally pigs in Gloucestershire.

See Steve on both 11th & 12th June for Direct Driller at Cereal

TICKET INFORMATION

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AGRONOMIST IN FOCUS...

GROUP 3 STAND-OUT SIGNALS SOFT WHEAT STRENGTH

Bamford is one of just five new varieties added to a cleaner, fresher AHDB Recommended List for 2024/25. *Mike Thornton*, UK Head of Crop Production at Procam, argues it's a clear front-runner, not just for its high yield.

Despite a strong line-up of new winter wheat varieties this year, the overall stand-out based on its yield, wide marketability, high specific weight, and impressively consistent disease resistance ratings has to be Bamford.

With a treated yield of 106%, it's 6% ahead of the next best Group 3 soft, and with an untreated yield of 92%, it has the second highest untreated yield on the entire winter wheat RL, regardless of classification.

There are just five newcomers on the 2024-25 AHDB Recommended List (RL). Ten have been removed and there's a much-improved layout. The overall result is that growers and agronomists get a cleaner, fresher look on winter wheats as they navigate their way more effectively through a maze of data towards an informed decision.

Mike Thornton highlights Bamford's 92% untreated yield score as a compelling addition to its CV

But it's not just the new-look list that causes Bamford to stand out. The new soft wheat, from independent breeder Elsoms Seeds, first caught our attention in NL1 trials following a tip-off from my Procam colleague, Seed Manager Lee Harker.

I recall Bamford's specific weight being over 78kg/hl in that first trial when most other wheats struggled to get close to that type of figure. The untreated Bamford plot looked incredibly clean and, with growers often looking for opportunities to lower agrichemical inputs, its 92% untreated score is a compelling figure on any variety's CV. It's undoubtedly the best Group 3 to come onto the RL in many years, but I believe growers should consider it, first and foremost, as a very high yielding wheat – not simply as a Group 3 biscuit wheat.

Although there's very little to separate Bamford and LG Beowulf on this year's list, Bamford's earlier maturity may well give it an agronomic edge with growers in the North.

From speaking to Christian Maltby, Seed Manager at Bartholomews, he believes that, for growers based in the South, Bamford's higher yield when compared to almost all other winter wheats would be its greatest attraction.

Growing high-yielding Group 4 feed wheat in the South-East is often less favourable due to a lack of local feed homes and export interest. Assuming growers can grow Bamford to a minimum 11% protein, allied to its robust Hagberg and specific weight data, high quality UK soft Group 3's like Bamford are highly marketable for export, due to a lack of Group 3 wheat being grown in other countries for the Iberian market.

Christian felt that with increasing

costs of fertiliser, and the higher risk involved in pushing some varieties to achieve 13% protein, growing a Group 3 to achieve 11% protein would be a preferable option for some growers. As a merchant, they're looking forward to seeing how the variety performs on a larger scale and expect to see strong seed demand this autumn. Their longer-term expectation is that subsequent high-yielding Bamford wheat crops, grown to a specific minimum grain quality will increase the market share of planted Group 3's in the UK.

Bamford looks well equipped for earlier drilling dates, which will appeal to growers following some serious crop establishment challenges in 2023. It's straw strength and moderate speed of development in the autumn make it well suited to earlier drilling, particularly in the north of England and Scotland where September drilling dates are preferred. Bamford also offers a fast speed of development in the spring and has an erect growth habit. Two significant agronomic characteristics that will help it to outcompete higher grassweed burdens - a key problem for UK wheat growers during the last two seasons.

hristian Maltby believes Bamford's attraction to growers will increase the planted area of Group 3 wheats

It has been a long time since we've seen a variety on the RL with a 6% yield advantage over the next best variety in its group. Bamford has the potential to revitalise the Group 3 sector and I believe it signals a landmark change for the UK soft wheat sector.

FARMER FOCUS
ANDY CATO

During an unrelentingly wet February, the only ray of sunshine was the arrival of our Red Sussex calves. It's always amazing to watch mother and baby choreograph an apparently impossible dance in which a sodden, half blind wobbly legged newborn finds the source of its milk. About a month before calving, we moved them up above the flood, onto one of our four sandier fields where the ground has remained relatively firm underfoot. On the lower clays that make up most of the farm, it's a different story.

There are some signs of progress. After harvest last year we got across a lot of ground with the subsoiler. Where there was standing water last winter, there hasn't been this time around. The role of diverse living roots in increasing water holding capacity shouldn't be underestimated either. Sunlight is the only source of regenerative energy coming into any farming system and the more we can capture, the more carbon flows through root exudates and the greater the porosity created by the creatures of the subterranean soil universe. Porosity and connectivity are key measures of soil health used by Rothamsted microbiologist Andy Neal, and explain the 354,000L per Ha of increased water storage in the top 30-cm of soil he estimated to result from a 1% increase in soil carbon. This has been misinterpreted in some forums, where it was said that there's no way soil organic matter can absorb that much water. But water is not stored in soil because organic matter absorbs it, but because of capillary action in pores smaller than 100 microns, formed as a result of organic matter decomposition by microbes. The more pores of this size there are, the more water is stored. Any data of this kind will of course be site specific, but this estimate is derived from direct observation and measurement of the increase in pore space due to increased organic carbon stocks. It gives an idea of the vast potential to build farming systems more resilient to increasingly wild weather.

Between the subsoiler and living roots, we've managed to get a couple of hundred sheep across the arable area this winter,without too much damage. But they haven't been grazing any winter cereals. The plan was to subsoil, followed by a stale seed bed operation to get on top of the rye grass and couch which has been an issue since we arrived three years ago, and which got a lot worse thanks to thin crops in last year's drought.

But the rain started and never stopped, and it became clear we'd have to resort to cover crops and switch to spring planting. Like everybody else, this meant accepting sky high seed prices and hoping for a kind end to the winter. The wettest February since the 1800s wasn't part of the plan. Patience becomes difficult as March becomes April but hope springs eternal that rich canopies of bi- and poly-crops will soon be emerging from nicely warmed ground. Hopefully rapidly enough to evade the inhabitants of our huge local rookery.

Alongside wheat and beans, we're also planting barley and pea. On a smaller plot, we'll be sowing spring barley, rye and peas, the rye and barley combination inspired by the African tradition of Maslins. These blends of different cereals were common and remain so in certain areas. Literature is limited but what there is often describes notable disease and drought resilience. To remove barriers to bi-cropping, Wildfarmed already offers whole crop processing to our growers. As such, it's worth exploring further possibilities of crop combinations that can be separated successfully post-harvest. Rather than applying all our chemistries and ingenuity to maintaining monocultures, the vigour of diverse cover crop mixes suggests that it is worth pursuing the idea of harvestable in-field diversity, applying our science and ingenuity instead to seed separation.

Last week I was asked to speak at a gathering of crop and soil scientists and farmers hosted by the Aurora Trust at Cambridge's Sainsbury Laboratory. With a room full of research bodies, I was keen to put forward questions for which so many of the farmers I speak to want answers.

Black grass; there are growers using £150/Ha of mixed herbicides to try and remain in control. On the other hand, we have seen fields following summer long cover crops go from being the most black grass infested to the cleanest. What are the mechanisms at work here? If it's a change in soil biology, soil porosity or shading, or a combination of those things, let's understand it better so we can optimise the efficacy of the cover crop blends.

Glyphosate; last year, Wildfarmed teamed up with Rothamsted to look at which is least bad for the soil - terminating cover crops with a buffered dose of glyphosate or with shallow cultivations. On highly biological soil, our trials showed that after 7 weeks, there were no traces of glyphosate. But also, that the cultivated ground had regained its functional connectivity. We now need to find the funding to investigate the long-term effects of both practices on the soil microbiome; the chelating effects of glyphosate and any disease implications of micronutrient deficiencies that follow. And whether the effects of glyphosate and tillage are more persistent on degraded soils. Depending on the results, it may be that biologically-rich systems can be successfully managed with careful cultivations - something which many good organic growers would be keen to confirm - but it may also be that using buffered glyphosate to terminate cover crops is a useful tool in getting arable systems up the biological ladder.

Plant Diversity; The American scientist Mary Lucero describes the day that DNA analysis of a Desert Salt Bush plant came back as a match for the DNA of a whale. The explanation was that both plant and whale were host to the same salt loving fungi. This world of fungal and bacterial endophytes living inside every plant cell and moving freely between them is beginning to shed light on how diverse plant communities "signal for help" andreceive it. This science has urgent and practical applications. Dr Christine Jones has an amazing photo in which half of a field has died in an Australian drought. The other half, sown with companion plants, is thriving. What are the best functional groups to confer this kind of resilience on cereal crops? At what seeding rates? Let's apply science to understanding how these mechanisms work to refine their application at scale.

Disease; there are myriad examples of farmers using nutrition management for successful disease control. In the US, John Kempf's AEA team are doing this across 4 million acres. On a more modest scale, but across the UK nevertheless, Wildfarmed growers are using plant SAP analysis and nutrition management to replace pesticide applications. Farmers around the world cite innumerable examples of crop diseases deemed incurable by chemistry that have been rectified through nutritional integrity and biology. Yet still this is not the subject of mainstream scientific enquiry, and here in the UK we don't even have a lab capable of old leaf / new leaf SAP analysis.

There were lots of positive conversations afterwards from different research bodies keen to work with the Wildfarmed community and take this research forward. Updates to follow.

Meanwhile, back to the here and now. Extremes of weather are cruelly exposing the fragility of recovery in soils, even those managed under no-till systems for a long time. When we compare the resilience of field margins to the fields themselves, everything points to biology as the critical difference. In the words of Wendell Berry

"We have harassed the temporary power afforded to us by fossil fuels to bypass nature's self sustaining complexity. But in doing so, we have created something very fragile, complicated and expensive"

If biology is the key, the role of a summer long cover crop as a massive biological kick start seems to become more and more important. Despite the recent announcement of restrictions on some elements of SFI, this doesn't affect the plan amongst some Wildfarmed growers to build a rotation around an NUM3 summer long cover, followed by, for example, a winter wheat and bean, a winter cover, then into a spring barley and pea.

Chairman of BASE UK, Camgrain Farmer Director, inspirational Cambridgeshire Wildfarmed grower... introducing all of David White's work would take me over the word count. But last autumn he and I took the NUM3 idea, together with the theory behind the strip cropping / inter-row mower approach, and combined it into what he has christened the Abbey Road system. But that's a story for another day.

CHANGING CROPS IN A CHANGING CLIMATE:

THE IMPACT OF RISING CO_2 LEVELS ON THE NUTRITIONAL QUALITY OF CROPS

Written by Louis Gray, UWE & Dr William Stiles, Aberystwyth University.

Take home messages:

- Increasing levels of CO_2 in the atmosphere are expected to change the nutritional composition of plants, and plant growth patterns
- Certain existing crops may start to perform less well, and other crops which are currently less widespread may become more suitable
- Understanding what crops will perform best under elevated CO_2 scenarios is essential in order to maintain food security

Climate change is anticipated to have significant impacts on crop production systems from factors including changing weather patterns and increased pest and disease incidence. In addition to the factors surrounding climatic change, increasing atmospheric CO_2 will also drive direct effects on plant growth potential and yield outcomes, and the nutritional composition of crop plant tissues. Developing an understanding of what influence this will have on crop growth patterns is essential in order to maintain food production and achieve food security.

The principal driver of climate change is the emission of greenhouses gases, chiefly carbon dioxide (CO_2), as a consequence of human activities. The amount of CO_2 in the atmosphere is now at the highest it has been in all human history, and almost certainly the highest it has been in the last million years (currently ~420 ppm). According to the Intergovernmental Panel on Climate Change (IPCC), CO_2 levels could potentially rise to 670 ppm by 2100 and temperatures may rise by about 3-4 °C. This is expected to have substantial influence on agricultural production potential and on UK food security.

The increasing level of CO_2 in the atmosphere is contributing significantly to changing weather patterns and other phenomena associated with climate change. Higher levels of atmospheric CO_2 are also expected to alter plant growth patterns, as this gas is essential for photosynthesis. This may result in an increase in net primary productivity and therefore carbon capture, but it would also be expected to be complicated by a range of factors such as water and nutrient availabilities, heat stress, and others.

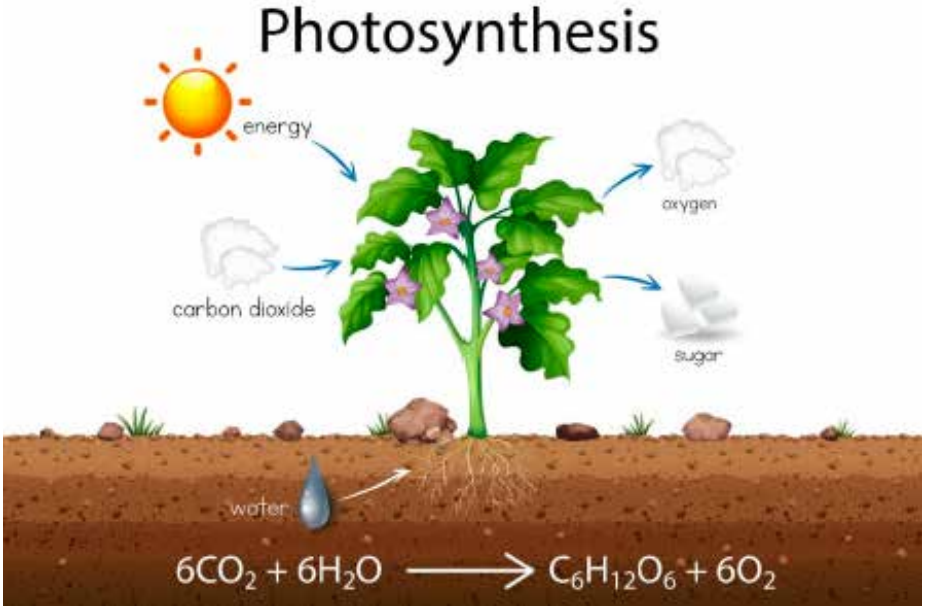
Changing plant growth patterns can also have significant impacts on the nutritional quality of cultivated crops, which may lead to shifting patterns of crop choice among producers, subject to consumer needs and demands, and

shifting crop suitability, as the changing environment alters which crops will offer the greatest potential for yield and nutritional outcomes.

Wales and the UK are currently reliant on food imports to meet the population's nutritional requirements. Considering the potential complications for food imports caused by Brexit and the environmental impacts associated with importing food, a shift in the type of crops the UK produces could be beneficial for the nutritional needs of the population.

Effects of increasing CO_2

Plant responses to increasing atmospheric CO_2 is a highly debated



topic. A rise in CO_2 is most often associated with increases in plant productivity due to higher rates of photosynthesis, but this is likely to be complicated by a range of factors including water and nutrient availabilities. Additionally, the different biological mechanisms employed for photosynthesis are also likely to have an effect.

There are three main types of photosynthesis: C3, C4, and CAM (crassulacean acid metabolism). The majority of food crops utilise either C3 or C4 photosynthesis (CAM is found in desert plants and is a strategy for minimising plant water loss), but the difference in biochemistry during photosynthesis between C3 and C4 crops may make certain plants better suited to high atmospheric CO_2 conditions.

C3 is by far the dominant form of photosynthesis found in the plant kingdom, used by around 85% of plant species. This includes the essential cereal grains wheat, rice, barley and oats, as well as peanuts, spinach, soybeans, potato, tomato and many other crops. C4 is utilised in only around 3% of terrestrial plant species, but these plants include some other important food crops, such as maize, sugar cane, millet, sorghum, and cabbage.

To put things in simple terms, the difference between C3 and C4 photosynthesis centres on how plants use CO_2 to make carbohydrates. During photosynthesis, an enzyme called RuBisCO is used to capture CO_2, which is then converted into carbohydrates through plant biochemistry. In C_3 photosynthesis, this process happens within the plant cell that the CO_2 enters into, through the stomatal opening. In C_4 photosynthesis, once CO_2 enters the plant it is transported to a second cell via openings between cells called plasmodesmata. This is done to concentrate the CO_2 where the RuBisCO is located, increasing process efficiency. The advantage this offers a plant is a reduction in photorespiration (which requires energy) and water loss, and better overall water-use efficiency.

Cereals:

Cereals are incredibly important crops, providing billions of tons of protein globally for human consumption and livestock feed. Elevated CO_2 has been found to negatively impact the nutritional quality of grain crops. For example, studies on barley, rice and wheat, reported that elevated

CO_2 mediated a protein reduction of 15, 10 and 10%, respectively. However, this effect is not consistent across all cereal crops. When considering grain crops such as maize or corn, elevated CO_2 does not appear to affect protein and micronutrient levels to the same degree. This difference in response is attributed to variations in the biological mechanisms employed by these plants when undertaking photosynthesis.

For C3 cereals, such as wheat, increasing CO_2 levels have been reported to drive reductions in zinc, iron, nitrogen, and protein in grain tissue. The impact of elevated CO_2 on nutrient concentration in grains has been shown to vary with soils and crops, with a greater negative effect on grains observed for fertile soil than infertile soil. Variability has also been noted between different genotypes and cultivars of the same crop, indicating some strains that may be better suited to high CO_2 conditions.

For C4 cereals, such as maize, rising CO_2 may not cause the reduction in protein concentration reported for C3 cereals, but these plants may also not benefit from the additional growth derived from the stimulation of photosynthesis. Given that C4 crops are able to concentrate CO_2 internally, this means photosynthesis will be CO_2-saturated even under normal CO_2 conditions. Therefore, there will be no increase in the photosynthetic carbon assimilation and no increase in the rate of photosynthesis due to elevated CO_2, resulting in very different responses in nutritional quality than C3 crops.

Although there seems to be little to no nutrient penalty associated with growing C4 plants under elevated CO_2, current staple C4 crops might not be the best crops to tackle potential future malnutrition due to elevated CO_2. This is because the nutritional quality of these C4 staples is generally not high due to poor protein digestibility rates, or low concentrations of compounds such as lysine. Indeed, a nutritional comparison of C3 and C4 grasses found that C3 grasses had higher protein content, but lower fibre content than C4 grasses when grown under elevated CO_2. Thus, this could be considered to indicate that C3 food crops would still have a higher nutritional quality than C4 crops under elevated CO_2 conditions.

Legumes:

Legumes are an agronomically important crop group due to their ability to fix atmospheric nitrogen (N). The incorporation of legumes in human diets can reduce the risk of a number of diet-related diseases such as obesity, diabetes, cardiovascular problems, and cancers that have increased over the last few decades. Variation in legume nutritional quality is also expected in response to elevated CO2 levels, but has been to shown to vary across different legume species.

In a study considering bean and soybean varieties, elevated CO2 did not affect the seed protein concentration of soybean, but increased seed protein concentration in beans. Lipid concentration was unaffected by elevated CO2 in both beans and soybeans. Soybean showed a significant reduction in manganese and potassium, and an increase in calcium at elevated CO2 when compared with ambient CO2 levels. Beans also showed a reduction in manganese and potassium, with an additional reduction in iron, and an increase in magnesium.

However, legumes appear to be less susceptible to changes in N concentration under elevated CO2, which contrasts with the 15% decrease observed in non-leguminous C3 species. This is due to factors including the decreased uptake of N from soil in non-leguminous plants, due to lower transpiration at elevated CO2. Legumes might also be better suited to limitations in N supply, as elevated CO2 can promote the rate of N fixation in nodule symbionts. In addition, increased C availability at elevated CO2 will improve N assimilation rates, in contrast to the impaired N assimilation associated with other non-leguminous C3 species. Nevertheless, the N fixation benefit from elevated CO2 observed in some legumes may be constrained by other environmental stresses, such as water availability.

An increase in legume production could be the solution to increasing environmental stresses and changes, as many appear to be quite resilient to predicted changes. Diversification of legume production and incorporation of new legume cultivars might also be beneficial. Cowpea, for example, a crop not commonly grown in Europe, not only has high protein quality, nutritional value and N-fixing ability, but is also more drought and heat resistant than many other legumes and other crops. Cowpea is also tolerant to low fertility soils and a range of soil pH, making it an interesting crop to consider alongside climate-change induced environmental instability.

Vegetables (root and leafy):

Elevated CO2 has been shown to increase the fructose, glucose and total soluble sugar content and to decrease protein, N, magnesium, iron, and zinc content of vegetables.

For root vegetable species, elevated CO2 was found to result in significantly higher yields, yet significant decreases in protein, vitamin C and fat content in carrot, radish and turnip. Additionally, all three of these vegetables showed an increase in sugar and fibre when exposed to higher levels of CO2. Elevated CO2 also decreased the amount of fatty acids, amino acids and a number of important minerals. Although these vegetables are currently high in nutrients, these findings suggest that future levels of elevated CO2 could in fact have a detrimental impact on the nutritional quality of root vegetables and alternative crops may need to be considered in future food systems.

The same may not be true for leafy vegetables. The nutritional value of spinach has been shown to increase under elevated CO2, with 14% higher vitamin C concentrations observed in spinach when compared with conventional conditions. This is likely to be highly variable across species and cultivars, and a wider study considering elevated CO2 effects on the nutritional quality of leafy vegetables, at a standardised 250-ppm increase, showed no overall effect. This was supported by meta-analysis focusing on iron, vitamin C and flavonoids, suggesting that elevated CO2 had no effect on these nutritional quality parameters. However, this meta-analysis did suggest that elevated CO2 increased antioxidant concentrations in leafy vegetables.

Fruit:

Fruits are also important sources of beneficial and essential nutrients for the UK population. A much larger proportion of fruit could potentially be grown within the UK than is currently, with some fruits likely to become more favourable as the climate changes. To understand the effects on fruit species, two commercially important species are considered here: strawberries and tomatoes.

For strawberry, elevated CO2 and higher temperature both caused significant increases in total polyphenol, flavonoid, anthocyanin and antioxidants in two strawberry varieties compared to plants grown under ambient conditions. The responses of strawberries were also significantly altered by the interaction of elevated CO2 and higher temperature, and all results were variable across strawberry varieties, suggesting some varieties are likely to offer better yield outcomes in these altered conditions. Interestingly, strawberry fruit grown under high CO2 (950 µmol mol−1) and high temperature (30 °C) was found to be rich in antioxidants and polyphenols, which could be beneficial in terms of human health.

For tomato, the evidence of effect is more variable. Elevated CO2 has been reported to lead to substantial reductions in protein, vitamin C, zinc and a range of other important nutrients and minerals. Contrastingly, studies have also shown increases in iron, copper, and certain nutritious compounds including ascorbic acid (vitamin C) under elevated CO2 when compared to ambient and open field conditions. As such it is challenging to conclude the effects of climate change on tomatoes grown in the UK, but the studies undertaken may at least indicate some potential benefits. Additionally, factors relating to the soil type, temperature and other environmental stresses would also be expected to influence overall effect.

Summary

Welsh agriculture currently faces significant challenges with regard to reducing the amount of greenhouse gases produced as a result of land management activities, whilst simultaneously finding ways to maintain food production in this changing climate.

The implications of elevated atmospheric CO2 on crop production and the nutritional quality of plants is complex. While some crops might respond negatively to future climatic conditions, others may benefit. This could depend on a number of factors such as their photosynthetic pathways. Many of the effects are likely to be contradictory depending on the crop plant, specific cultivar, and the environment that it grows within.

Due to the different biology and metabolic pathways of different crops, care must be taken when comparing the responses of different cultivars and crop families. It's important to study the individual responses of crops to elevated CO2 and other environmental factors as well as compare similar groups in order to understand the complexity of the impact of environmental stresses on the nutritional quality of food systems. Nevertheless, understanding the effects of elevated CO2 on the crops on which we currently rely is essential in order to build a picture of how crop choices will need to change, and what crops should be targeted in the future, in order to meet the nation's nutritional requirements and to maintain food security.

Louis Gray would like to acknowledge the kind support of the Sustainable Food Trust whilst undertaking this research.

DRILL MANUFACTURERS IN FOCUS...

THE MZURI SYSTEM DELIVERS CONSISTENCY AND RELIABILITY IN HEREFORDSHIRE

In the picturesque countryside of Herefordshire, a farmer is singing the praises of a British drill manufacturer that has revolutionised his farming practices. Meet Adam Lewis, the forward-thinking farmer at the forefront of sustainable agricultural change. An AHDB monitor farm and an advocate for regenerative agriculture, Adam is also a Mzuri Ambassador supporting growers with their transition to single pass crop establishment through his own real-world experiences.

Mr Adam Lewis

Adam's journey with Mzuri began in 2017 when he purchased his first Mzuri Pro-Til after a knowledgeable demonstration the previous year. Since then, he has become an enthusiastic advocate for the company and its unparalleled commitment to customer service. ***"I am continually impressed by the outstanding customer service from the Mzuri team, an aspect that sets them apart from other companies I have dealt with. The sales and service team go above and beyond."*** praises Adam.

A particular challenge Adam faced which prompted him to go down the Mzuri route was dealing with changeable soils that caused uneven crop establishment due to varying conditions and moisture levels across the field. With the Mzuri system however Adam is able to achieve consistent establishment across his fields and farm, thanks to several key innovative features at the heart of the Mzuri Pro-Til's design.

The Pro-Til features a leading tine which delivers fertiliser below the seed whilst also contributing to a clean, friable seeding zone. This ensures emerging crops have direct access to targeted nutrition required for even establishment and encouraging the quick get-away of crops in challenging seasons. Consistency of cropping is further strengthened by the Mzuri Pro-Til's independent pivoting coulter arms, which individually guarantee accurate seeding depth thanks to hydraulic pressure exerted onto ground following depth wheels. Unlike simpler designs on the market, the inclusion of individual depth wheels ensure seeds are placed accurately across the width of the drill, irrespective of undulating terrain.

Between these seeded rows, previous crop residue is maintained on the field surface, acting as a natural shield protecting the soil from capping and erosion. The residue also contributes to improvements in soil organic matter, being utilised by worms and being allowed to break down naturally. As a direct result of leaving his previous crop residue on the surface, Adam has increased the soil organic matter content from 2.8% to an impressive 3.8%. Visiting guests have commended on the lift in soil colour, a visible testament to the positive changes.

The combination of these features, including operational and economic benefits, has resulted in a system that delivers for Adam year on year.

Minimising soil disturbance

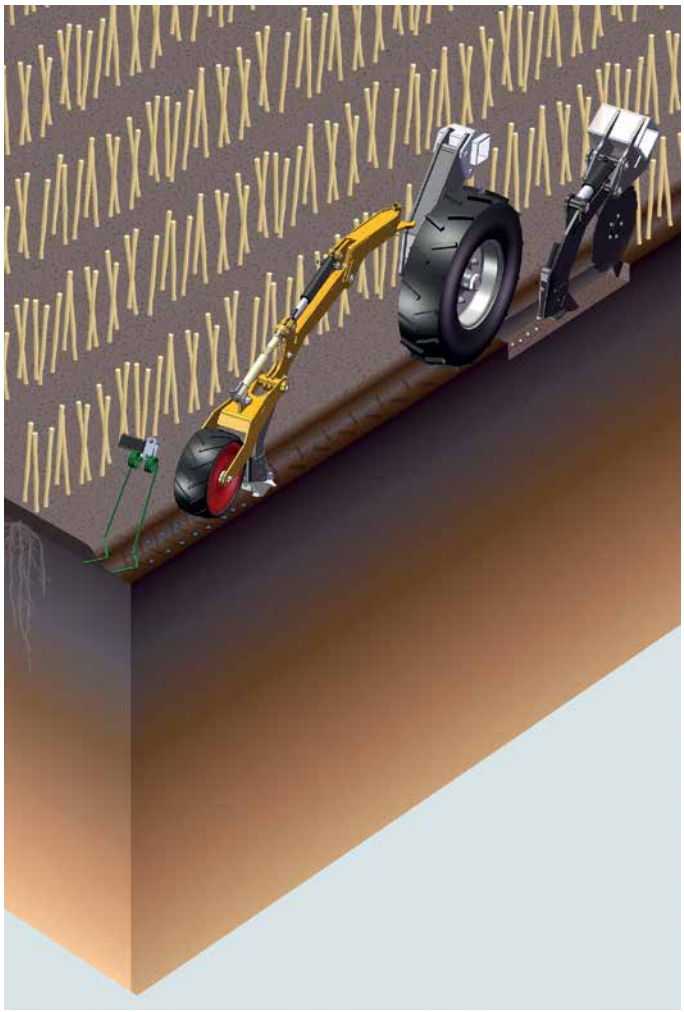
Adam admits to being tempted by the call of a disc drill, however following a brief experiment on his own farm, it quickly became apparent that the disc drill could not deliver the reliability and flexibility that Mzuri's single-pass tine drill is renowned for.

Wheat crop established using the Mzuri Pro-Til

Mzuri Pro-Til 3T

Instead, still with an ambition to further reduce soil disturbance, Adam converted his Pro-Til to Mzuri's 3-inch dual band coulters, which when drilled on 333mm row spacing delivers an impressive crop stand with minimal disturbance. "The coulter ensures minimal soil disturbance, even in adverse weather conditions there is no significant disruption to the soil" Commends Adam.

Another hallmark of a Mzuri sown field, is the wider row spacing over conventional establishment. Most commonly drilled on row centres of 333-363mm depending on model, the Pro-Til offers the ability to double this using it's 'Select' mode which sees alternate legs raised to drill on 666-726mm centres, typically suited to Oilseed rape and Maize. Mzuri advocates drilling on wider row centres, which optimises light interception promoting healthier and well tillered crops. By widening space between crop rows, airflow is improved, which has contributed to a remarkable shift in folia and insect management practices for Adam.



Mzuri leg configuration and coulters- demonstrating fertiliser placement, reconsolidation and seeding

Adam's approach to working with nature has seen insecticides eliminated for an impressive decade at Hampton Wafre Farm, which in turn has reduced production and labour costs increasing the profit margin across the farm. In particular, a natural ally, the Devil's Coachman Beetle has benefited from Adam's stance on insecticides and has itself taken charge of slug control, offering a sustainable solution to a historically challenging issue.

Since adopting the Mzuri system, Adam has seen a significant reduction in diesel usage for crop establishment, saving an impressive 40 litres per hectare. Not only does this save on operational costs, but it also reduces the farm's carbon footprint and contributes to a more sustainable agricultural operation.

FETF Grant Funded

Last year Adam upgraded to a 2023 Pro-Til 3T, which was part funded through the Farming Equipment and Technology Fund (FETF). Under the category code FETF206 (2024 code), the grant funded £25,000 towards the cost of the drill which has gone on to provide considerable cost savings over conventional establishment. The 2024 round of the FETF has recently been released and now offers growers up to £40,800 for direct drills with fertiliser placement (FETF206), which includes the Mzuri Pro-Til range.

Adam commented "The grant has been fantastic for updating our existing system and has allowed us to make the changes needed to secure a sustainable long-term future, both for our business but also the environment."

Adam acknowledges that change can be daunting, especially when it comes to altering established farming systems. However, he firmly believes that the Mzuri system has been the driving force behind significant improvements within his soils, including greater consistency and resiliency and contributed to a noticeable reduction in chemical applications. With the Pro-Til, Adam now enjoys extended drilling windows and enhancing overall productivity, making it a long-term management plan with significant benefits.

For more information scan the QR code below

MOORE UNIDRILL **CELEBRATES 50 YEARS OF INNOVATION** WITH THE ALL-NEW GRAIN & FERT HOPPER UNIDRILL

In the realm of agricultural machinery, where innovation meets tradition, Moore Unidrill stands tall as a pioneer in direct drilling technology. This year marks the golden anniversary of the company's groundbreaking invention, the Original and Still the Best Direct Seed Drill, and to commemorate this milestone, Moore Unidrill has unveiled the All-New Grain & Fert Hopper Unidrill, a testament to five decades of relentless dedication to perfecting direct drilling.

For half a century, Moore Unidrill has been at the forefront of revolutionizing agricultural practices with its direct drilling solutions. The company's commitment to innovation and sustainability has set a standard that continues to resonate with farmers globally. The unveiling of the All-New Grain & Fert Hopper Unidrill not only pays tribute to the company's rich history but also signals a new era of efficiency and versatility for farmers who want an adaptable, reliable, and quality direct drill.

The machine's simplicity is a testament to Moore Unidrill's commitment to providing farmers with machinery that is both user-friendly and dependable. The machine uses two Accord Metering Units and one Hydraulic Fan. This keeps the machine simple and easy to calibrate as well as using common of the shelf parts which are readily available from stock. The soil engaging part of the machine uses the same components as all other models of the Unidrill so you can be reassured that back up and parts availability will not be a problem to any Moore Unidrill owner.

Moore Unidrill's launch of the Grain & Fert Hopper Unidrill at the LAMMA 2024 exhibition was met with great anticipation from the farming community. The machine's cutting-edge seed hopper design and advanced features position it as a game-changer in the agricultural direct drill market.

The New Grain & Fert Hopper Unidrill's key innovation lies in its ability to seamlessly integrate fertilization with the seed drilling process. This drill can apply two different products in one pass. It can be two types of seeds or seed and fertiliser or a combination with e.g. slug pellets or only one type of seed. This dual functionality not only enhances efficiency but also brings economic benefits to the farmer. By simultaneously applying fertiliser with the seed, the machine ensures optimal nutrient distribution, leading to improved crop yields and healthier plants.

The advantages of this integrated approach to seeding and fertilising

extend beyond the economic realm. The environmental impact is reduced as well, with minimized soil disturbance and lower energy consumption compared to conventional drilling methods.

One of the standout features of the Grain & Fert Hopper Unidrill is its adaptability. This versatile machine is not limited to a single type of seed or fertilizer, offering farmers the flexibility to diversify their crops without investing in multiple pieces of equipment. Whether it's different varieties of seeds or distinct fertilizers tailored to specific soil conditions, the Grain & Fert Hopper Unidrill caters to multiple seeding tasks.

The All-New Grain & Fert Hopper Unidrill will also be eligible for the FETF grant in the UK. For more information about this popular grant, we encourage farmers to check the DEFRA website or contact Moore Unidrill directly.

The All-New Grain & Fert Hopper Unidrill stands as a beacon of progress in the agricultural machinery industry. Moore Unidrill's 50-year journey, marked by a commitment to excellence and sustainability, has culminated in a machine that not only honours its past but also paves the way for a more efficient, adaptable, and environmentally conscious future in farming. As we salute the achievements of the past, let us also look forward to the next 50 years of innovation, growth, and success for Moore Unidrill and the farmers it continues to support.

NITROGEN RELEASE FROM COVER CROPS

Rachel Thorman and Anne Bhogal, ADAS

Cover crops are grown primarily to 'protect or improve' soils between periods of regular crop production. Whilst the benefits of cover crops for erosion control and reduced overwinter nitrate leaching losses are well established, the legacy effect for subsequent crops in the rotation is unclear. Of particular relevance is the timing of nitrogen release from cover crop residues and how this influences the nitrogen fertiliser requirement of the following cash crop and subsequent nitrate leaching losses.

The Nitrogen release from Cover Crops (NiCCs) project, funded by Affinity Water and Portsmouth Water and delivered by ADAS, evaluated the effect that cover crop species choice and different destruction methods had on nitrogen release into the following crop and beyond.

Trials were undertaken over two cropping seasons on commercial farms in Hertfordshire and West Sussex with two cover mixes and a weedy stubble control. The two cover crop mixes were:

Mix 1: Phacelia (20%) & Oil Radish (80%) @ 15 kg/ha

Mix 2: Japanese oats (45%), Buckwheat (45%) & Phacelia (10%) @ 10 kg/ha

The cover crops were then destroyed either mechanically by rolling on a frost, chopping and incorporating, or with chemicals.

The results showed that cover crops reduced nitrate leaching losses by up to 90% when compared to the weedy stubble control. Leaching losses were dependent on over winter rainfall, the amount of cover achieved and cover crop type with the cover crop mix containing the fast growing, nitrogen scavenging oil radish giving the greatest benefit in reducing leaching losses.

Cover crop destruction (Hertfordshire) - roll on a frost

The reduction in nitrate leaching losses by the cover crops increased soil nitrogen supply in the spring by up to c.35 kg N/ha. If all the nitrogen in the above ground cover crop would become available to the following cash crop, a decrease in the nitrogen fertiliser requirement of the cash crop would potentially be justified. This justification was dependant on the amount of cover crop biomass and nitrogen uptake, so cannot be guaranteed in all situations.

Cover crop destruction (West Sussex) - flail and incorporate

It was evident from topsoil mineral nitrogen measurements taken following spring cover destruction, that cover crops released more nitrogen during decomposition (mineralisation) than from the weedy stubble control, reflecting the greater nitrogen uptake over winter by the cover crops.

Chemical destruction of over winter cover using glyphosate increased the amount of topsoil mineral nitrogen compared to mechanical destruction, regardless of the method used i.e. rolling on a frost or chopping. It is probable that glyphosate breaks down vegetation more rapidly allowing mineral nitrogen to become available for use by the following spring cash crop earlier than with mechanical destruction.

Mechanical destruction of over winter cover by chopping had limited

Cover crop destruction - glyphosate (used at both sites)

effectiveness in destroying oil radish (& its below ground tap root) where it was used in a cover crop mix. The resultant oil radish regrowth required a more robust post emergence herbicide for control in the subsequent spring cash crop.

Although there were different spring cash crops grown at the 2 sites, crop yield, grain nitrogen offtake and total crop nitrogen uptake were consistently reduced where the covers had been destroyed mechanically (rolling on a frost or chopping) than by using glyphosate. Spring oat yields were reduced by 0.7 t/ha where the cover crop was destroyed by rolling on a frost, and spring barley yield was reduced by 1.0 t/ha following chopping of over winter cover.

Across both sites, cover crops had a positive effect on the yield of the following spring cereal. The mean spring oat yield was 0.2 t/ha greater where cover crops had been used compared with a weedy stubble control, and cover crops resulted in an increase in the spring barley yield of 0.5-1.0 t/ha.

This study showed that it was more cost-effective to not grow a cover crop and destroy any weeds chemically, although the margins over and above growing a cover crop (with chemical destruction) were small and did not take account of any environmental incentive a farmer might receive for growing a cover crop (e.g. SFI). The study has clearly shown the importance of such incentive schemes to support cover crop use so that 'harder to monetise' benefits such as improved water quality, soil health and biodiversity can be realised. There is also the potential to reduce fertiliser nitrogen inputs following cover crops, although further work is required to more fully understand the level of reduction possible.

GETTING TO THE ROOTS OF **BLACK-GRASS WATERLOGGING TOLERANCE**

Written by Rothamsted

Dr Dana MacGregor, Weed Molecular Biologist

Root structures and genetics give the weed an advantage over wheat and explain field patches.

Black-grass thrives on heavy land, particularly where drainage is poor. Now a new study has shown that this problematic weed uses specific adaptations to flourish even when soil is totally saturated for up to three weeks. The data show that when waterlogged, black-grass plants grow bigger than their well-drained counterparts while wheat growth under the same conditions was significantly reduced.

The research also examined different populations of black-grass and showed that the more herbicide resistant the population was, the more waterlogging tolerant it was too.

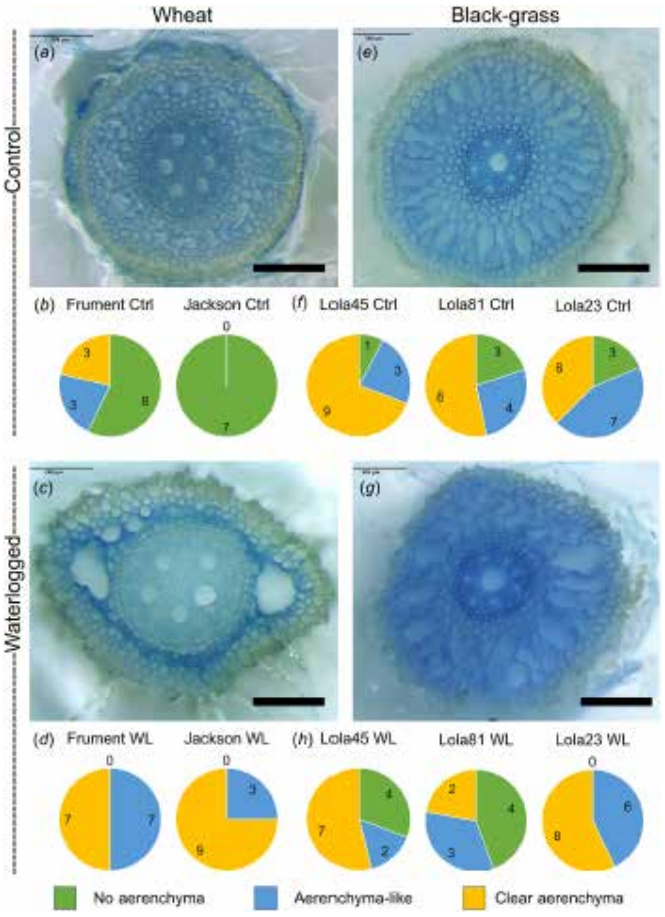
Other studies have shown that weed competition early in crop development has the greatest impact on yield. These findings suggest fields infested with herbicide resistant black-grass are going to be badly affected by autumn waterlogging. The results also help to explain why black-grass tends to form patches in areas of the field where the soil is good at holding onto water.

"This is an important step forward in our understanding of what makes black-grass so resilient," said Rothamsted's Dr Dana MacGregor who led the research. "We are getting closer to pinpointing the physical and genetic mechanisms that make black-grass such a formidable foe for cereal farmers."

For the study, seedlings of wheat and black-grass were flooded for up to 21 days in pots in the greenhouse. During this time, the size of the plant was measured and plant tissues were collected and analysed. The plants' roots were carefully examined under the microscope to see if structural changes could be identified. Changes in gene expression and metabolism were also measured.

"We knew that wheat plants alter their root structure in response to waterlogging, making drinking straw-like structures called aerenchyma that increase gas exchange from the unflooded tissues down into the flooded roots. Although this survival response helps, renovating roots takes time and energy. What we were surprised to see is that blackgrass always had these structures even in the well-drained conditions. In other words, black-grass is "ready to go" when fields are flooded, whilst wheat and other crops, must remake their roots to survive," said MacGregor.

Molecular analyses also showed that wheat changes gene expression and metabolite concentrations when waterlogged, turning on pathways that will help it to survive or using up stress-relieving metabolites. Black-grass on the



Black-grass has constitutive aerenchyma in the roots, whereas wheat induces root aerenchyma in response to waterlogging. Microscopy sections showing evidence for aerenchyma formation in wheat (cultivar Jackson a, c) and black-grass (biotype Lola45 e, g). Scale bars represent 200 µm. Qualitative assessment for presence or absence of aerenchyma in black-grass (f or h) and wheat root sections (b or d). Number of sections with no aerenchyma (green), small or ill-defined aerenchyma (blue) or clearly identifiable aerenchyma (yellow) are shown in the pie graphs.

other hand showed minimal responses, behaving almost as if it was oblivious to the waterlogging. Despite the small response, the transcriptomic and metabolomic profiles of these two species were different. These differences could not only help shape potential control strategies for this pernicious weed, but may also identify new physical, genetic or metabolic traits that may be helpful in future-proofing climate stressed crops.

"Black-grass is incredibly resilient and will probably do pretty well even in the face of climate change," says MacGregor. "If we want to future-proof our crops, studying how this weed survives today's challenges could help us to identify new or useful traits that could be used in tomorrow's crops."

Black-grass is one of the most problematic and damaging agricultural weeds for winter wheat in Western Europe. Severe infestations can result in yield loses of up to 70%, squeezing farm productivity and ultimately imperilling our food security. It costs UK farmers around £400 million per year and as few as 12 plants per square metre could reduce crop yield by 5%.

The full peer reviewed paper can be read here:

The mechanisms behind the contrasting responses to waterlogging in black-grass (Alopecurus myosuroides) and wheat (Triticum aestivum)

www.publish.csiro.au/fp/pdf/FP23193

ROTHAMSTED RESEARCH

Abstract

Black-grass (Alopecurus myosuroides) is one of the most problematic agricultural weeds of Western Europe, causing significant yield losses in winter wheat (Triticum aestivum) and other crops through competition for space and resources. Previous studies link black-grass patches to water-retaining soils, yet its specific adaptations to these conditions remain unclear. We designed pot-based waterlogging experiments to compare 13 biotypes of black-grass and six cultivars of wheat. These showed that wheat roots induced aerenchyma when waterlogged whereas aerenchyma-like structures were constitutively present in black-grass. Aerial biomass of waterlogged wheat was smaller, whereas waterlogged black-grass was similar or larger. Variability in waterlogging responses within and between these species was correlated with transcriptomic and metabolomic changes in leaves of control or waterlogged plants. In wheat, transcripts associated with regulation and utilisation of phosphate compounds were upregulated and sugars and amino acids concentrations were increased. Black-grass biotypes showed limited molecular responses to waterlogging. Some black-grass amino acids were decreased and one transcript commonly upregulated was previously identified in screens for genes underpinning metabolism-based resistance to herbicides. Our findings provide insights into the different waterlogging tolerances of these species and may help to explain the previously observed patchiness of this weed's distribution in wheat fields.

COVER CROPS FOR **INTEGRATED WEED MANAGEMENT**

Cover crops can suppress weeds and volunteers by competing for light, water and nutrients. Some species also release chemicals that inhibit weed development.

Carefully managed cover crops can suppress weeds through various means. The effect varies depending on the cover crop and the weed species:

- They add diversity to the rotation and reduce opportunities for weeds to adapt to a cropping pattern
- Several cover crop types can out-compete weeds and help provide a cleaner seedbed
- Management practices associated with growing cover crops (e.g. mowing and grazing) can suppress weeds
- Long-term leys, with a lack of soil disturbance, can reduce viable seed numbers
- Some brassicas contain high levels of chemicals that can sterilise soil

Note: Make sure cover crops do not seed and become weeds. For example, phacelia can self-seed prolifically and become a weed.

Weed competition

Cover crops can compete with weeds for light, water, and nutrients.

- Increased competitive ability is linked to early emergence, seedling vigour, rapid growth, and canopy closure
- When establishing the following crop, ensure cover is uniform and minimise soil disturbance
- Some cover crops work by allowing weeds to become established and then destroyed before they produce viable seed. In this situation, cover crop canopies need to be open enough for weed germination

A note on black-grass

Cover crops only have a small impact on black-grass. Agronomic factors, such as cultivation timing and type, use and timing of glyphosate, date of crop establishment and diversity of rotation, have a bigger effect on black-grass populations. A change in the timing of crop establishment has the greatest impact.

Allelopathy

Allelopathy is where chemicals produced by one plant (or plant-associated microorganisms) affect the growth and development of another plant.

The release of allelochemicals can be affected by plant age and vigour, environmental factors and the presence of other plants.

The impact of these chemicals is affected by soil texture, organic matter, temperature, light and microbial breakdown.

Some plant species secrete chemicals into the soil (both during their life and after incorporation) that inhibit weed seed germination.

Sometimes, these can also inhibit germination in subsequent crops, especially directly sown (i.e. not transplanted) small-seeded crops; the effect can last for several weeks.

Cover crops reported to have in-field allelopathic effects include rye, oats, barley, wheat, triticale, brassicas (oilseed rape, mustard species, radishes), buckwheat, clovers, sorghum, hairy vetch, sunflowers and fescues.

However, it is not easy to separate physical competition and allelopathic effects.

COVER CROPS FOR **INTEGRATED PEST MANAGEMENT**

Cover crops can disrupt pest life cycles and reduce their populations. Brassicas are also used as a biofumigant to manage some soilborne pests. Certain crop species can also be used as trap crops and to encourage beneficial organisms.

Cover crops contribute to integrated pest management (IPM) through a variety of mechanisms.

Biofumigation

When certain cover crop material is chopped up and incorporated into the ground, it releases toxic compounds that help sterilise the soil.

For example, brassica cover crops release glucosinolates – and products of their degradation, such as isothiocyanates – as well as volatile sulphur compounds that are toxic to many soilborne pests.

Biofumigant cover crops have been demonstrated to be useful for managing beet cyst nematodes and rhizoctonia root rot in sugar beet and potato cyst nematodes in potatoes.

How cover crops are produced, destroyed and incorporated will affect the efficacy of biofumigation.

Biofumigation for PCN management

Trap crops and host disruption

Some cover crops can act as a trap crop by promoting pest egg hatch, including some nematode species.

Cabbage root fly and other brassica pests can be disrupted by diverse planting, for example, with intercropped cover crops (understory or strips). However, the approach requires experimentation in each system.

Predator habitat

Cover crops provide habitats for general predators, which is especially important over the winter.

Summer-flowering plants also encourage beneficial predators such as hoverflies, lacewings and parasitic wasps.

Do cover crops encourage pests?

Cover crops can encourage some pest species, but they can also help control pests in grass leys.

However, long grass-clover leys can harbour soilborne pests, such as leatherjackets and frit flies, which can reduce dry matter production significantly and even destroy a grass ley reseed.

Good management can reduce the impact of soil pests:

- Autumn ploughing and disking can reduce wireworm numbers
- Close mowing between July and September reduces egg-laying by crane flies (the adults of leatherjackets)
- A quick mustard crop (high-glucosinolate variety) can be effective at reducing soilborne pests through biofumigation, providing it achieves a large biomass with rapid incorporation into sufficiently damp soil

Some cover crop scenarios can increase slug populations. However, ryegrass or lucerne are unlikely to cause problems.

Sheep grazing a cover crop

Some cover crop species host soilborne pests, providing a 'green bridge' between main crops.

Ploughing in leafy crop residues may also support egg laying by bean seed flies.

BAYER AND TRINITY AGTECH JOIN FORCES TO DRIVE **REGENERATIVE PRACTICES IN AGRICULTURE**

Bayer's European Carbon Initiative enables farmers, food processors and retailers to achieve carbon commitments and implement regenerative agriculture practices. By 2025, Bayer expects to significantly increase the number of food and ag value chain projects and the number of participating farmers / Trinity Agtech's Sandy platform delivers a trusted and distinctive natural capital navigation capability for carbon and sustainability impact management and supports farmers in managing their environmental sustainability, their profitability and their business resilience – all aligned with the latest Intergovernmental Panel on Climate Change (IPCC) methodology and compliant with international reporting and accounting standards

Bayer today announced a partnership with UK-headquartered company Trinity Agtech. As part of Bayer's efforts to drive regenerative agriculture, Trinity Agtech's platform Sandy will be instrumental for Bayer's Carbon Initiative in the region EMEA in measuring and monitoring carbon on a farm level. Furthermore, the cooperation will enable the customized development of Bayer's solutions to value chain players needs and growers based on Trinity's capabilities. Leveraging science, digital and agronomical strengths on both ends the result is a unique regenerative agriculture ecosystem, developing high quality assets for a market that needs to be committed to tangible and credible outcomes.

The European Carbon Initiative is vital to Bayer's overall strategy to shape regenerative agriculture. This includes making agriculture more productive and resilient while restoring natural resources. Started off in 2021, the Carbon Initiative now includes multiple tailored projects with large companies from the food supply and agricultural value chain. Today, farmers across several European countries and companies across the Food and Farming supply chain are working alongside with these partners to reduce carbon emissions and sequester carbon in the soil. Project results show that growers that are using regenerative practices are emitting on average 15 percent less carbon than conventional farmers. By 2025, Bayer expects to significantly increase the number of food and ag value chain projects and the number of farmers participating in value chain programs as the European Carbon Initiative is going to switch from pilot phase to scale-up phase for commercial projects.

To support these goals, reliable monitoring, reporting and verification (MRV) is key for all players of the food value chain to be compliant with third parties, global guidelines, certification bodies and regulatory requirements. With Sandy, Trinity Agtech has developed a new generation, trusted and easy-to-use cloud-based platform where farmers and project developers will bring all their data into one place to create a fact-based and primary data driven register of a farm's natural capital. This allows the farmer to assess the farm's carbon balance and options going forward.

"Our collaboration with Trinity offers many benefits for farmers and for our partners in the food value chain that want to deliver against their carbon reduction commitments and want to support regenerative practices in agriculture," said Lionnel Alexandre, Carbon Business Venture Lead for Europe, Middle East and Africa at Bayer's Crop Science Division. "We need reliable measuring technology and data analysis to verify carbon reductions and carbon sequestration on the farms. Trinity contributes with its state-of-the-art platform that is acknowledged by many experts around the globe."

Working with internationally approved models to ensure accuracy

Trinity's models and analytical frameworks are nationally and internationally compliant with the IPCC standards and other key global guidelines, such as the GHG-P, in addition to previous verification against ISO 14.064 and 14.067 methodologies. Trinity Agtech's distinctive scientific board contains leading international experts to ensure the most accurate possible assessment for the farmer with the available data. A recent study commissioned by the UK Department for Environment, Food & Rural Affairs (DEFRA) across 81 carbon calculators has placed Trinity's software Sandy on the first rank in assessing farm carbon footprints and natural capital.

"We're proud of Bayer's commitment to credible and trusted sustainability analytics and their power in advancing the prosperity and environmental progress of the Food and Farming supply chain. Trinity is delighted to be Bayer's analytical partner of choice in this vital program," said Dr Hosein Khajeh-Hosseiny, Founder and Executive Chairman at Trinity.

All digital and cloud-based solutions from Bayer and its partners meet or exceed global data privacy requirements and provide data storage in the world's most trusted cloud environments with leading security offerings. Most importantly, farmers own and control their farm data. They decide on what they share and what data they make available.

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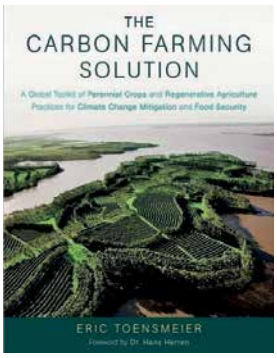
WHAT DO YOU READ?

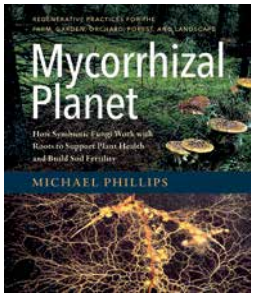
If you are like us, then you don't know where to start when it comes to other reading apart from farming magazines. However, there is so much information out there that can help us understand our businesses, farm better and understand the position of non-farmers.

We have listed a few more books you might find interesting, challenge the way you currently think and help you farm better.



The Carbon Farming Solution

Agriculture is currently a major net producer of greenhouse gases, with little prospect of improvement unless things change markedly. In The Carbon Farming Solution, Eric Toensmeier puts carbon sequestration at the forefront and shows how agriculture can be a net absorber of carbon. Improved forms of annual-based agriculture can help to a degree; however to maximize carbon sequestration, it is perennial crops we must look at, whether it be perennial grains, other perennial staples, or agroforestry systems incorporating trees and other crops. In this impressive book, backed up with numerous tables and references, the author has assembled a toolkit that will be of great use to anybody involved in agriculture whether in the tropics or colder northern regions. For me the highlights are the chapters covering perennial crop species organized by use staple crops, protein crops, oil crops, industrial crops, etc. with some seven hundred species described. There are crops here for all climate types, with good information on cultivation and yields, so that wherever you are, you will be able to find suitable recommended perennial crops. This is an excellent book that gives great hope without being naïve and makes a clear reasoned argument for a more perennial-based agriculture to both feed people and take carbon out of the air. Martin Crawford, director, The Agroforestry Research Trust; author of Creating a Forest Garden and Trees for Gardens, Orchards, and Permaculture

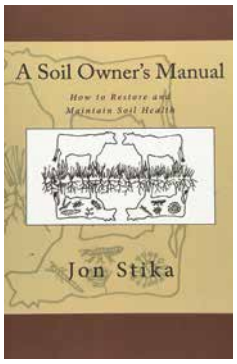


Mycorrhizal Planet: How Symbiotic Fungi Work with Roots to Support Plant Health and Build Soil

An Mycorrhizal fungi have been waiting a long time for people to recognize just how important they are to the making of dynamic soils. These microscopic organisms partner with the root systems of approximately 95 percent of the plants on Earth, and they sequester carbon in much more meaningful ways than human "carbon offsets" will ever achieve. Pick up a handful of old-growth forest soil and you are holding 26 miles of threadlike fungal mycelia, if it could be stretched it out in a straight line. Most of these soil fungi are mycorrhizal, supporting plant health in elegant and sophisticated ways. The boost to green immune function in plants and community-wide networking turns out to be the true basis of ecosystem resiliency. A profound intelligence exists in the underground nutrient exchange between fungi and plant roots, which in turn determines the nutrient density of the foods we grow and eat.

Exploring the science of symbiotic fungi in layman's terms, holistic farmer Michael Phillips (author of The Holistic Orchard and The Apple Grower) sets the stage for practical applications across the landscape. The real impetus behind no-till farming, gardening with mulches, cover cropping, digging with broadforks, shallow cultivation, forest-edge orcharding, and everything related to permaculture is to help the plants and fungi to prosper . . . which means we prosper as well.

Building soil structure and fertility that lasts for ages results only once we comprehend the nondisturbance principle. As the author says, "What a grower understands, a grower will do." Mycorrhizal Planet abounds with insights into "fungal consciousness" and offers practical, regenerative techniques that are pertinent to gardeners, landscapers, orchardists, foresters, and farmers. Michael's fungal acumen will resonate with everyone who is fascinated with the unseen workings of nature and concerned about maintaining and restoring the health of our soils, our climate, and the quality of life on Earth for generations to come.



A Soil Owner's Manual: How to Restore and Maintain Soil Health

A Soil Owner's Manual: Restoring and Maintaining Soil Health, is about restoring the capacity of your soil to perform all the functions it was intended to perform. This book is not another fanciful guide on how to continuously manipulate and amend your soil to try and keep it productive. This book will change the way you think about and manage your soil. It may even change your life. If you are interested in solving the problem of dysfunctional soil and successfully addressing the symptoms of soil erosion, water runoff, nutrient deficiencies, compaction, soil crusting, weeds, insect pests, plant diseases, and water pollution, or simply wish to grow healthy vegetables in your family garden, then this book is for you. Soil health pioneer Jon Stika, describes in simple terms how you can bring your soil back to its full productive potential by understanding and applying the principles that built your soil in the first place. Understanding how the soil functions is critical to reducing the reliance on expensive inputs to maintain yields. Working with, instead of against, the processes that naturally govern the soil can increase profitability and restore the soil to health.

DISC BLADES FROM THE FOUNDRY TO THE FARM

Since 1881 Forges De Niaux from France have been making and supplying quality Disc Blades to OEM's and Farmers. The first traces of activity on their french industrial site date back to the 19th century. With abundant wood, water and iron, the Vicdessos valley was an ideal location for forging activities. The production process used at this time was the so-called "forge à la catalane". By 1945 and the end of the second World War the Marshall Plan brought American farming techniques to Europe. As disk ploughs were being introduced in Europe, Forges de Niaux started to specialise in disk blade manufacturing. In 1985 the Niaux 160 quality was introduced. The use of boron steel allowed Forges De Niaux to bring the hardness level to 160 kg/mm^2. The Niaux 160 boosted the international development of Forges de Niaux. Then in 2009 there was the launch on the Niaux 200 quality, a landmark year for Forges de Niaux making them the leading global disk blade manufacture. The patented Niaux technology fixed a new quality standard with an evolutive hardness of up to 200kg/mm^2. The Niaux 200 disk blades became the disk blades with the best lifespan on the market and still are.

Today's Technological transformation over recent years has transformed the company: Robotisation of processes, continued R and D and the creation of a modern and integrated information system have all led to Forge De Niaux being the global leader in the manufacture of Disc Blades.

The Forge De Niaux philosophy has always been to create value by improving the performances of wear parts and this is now available to UK farmers through their relationship with Bourgault Tillage Tools and BTT UK.

Niaux 200 disk blades provide high quality work over a longer duration than other disks on the market giving farmers the all-important lower cost per acre figure.

The research and development efforts implemented at Forges De Niaux on metallurgy and heat treatment have allowed for unsurpassed hardness (up to 58 HRC) on the discs outer edge for a longer lifespan, and a more flexible disc centre (40 - 50 HRC) to allow for any shocks and possible cracking around the bolt holes.

This combined with the Niaux 200 disc blade auto sharpening technology means that the quality if the cut will help deal with all crop residues and the more the disc wears the sharper the blade. Time, effort and cost in changing a set of disc blades is significant so you want to make sure that any replacement discs offer the right return on the investment. There is the old saying 'By cheap, Buy Twice, Change Twice.

Contact Bourgault Tillage Tools (BTT) to discuss the available full range

Call **01733 971971** Or email **help@bttuk.com** Or buy at Farm Market Place.

Since 1881, Forges De Niaux, France, has excelled in crafting quality Disc Blades for OEMs and Farmers. Partnering with Bourgault Tillage Tools and BTT UK, Forges De Niaux now offers UK farmers access to their Niaux 200 disk blades, renowned for extended durability, delivering high-quality work, reducing the cost per acre. The Niaux 200's auto-sharpening technology ensures a consistently sharp blade, enhancing crop residue management. With the adage "Buy cheap, Buy Twice, Change Twice" in mind, Forges De Niaux provides a reliable and cost-effective solution for farmers.

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Chris, Clive and the rest of the Direct Driller team

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