

ISSUE 10 | JULY 2020

# DIRECT DRILLER

MAGAZINE

## THE FUTURE OF YOUR SOILS

## Anger and Frustration

### ALSO IN THIS ISSUE

Treating soil  
as dirt - **Page 14**

Organic Wheat Varieties:  
Part 2 - **Page 63**



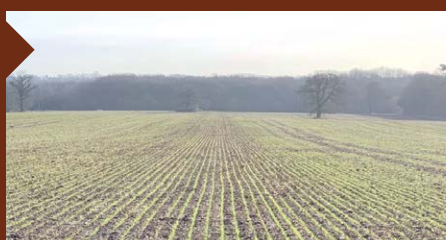
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# DIRECT DRILLER

MAGAZINE

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July 2020

## EDITORIAL

Editor Mike Donovan  
e: editor@farmideas.co.uk

## CONTENT MANAGEMENT

Chris Fellows  
e: chris@agriwebmedia.co.uk

Clive Bailye  
e: clive@agriwebmedia.co.uk

Richard Harding  
e: richardharding@procam.co.uk

## GRAPHIC DESIGN

Very Vermilion Ltd.  
t: 07745 537299  
www.veryvermilion.co.uk

Website: www.directdriller.com

Forum: www.thefarmingforum.co.uk

Twitter: www.twitter.com/directdriller

## MEMBERSHIPS

Farm Safety Partnership  
BASIS  
DairyPro Federation of Small Business

## Advertising Enquiries

Contact Chris Fellows  
On chris@agriwebmedia.co.uk  
01543 396 770

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# INTRODUCTION

## MIKE DONOVAN, EDITOR

We, the readers of Direct Driller, need to give a huge round of applause to Clive and Chris, the energy behind this magazine, together with all the contributors to this issue. The contents is truly awe-inspiring, and the knowledge it contains colossal. It's impossible to pick individual articles because that relegates the others, and it is all Premier League stuff.

It may be pie in the sky, but I continue to envisage staff and students in colleges and universities up and down the land devouring each issue, for both its editorial content and the highly focussed advertising it carries. If you, as a reader, have connections in these places do please introduce Direct Driller to them. We would be delighted if they got in touch with us. I can see staff and students being inspired to set up studies on a whole variety of direct drilling topics - drills; fertilisers; organic No-till; crop protection; cover crops; crop termination; crop rotations - and much more. No-till presages a whole new world to research, understand and implement. The 'funding' is already there and I can't for the life of

me see what is holding farm education back, while farmers, such as those featured in every issue of Direct Driller, are doing their own experimenting and assessing.

The topic is important for practical farmers today. All involved in farming are well aware that we are at a tipping point. We have perhaps a year, two at most, to decide the direction of travel for our farms. How are we going to make up the financial shortfall? Is our farm on the right course? Given what we know, or anticipate, or fear for the future, can we say with confidence that we are doing the right thing? Going in the right direction?

As we work our guts to get the harvest in there may well be a moment when farm planning takes a lucid position in our minds. Get a good day when the wheat is fit, the yield better than you dared expect, and in the cab there's the hum of the harvester engine, the rattle of corn going up the feeder... just right to get those 'what if' thinking juices going.

There's so much to consider, from the

present financial position of our farm today, the margins we are making, and the people who are currently involved in the business.

Are the important figures for the farm business getting better, or have the numbers showing our net returns, the figure that remains after all the costs are taken into account, been somewhat lacklustre?

Here are the warning signs which we can choose to ignore or decide to address, either on our own or with the help of others. Many will choose the former. There's nobody they know with the answer, and the problem with experts is that there's no point in ignoring their advice. Experts can of course be disastrously wrong.

The knowledge contained in this issue can only help set you up for better things. Happy reading!



## TO SHOW OR NOT TO SHOW

By now the show season should be well underway and in some ways it still is. But not in the way we are used to it. Shows like Groundswell, are for many, the highlight of our year. Not just a place to learn, but a place to meet friends, chat about farming and have a beer. The last part particularly appeals to me when attending Groundswell, especially when the sun is shining.

However, all is not lost. There is still lots going on. Shows cannot happen, but small one-to-one tours can. Online shows have become a thing and I suspect they will become a part of all shows going forward. At online shows, you can attend webinars, watch videos and live product tours and speak to exhibitors. It's all a bit new, but they offer a permanent record of a show that normally just doesn't exist after a live show. Farmers can follow up after events have finished, catch up on

webinars they missed and keep talking to exhibitors long after the show day has passed.

In fact, the only thing missing from an online show, is the live show itself. A live/online hybrid show offers all the benefits of face-to-face contact with all the convenience of being able to catch up with content when it's convenient to you and see all the things you missed at the live show. Looking back, there has always been shows I've missed due to other work commitments or clashes. Online shows, while also having live content, do offer convenience. Shows are busier in the evenings than they are in the day for instance. Farmers still want to attend, but they can do it when they want to, even from the tractor cab.

Online shows also bring in a wider audience. Virtual Cereals was attended

by over 30,000 people on The Farming Forum and this included people from over 90 countries around the world. This is a bigger audience than attends the live show, although you do not have their attention for the same period of time. But if you had both, then it offers the best of both worlds. I have always wanted to attend the No-till shows in the States, but it always seem to clash with other events in the UK. The thought of being able to attend international events online is really appealing and I'd still happily pay for a virtual ticket. So, to add to hybrid cars, we will have hybrid shows going forward. Welcome to 2020!

You can still view Virtual Cereals by scanning the QR Code.



*Written by Chris Fellows*



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# FEATURED FARMER

## JAMES ALEXANDER

CONTRACTOR, LITCHFIELD FARM, ENSTONE, OXFORDSHIRE



### Farm Facts

FARM SIZE: 1500 acres (800 farmed organically, 700 conventionally)

MANPOWER: 2.5 - 3.5

FARM TYPE: Arable with flying stock (lambing here)

TENURE: Contract farming

REGION: South East England

SOIL: Cotswold Brash

APPROACH: Organic & conventional

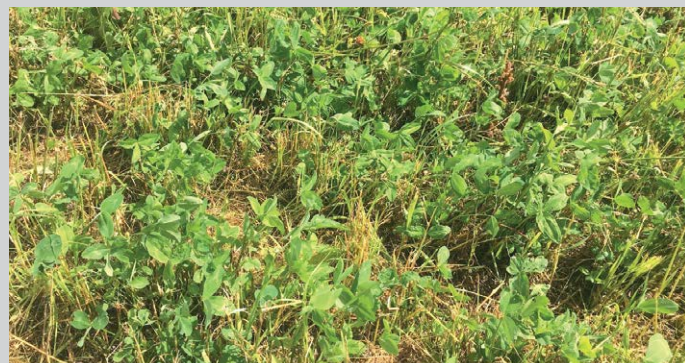
KEY FARMING PRACTICES:

Undersowing, Diverse leys, Cover crops, Direct drilling, Diversified rotation, Leys

**Litchfield farm near Enstone in Oxfordshire (owned by Nicola and Kevin Knott) is one of four farms I contract farm (of a total of 1,500 acres, this one is 800 acres). Litchfield is an organic arable farm while the others are 'conventional.' In general the rotation is a 2-year ley, spring beans, spring / winter wheat, spring barley, and oats. (In a conventional rotation we generally have a 2-year ley, winter wheat, spring barley, and oilseed rape.)**

I've learnt a lot from farming organically that I've taken into the conventional and vice versa. I have the benefit of both worlds - I can do both and see what works! The conventional farms are all direct drilled - wherever we can we direct drill. The organic Litchfield farm is the complete opposite - we plough, cultivate, and drill. I am focused on trying to find a way to reduce cultivations and direct drill, looking after the soil health and managing weeds as best I can. I've been involved in an Innovative Farmers field lab looking at alternative method for terminating cover crops which you can find out more about from the link \* below. Various cover crop trials I have been carrying out have led on from this field lab; I have been experimenting with mustard and oil radish (see below), beans, oats, peas, vetch and rye.

We had been stockless for about 11 years but now have 125 breeding ewes which are permanent and being lambed so we can start having our own flock of sheep on the farm (Sam



Clover

& Charlotte Clarke set up an organic flock and they're lambing them here - they'll go on the leys and cover crops). We saw the benefits in 2018 when we grazed 90 acres of cover crops on arable fields which meant we could min till the fields rather than plough them. I grew some of the best oats I've ever grown - can't say it's all to do with the sheep and cover crops but I'm sure it had a big impact.

We have about 180 acres of clover leys in the rotation every year. Fattening lambs on clover is brilliant - it gives us an easy way of grazing the lambs but then we also have the option if we are putting winter cover crops down, to graze them with sheep - and if it means we can min till instead of ploughing, all the better!

Blackgrass is worse in some years than others - it depends on the rotation and the fertility we have in the soil. We sheep, top, sheep, and top leys and leave as a mulch, the aiming being to turn clover leys without ploughing.

In addition to the farming I also manufacture and sell no-till drilling equipment.

### Sustainability in practice:

Using a roller crimper to improve weed management and soil health

I am very keen to reduce tillage in the organic system - having seen the benefits in the conventional system, so I direct drill where I can. Cover crops are an essential part of that system but I need to find a way to control them without using glyphosate. I have therefore been developing a UK-focused roller crimper which essentially breaks the stems of the cover crop when it's going to seed (it's weakest point) and then can kill it. This is a key part of the conventional farms but in the last few years I've been experimenting with how I can make it work on the organic farm. Two years ago I tried rye and vetch and found that it was quite challenging to kill the vetch - it took multiple passes, but I am hoping to develop this system...

See the scrolling images above to view a field of vetch at various stages of crimping.



Clover crop with mustard



*Crimper in action*

Watch the video footage below to find out more of what James has to say about using a roller crimper to manage cover crops, assist with direct drilling, and improve weed management and soil health.

### Permanent cover crop of white clover

James explains: "In a field after the spring barley has established, we're undersowing it with a crop of white clover (small variety). The idea being, similarly to another trial with mustard and vetch, that we keep an understory of white clover permanently in the bottom of the crop which will then allow us to direct drill the following crop back into it. I'm looking at this as part of a field lab I'm involved in that's exploring using a permanent living mulch understory in low input / no till systems... By having the clover there, we also have a permanent source of nitrogen so we mightn't have to do our 2 / 3 year red clover leys which we're losing a bit of production with. It means we can keep cropping, and hopefully produce some better quality crops and yields too. We plan to direct drill oats into it in the autumn. We could mow and drill into the clover or graze it hard with sheep then drill into it. With having an understory of clover, if it's a good cover, it means I can just about drill into it any day of the year. We'll learn over the next year or so what works best; if we put a spring crop in, we can leave the clover over the winter and drill the spring crop beginning of March so it can get going before the clover does. We'll probably establish the clover when the spring barley is at a couple of leaves stage. I'm not sure yet if we'll put the clover in with a drill or spread it and grass harrow it; it will depend on the conditions at the time."

### Buckwheat to help with dock control

James has been growing buckwheat for two or three years to try and help with the dock problem. Buckwheat is thought to emit allelopathic chemicals that can help control docks (see information in relation to another field lab here).

He says: "Our initial idea in relation to dock control was to keep cultivating, which accelerated the problem! Last year (2019) was the third year we've put a buckwheat crop in over the summer straight after the spring barley. We direct drilled the buckwheat into it and have been ploughing the buckwheat in green before it dies which helps stop the docks growing. We think we are seeing less and less docks. We're home saving our own buckwheat seed to make the job cheaper. Higher seed rates (thicker crops) do better. Buckwheat lifts P and K (phosphate and potash) from deep down in the soil which is

another bonus. It is also twice as efficient at taking nitrogen into the plant. We put buckwheat in with our rape as a companion which we have found helps control flea beetle. The flowers are also great for beneficial insects.

#### MOTIVATIONS:

One of my main motivations is to look after the soil - our most precious resource. In the organic system, fertility building leys help protect and feed the soil but also help us control blackgrass - using a 2-year fertility-building ley by mulching. On the farms managed conventionally, direct drilling and no till works very well if you can do it year after year and combine with using cover crops - winter cover crops or 8 week cover crops during the summer - it gives you a lot back. I am aiming to go reduced tillage or direct drilling in the organic system. The farming system needs to be reliable and viable - for me and the owners.

We've started to feed our soil with some molasses - we trialled it in 2018, and in 2019 we have used it on a wider scale. On the conventional farms we've been able to cut fertiliser back by 5% with using molasses. The molasses makes the bugs in the soil happier; they're working for us and help us to look after the soil. They also help us utilise the fertiliser we're applying better on the conventional farms. With good soil comes less pests and less weeds, which can only be a good thing.

We generally direct drill our fertility building leys (but min till some). If we can do more no till, it would undoubtedly be more weatherproof and soil friendly than ploughing. This last year we have had fields that have been ploughed and cultivated that we couldn't touch because they were too wet, whereas with fields that had been direct drilled, we only needed the surface to dry off.

In the video clip here James touches on some of the learnings from both the organic and conventional way of farming (apologies for the wind interference!).



### FARMER TIPS

- No till works very well if you can do it year after year and combine with using cover crops.
- A good understory of clover means that you can direct drill in to it most days of the year (weather permitting).
- Introducing a cover crop of buckwheat into your rotation can help mobilise phosphorus in your soil - it's good at scavenging for phosphate; breaking it down and making it available to subsequent crops after incorporation. It can also grow really quickly.
- Using a crimper to destroy cover crops produces a thick mulch which helps retain moisture in the soil and prevents weeds from germinating.

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# AGRICULTURAL ETHICS: A DECISION MAKING TOOL FOR FARMERS? (PART 1)

*Written by Ralph Early*

"No one will protect what they don't care about; and no one will care about what they have never experienced." David Attenborough.

**Not so long ago, wildlife in Britain was so much more abundant than it is today. Back in the 1960s, in early summer, one could walk the fields of most counties from Land's End to John O'Groats and quite literally trip over wildlife: rabbits, hares, pheasants, partridge, and many other species hiding in knee-high grass.** A stroll through meadows carpeted with stunningly beautiful wild flowers would fill the air with butterflies, as once disturbed they departed the sweet nectar in one location to alight on blossoms in another. At night the same meadows would be filled with moths, swarming uncontrollably to the light of a torch. For anyone who remembers such experiences, this was Britain's countryside at its most glorious. Sadly, in 2020, that world no longer exists, which is an undeniable calamity. The loss of so much of Britain's wildlife over the last half century, and with it many irreplaceable ecosystems, undermines the capacity of Britain's natural environment to support planetary ecosystem services. **This is a moral issue of immense importance to the future of humanity and the innumerable species with which we share the planet. It is also, distressingly, an incontestable catastrophe for young people today, for they will never experience British wildlife of the quality and diversity routinely encountered less than a lifetime ago.** They will never know nature's wonders common to the Britain of their grandparents and great-grandparents. A land where skies were filled with birds, hedgerows buzzed loudly with insects, and countless small mammals, reptiles and amphibians scurried in search of food. That world has passed into history and tragically may never return.

## The past is the key to the future

If we are wise we will learn from the diminution of Britain's natural heritage: a disaster that was so clearly avoidable, but which we chose not to see even as it was unfolding. Indeed, we have a moral duty to learn from it not just for ourselves, but for future generations whose rights we may deny through our

own thoughtlessness and selfishness. We must learn from the past and in doing so must find ways to chart an ethically sound and ecologically sustainable course for the future. In this we should recognise that the word 'sustainability' is itself morally instructive. Sustainability as a term is now part of common usage in the agrarian lexicon. **This is a positive sign. It confirms recognition that we are prepared to admit that aspects of farming practice, as we have employed them for decades, are in fact environmentally harmful.** They are demonstrably unsustainable. Importantly, by being prepared to admit we got things wrong, we express understanding that we know we must change the way we farm. We also need to change the way we think about agricultural food production such that we find better ways to work with nature, not against it. In this respect we need to dispose of irrational perspectives, such as the perverse idea that by divine moral right mankind has dominion over nature. Such archaic notions are embodied in many of the farming and land use practices that created the problems we now face. If we are to manifest a truly sustainable future, a paradigm shift and definitely an ethical shift in our thinking about food and farming will be needed. Happily this is underway, as evidenced by many practical actions being employed by enlightened, progressive and morally aware farmers, such those using zero tillage methods to restore soil quality and fertility. It is also seen in the way ethical thinking is being used overtly and in less obvious ways to guide agricultural food production more broadly. Notably, we are witnessing the development of agricultural ethics as a specialised branch of moral philosophy, and a decision making tool, accessible to farmers, agri-food businesses, policy makers etc.

This article is then the first part of a two-part article on agricultural ethics which, it is hoped, will be of particular value to everyday farmers as the professionals to whom we remain constantly indebted for keeping us fed. The aim of the article

is to explain something of the concept of agricultural ethics and how it can be of practical value. However, before we immerse ourselves in ethical theory in part two, in this part we should first reflect a little on the history that has brought us to this point.

## Change and acceleration

Change is inevitable. During the last century it has occurred at an almost unimaginable rate, particularly in the industrialised world. Since the end of World War II, significantly as a consequence of Norman Borlaug's Green Revolution, British agriculture has been transformed almost beyond recognition. Britain's rural landscape began to change markedly in the 1960s, with a pace that accelerated through the 70s and 80s. Post-war agri-food policies aimed at enhancing Britain's food security were partly responsible, as was the EEC's Common Agricultural Policy which aimed at maximising agricultural productivity. These factors catalysed a momentous shift in perspective with respect to the purpose of farming and, significantly, the end of the 1960s began to see the transference of elements of farm decision-making from farmers themselves to a new breed of off-farm, agricultural specialist, the farm consultant. These advisors employed by agri-business corporations, banks and ADAS (Agricultural Development and Advisory Service), among others, introduced new perspectives to British farming which centred on 'efficiency', 'productivity' and 'profitability'. These terms became watchwords for the industry. But nature is not efficient, productive or profitable in any way that agricultural economists, especially ones wedded to the neoliberal capitalist ideology of Friedrich Hayek and Milton Friedman that now shapes the British economy, would appreciate. A consequence of the development of agriculture as a movement centred almost exclusively on productivity, efficiency and profit, was that big came to be regarded as beautiful. Small-scale, mixed farms were regarded as a thing of the past. Large



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farms grew larger, increasingly focusing on fewer or even single enterprises, and monoculture agriculture became the new norm. Such farming was prized because it was modern. It represented a vision of the future, communicated evangelically to aspiring young farmers in colleges and universities throughout the land, with the support and endorsement of burgeoning transnational agri-business corporations. As British farms changed so farmers, once steeped in the traditions of preceding generations and a sense of spiritual indebtedness to nature and the land, were transformed into agricultural technologists. A new breed of farmer had arrived. The farmer as expert in distinct and even separate types of agricultural food production. No longer the generalist, increasingly the specialist.

**As farming has become more specialised, a relatively small number of major agri-business companies have achieved significant influence over the British agricultural sector.** At the same time, the supermarkets have ensured that they are the main points of access to the food marketplace for British farm produce. Power imbalances are now common within the food system and the pressure to survive is a constant source of anxiety for farmers, often exacerbated by the lack of morally just financial rewards. For some, solutions lie in the application of new technologies, for agriculture itself is a technology, and in this they may be right. At least in part. Experience reveals, however, that both science and technology often have the tendency to advance faster than the wisdom required to regulate and control them. New technologies such as precision farming, genetic engineering and CRISPR-Cas9 (clustered regularly interspaced short palindromic repeats and the CRISPR-associated enzyme, Cas9) will undoubtedly play a role in the development of British agriculture, as will other technologies. But if farming is to become truly sustainable and, importantly, ecologically benevolent in the way it serves the needs of humankind today and in the future, it will need to embody moral values based in a deep respect for ecology and the workings of the natural world. Such values will inevitably be informed by the theory and practice of agricultural ethics which, necessarily, will demand that all who regard themselves as agriculturalists, whether directly involved in farming or employed in ancillary and support sectors, remain conscious of Ernst Friedrich Schumacher's words, "Modern man talks

of the battle with nature, forgetting that, if he won the battle, he would find himself on the losing side."

### Old problems demand ethical solutions

As farmers work to survive in an increasingly competitive world they quite reasonably seek opportunity in innovative ideas and technologies. However, while novel ideas and technologies may yield many benefits, they may also entail unintended consequences which bring to the fore a variety of ethical dilemmas. Indeed, the central moral issue faced by all farmers is found in the fundamental duality of doing good through the production of food yet, at the same time, minimising and ideally preventing the harms that agricultural practices may entertain. For instance, over the last 50 years agricultural policy decisions, combined with market forces and innovations by the agricultural machinery and agri-chemicals sectors, have triggered an increase in the size of farm machinery with promises of continually increasing efficiency, productivity and profitability. This, though, has generally been associated with the elimination of hedges and other wildlife habitats in the UK to create larger, more efficiently managed fields with the unintended consequence of a concomitant decline in wild and farmland biodiversity. Ploughing and the use of heavy machinery, once considered a standard practice, is now known to cause soil erosion and the release of carbon dioxide, a greenhouse gas, while artificial fertilisers accelerate the loss of soil quality and organic matter, catalysing the breakdown of aggregate structure so increasing erosion and loss of top soil. Additionally, phosphate, a constituent of synthetic fertilisers and organophosphate pesticides, causes fresh water eutrophication while nitrogen from fertilisers causes sea water eutrophication. **Research, reported in 2014, suggests that the quality of British farmland soil is now such that only around 100 harvests are likely, which is why the improvement of soil quality has been set as a priority objective for national agricultural policy.** These are just a few of the issues that farming faces and which raise numerous questions of an ethical nature. Indeed, many are issues that may best be understood by means of an ethical lens, so helping to determine the route to genuinely sustainable and regenerative forms of agriculture.

### A moral compass for farmers

Ethics is concerned with the moral values and principles that govern human behaviour. It deals with concepts of moral goodness and moral evil, perhaps more easily understood as moral badness, as well as with human actions framed as what is either morally right or morally wrong. Agriculture yields many benefits for humankind, being the source of most food as well as e.g. biofuels and fibre. **But the practice of agriculture can itself present a range of moral concerns, simply because it has the potential to cause both benefits and harms.** For instance, the loss of wild habitat to agricultural food production has already been cited as a moral issue and one that raises many questions about the moral rights of the environment and biodiversity. The use of agri-chemicals demands ethical consideration of the utilitarian balance of benefits versus harms with respect to possible negative externalities, e.g. effects on pollinating insects and the health of farm workers and consumers. Farmed animals, as sentient beings capable of experiencing pain and suffering, deserve for valid moral reasons to be respected and cared for appropriately. These are among many of the moral issues embedded in the practice of agriculture which, because of space, we cannot appraise here but will do so in part two.

Agricultural ethics is then an applied subject of practical value to contemporary farmers who, unlike preceding generations, face a diversity of existential threats which must be resolved if farming itself is to be sustained long into the future. An inescapable and often uncomfortable truth is that many of the challenges that farmers face today are rooted in the practices of agriculture developed in the last 100 years or so, as well as in the general industrialisation that occurred during the last two centuries. Such challenges are epitomised by the problem of anthropogenic global climate change. Solutions to most agricultural problems will doubtless be found in the sciences and technology. But as farming redefines its path to an industrious and ecologically sustainable future, we can be sure that agricultural ethics will provide the moral compass required to navigate the journey and ensure safe arrival.





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# THE PATH TO CONSERVATION AGRICULTURE

*Written by James Warne, Soil First Farming*

Social media can be a useful source and tool for knowledge transfer, discussion around various topics etc. But far too often it can also be the source of misinformation or confirmation of prejudice, particularly where the discussion deviates from received wisdom. I am referring here to agriculturally based discussions around the topics of Conservation Agriculture (CA), soil nutrition, agronomy etc. There are some common recurring themes which need addressing because all too often much of the advice given is in my opinion flawed for many and various reasons. In this article I will touch on a few of these questions...

## **'My soil is not ready'**

'My soil is not ready' is a common retort. When will your soil be ready? Next year, in two years or five years? By what criteria are you assessing your soil to make this statement? To paraphrase Morrissey, my normal response to this question is how soon is now? The point being that while you continue to cultivate you are slowly, but surely, moving your soil further away from that point of 'being ready', whatever that is. Cultivation, while undoubtably bringing some short-term benefits, also brings about its own set of problems; reduced porosity over the longer term; oxidation of organic matter; decimation of worm populations; increased risk of run-off and soil erosion with the consequential issues of diffuse water pollution from fertiliser and pesticides, to name a few.

The path towards Conservation Agriculture can start now if you want it to. Every year of dither and delay is another harvest where you didn't try something new, and maybe didn't benefit from the potential to reduce establishment cost. One certainty is that agricultural production in the UK is sliding down the political agenda which will result in reducing financial support. What is apparent from the last few months is that food security is not on the current governments agenda unless it is by means of food import. Whichever way you look at it farming is going to have to work hard to cut its production costs to remain profitable.

So, back to the original question when will the soil be ready? The questions you need to ask yourself are; how did the field in question yield at the last harvest? If the answer is 'as well as could be expected and comparable to other fields' that's a good starting point. Have you trafficked said field with harvest operations or post-harvest operations such as muck spreading or baling? And

finally, have you taken a spade out and looked at the soil structure? If you are happy with all the above questions then now is a good time to start changing the system. If you at all uncertain then call in a third-party opinion.

## **This soil probably isn't ready for no-till.**

You can of course reduce the risk by not converting the whole farm in one year, consider implementing the system across a whole rotation or maybe two rotations. But do not fall into the trap of opportunistic direct drilling as a way of reducing establishment cost because you will never realise the full benefits of the system. Each subsequent cultivation effectively resets the clock and you end up having to travel through the troublesome early years of soil cultivation 'cold turkey' (see below) each time. You haven't reduced the fixed cost structure of the business because you have been holding onto cultivation equipment that could be sold.

## **'I have the wrong type of soil', (it's too heavy, too light or contains too much silt etc, etc)**

Any soil type can be successfully managed through a CA system but it's true some demand a lot more attention than perhaps others. Light sandy soils with very low organic matter will have a tendency to quickly slump and consolidate, this also applies to soils with a high silt content. Much care has to be applied to field operations only happening when the soil is able to carry the machinery.

Cover crops and cash crops with good rooting characteristics should be grown in the early years as this is what is going to give the soil structural and physical stability. I cannot stress this enough, it's so important to avoid any performance

drop which is one of the main obstacles to adoption. As far as plant growth is concerned the important factor is the pore space characteristics are strongly influenced by the stability of the soil structure when wetted. The presence of earthworms, plant exudates, humus and plant roots themselves all act to encourage the formations of soil structures stable in water. Clay based soils will have a degree of natural structure provided by the clay colloid, whereas the silts and sands will not have much clay and little organic colloid to help with structure. These soils are often easier to manage in the earlier years, especially where they are calcareous and therefore will have a good calcium carbonate content. As alluded to above the key to success is the early introduction of large amounts of carbon either by chopping residues, spreading manures and compost etc, and by growing cover crops. Doing all of these in the early years is necessary to stabilise the soil structure, to encourage natural porosity and fertility.

## **'I am looking at buying a disc drill'**

Many seem to be obsessed with moving the minimal amount of soil and consequently are looking at disc drills because they are all over social media. Yes, this is true, disc drills can move very little soil and that can be a good function in some circumstances, but not always and certainly not at the beginning. In the early years the soil will be in a state of cultivation 'cold turkey'. Take away the cycle of annual cultivation and the soil will start to slump, consolidate and loose porosity before the biology and chemistry starts to sort out the physical stability of the soil and increase the porosity once again. This can reduce crop performance in the early years, this is cultivation cold turkey. Tine drills by their very action will create a little



tilth and give a better result more often than not especially when soils are dryer or wetter than ideal.

Tine drills can also drill through green cover if judiciously managed, and they will certainly drill through chopped straw better than any disc drill. The

over the country. Where tine drills have been used the results are considerably better, but still not perfect. Even this spring it is very easy to spot crops which have been disc drilled where the slots are opening as the soil dries revealing the plant roots to the air and



Disc drilled slots opening.



Tine drilled wheat taken in late January 2020 (crop drilled early December 2019)

fallacy of only using a disc drill has been shown time and again over the winter months. Poorly established or failed wheat crops resulting from using disc drills on over-wet soil can be seen all

increasing the rate of soil moisture loss. When I mention tine drills I am not referring to those with any form of leading leg, these are strip-till drills and

should not be confused with a genuine no-till tine drill. Leading leg strip-till drill designs move too much soil to be ever considered for a genuine CA system.

Don't believe everything you read on social media (unless it's about government hypocrisy), get a second opinion, or visit someone who's already doing it. No-till is part of the solution, not part of the problem.

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# WHY DO WE HAVE TO TREAT OUR SOILS LIKE DIRT?

by Nick Woodyatt, Soil Fertility Consultant at Aiva Fertiliser

Normally when starting an article there is much gnashing of teeth and wandering around the garden, or pub in my case, deciding on how to help and enlighten our industry (hopefully). But seeing as it did not stop raining during the autumn/winter, on this occasion the decision was somewhat easier. My town should have been re-named Upton under Severn. On my rounds I saw two four-wheel-drive tractors tied together pulling a plough through the field which looked like toothpaste and all eight wheels were spinning as they pulled themselves down onto their axles: really. Funnily enough the managers of this farming area were having a heated debate at the same time on whether to use a direct or strip till drill which simply amazed me.

**We all know that if we lose Glyphosate then getting to a good position [soil wise] for direct drilling is going to be so much more difficult, but not impossible. What is perhaps now becoming obvious, is the effect that climate change will have on this method of growing, with longer and wetter periods, and yes, I do realise now we've gone from one extreme of constant rain to the next which is as dry as a party in a nunnery, but that still has the same effects.**

On my farm walks I saw the relentless tapping of billions of raindrops on the soil surface produced an 80-100mm cap that has the consistency of wet play-dough which, is either going to cap over growing crops or produce an airless situation in to which seeds will be put. Indeed, I watched seeds direct and strip drilled (on good soils) and I have had to ask the question, 'Why'? The direct seeds are firmly encased in a solid wall of mud so as they chit, they will more than likely rot. The strip tilled seeds are more of a surprise. I tripped over this problem in the wet autumn when I was told that my bacterial application had stopped having the desired effect on clubroot in cauliflower. When I visited the problem it was plain to see that the soil wasn't

ready for this method of drilling and the drill had in effect formed shallow drains across the field, therefore producing an anaerobic environment for the soil life hence allowing the harmful anaerobic pathogens to run amuck. Now if it had stayed like that I wouldn't have been too alarmed, but since then, I have noticed that the lifted rows left by the strip till are overtly wet compared with the surrounding soil regardless of how good the surrounding soil is. The phrase that we earn the right to use any specific piece of machinery is oh so right.

## The importance of air

This is leading me to suggest we need to see that there are times when sowing isn't going to work (difficult to say the least) and we need to stick to the rule that the soil needs what the soil needs, to get air into it. If you can't find it in you to see that I may have a point then get a friend to strangle you and see how long you can last and no, there is no difference (only in time). We discuss soil, nutrients and where unenlightened, agrichemicals, but how often do we look at air and its importance. Without a free and open soil structure everything else starts to fall apart and your inputs will rapidly rise whilst your profits rapidly fall. A perfect soil contains 50% air, and this impinges on so many plant processes and as farmers who are or considering min/no till we really need to understand that this allows:

- Fresh air into the soil where bacteria such as *Azotobacter* can convert gaseous N into a plant available form saving you money.
- Better penetration of applied nutrients in whatever form they are applied to avoid this surface rooting that we see in many crops.
- Carbon Dioxide from bacteria from the soil up into the leaf increasing photosynthesis and increasing your yield (Why do you think the stomata are on the underside of the leaf?)

- Roots to penetrate deeper to get to more nutrients allowing you to reduce your inputs and this increases drought resistance.
- Better roots which allows more sugar release into the soil which feeds the soil life which in turn feeds your crop and resists disease therefore less inputs (the circle of life).
- Better penetration of earth worms who do so much for you free of charge that it is one of the wonders of the world why we try to kill so many (oh, I remember, it's the profits of the chemical companies, silly me)

I could go on and on, but I think you get the message, start with air and work out from there as against start with Nitrogen and work for the chemical companies. However, as we have to work with excessive wet and excessive dry periods is there anything that we can do to alleviate the situation and of course the answer as always is yes.

**Many farmers who are going down the min/no till route are doing it because they feel a moral duty to improve their soils for future generations and those like me, fancy making a profit occasionally. Those who are doing it just as a Black Grass control have stopped reading ages ago.**

## It's more than the right products

Firstly, let's make it clear that to improve a soil for both dry/wet periods isn't just a case of buying the right products as some want us to believe. One farmer has been told that by applying a good soil wetting agent excess water will drain away; this was said to a farmer whose soil was under water so we did have to wonder where the water would go. There are any number of ways of moving forward and I am going to mention my friend Tim Parton who was 'Soil Farmer of the Year 2017', 'Arable Innovator of the year 2019' and is 'Sustainable Farmer of the Year 2020' and has transformed his soils over the last 10 years just by judicious use of



cover crops which absolutely amazes me on two fronts. The first is that Tim is a farm manager so has treated soils with a loving care even though they are not his. How can you not respect a man like that?

Secondly there are many salesmen, sorry, agronomists, who claim cover crops are a waste of time. Tim now uses a low input system so that a bad season doesn't throw him into pits of despair and he can afford to wait to sow until conditions are right, like me believing that a well planted spring crop will outperform a badly planted winter one. If you get chance to hear Tim speak it is well worth the effort as he explains how regenerative farming starts and ends with looking after the soil, as well as drastically reducing Nitrogen inputs which then allows everything else to work. I have enjoyed working with Tim again this year to make sure that we keep Nitrogen levels low to remove the need for PGR's or fungicides so smiles all around, well apart from a few obviously but they have had their pound of flesh many times over.

- Please note that I am not making light of this as depression is a major part of our industry so let's keep an eye on neighbours and colleagues -

Along with cover crops we are seeing an increase in digestate use and any number of other manure wastes, although we do need to look at those to protect our soils for the future and to make sure they don't become toxic in drier conditions. **My point here is that for every 1% of organic matter that we can increase in the soil we will get an extra 17,000lbs of water available** to the plants plus drainage is improved as airspaces remain airspaces, except

that is in severe flooding. I know that sounds stupid as we were under the damn stuff but as soon as it goes dry, we will all be saying, 'Why don't we store more of the water that is around in the winter?', won't we? Also, organic carbon, not matter, allows the soil to breathe even when it is very wet (not flooded unfortunately).

### Getting better roots

I have never believed that there is a time when you can't learn something which is why I don't like the term 'expert' which denotes a closed mind.

On my travels I have seen things starting to change on regenerative farms where limited tillage is the name of the game:

- Far better plants where no seed treatment was used allowing better germination and faster and better root penetration.
- An amazing root explosion where natural microbial counts were augmented with added brews of bacteria. In one trial, noted at the end of January, the seed in the normal field was on its third leaf but only had a poor shallow root. On the adjacent field under the same conditions but with my added seed drench (bacteria, humate and Silicon), we had similar tops to the plants, but the roots were over 300mm deep (that's a foot to my dad!)
- Superb root systems where digestate and slurries are buffered with a Humate such as AF Nurture N from Aiva Fertiliser (see, I told you I was a salesman). I have digestates that kill seeds if applied directly to the seed but work wonderfully when added to a Humate.

As far as a way forward is concerned, we need to feed what we have in the ground growing as it has very little in the way of available nutrients although I do not agree with flying around with Nitrogen as that is just meat with no gravy, leading to empty calories and the need for fungicides. Try spraying with Phosphorous, micronutrients and Silicon to prepare the plant for the Nitrogen otherwise you will have to use agrichemicals. I would say not to go onto the ground before it can take you, but I know a waste of breath when I see one.

Apply the N with AF Nurture N (me again) so that you can reduce the amount you use by 30% with no visible signs of a yield difference but a major step on the way to better soils and higher profits. With Boron being an issue I believe that we should use less but more often otherwise it can get a bit toxic. I have put Boron on this year in lower levels but more often as little and often always seems to pay dividends for me.

### Controlling disease

**Amongst regen farmers we are starting to see that getting the soil healthy and balancing and reducing nutrient input can have a huge difference on disease control.** Where we use a biological seed drench and a microbial package as a foliar programme along with micronutrients in low/no till systems, we use no PGR's or fungicides which is a major target of all my farmers. The overuse of chemicals has left us with monsters such as Fusarium and Cabbage Stem Flea Beetle which now we must deal with. Our biological system has had a dramatic effect of Fusarium and other diseases with really low rates in the seed when tested so, there is another way. Following the wet period, I noted huge amounts of Phytophthora on farm which could be the next monster to attack us, although luckily the healthy biological system used by many regen farmers actually stops this problem so we will be able to explain this to more conventional farmers when they are scratching their heads so try not to look too smug.

So, do we have to treat our soils like dirt? Of course not, we just have to grow well and work with nature and not ight it!



# DRILL MANUFACTURERS IN FOCUS...



## THE FUTURE LOOKS BRIGHT

The past few months have been challenging for all of us. We were gearing up for a remarkably busy spring with more demonstrations than we could have imagined. However, the arrival of the Coronavirus and the ensuing lockdown meant early on we took the decision to cancel all Spring demos for the safety of our employees and the farmers we would have been demonstrating to.

All was not lost though we were still using the Virkar on our own farms and following on from the success of establishment in the autumn. We were looking forward to really testing it again this Spring and the results have been outstanding.

### New for 2020

The Virkar Dynamic DC has had a few changes and new options for the 2020 season. It is now available in widths up to 7 meters, available with 3 hoppers, hopper extensions, and auger feed loading. As well as the new front cutting disc which really improves the drills capability in heavy chopped straw ground. There are now the options to be able to put tramlines in, and a factory fitted camera system with hopper camera and rear camera which improves the user experience. Also, we have developed over the past few months a more resistant spring compensator in the coulter, for heavier ground meaning you divert more pressure to the seeding tine and closing wheels meaning easier slot closure on heavier ground.

### The new normal

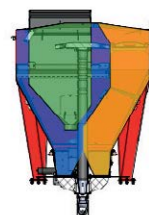
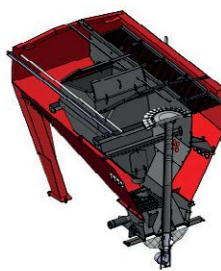
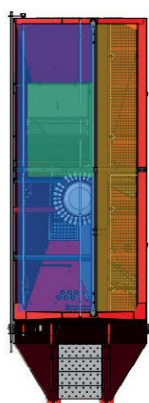
I think it is now clear to see that our weather in this country is becoming harder and harder for us to achieve what we want as farmers. Months of wet followed by months of dry, means crops have been under a lot of pressure.



Spring oats being drilled into a former buckwheat cover crop.

Having direct drilled Spring Oats Spring Barley & Spring Wheat, into a wide range of scenarios such as 5 ft tall buckwheat, oats, and phacelia cover crops, we were extremely

impressed in how the drill dealt with the conditions. The ability to conserve moisture through No-Till in the Spring is becoming crucial. All our Spring crops that were direct drilled look extremely healthy and strong. Being able to drill the field using only 2.5 litres of fuel an acre and seeing a brilliant crop emerge knowing you have saved £25/30 acre over the previous system is a good feeling.



Layout of 3 hopper option

- 1.850 l
- 3.000 l
- 350 l



Spring oats establishment after buckwheat cover crop.

### One Year on

Having now run our 6 Meter Virkar Dynamic DC for a whole season. It is



clear to see that it has exceeded all expectations. It truly is one of, if not the most versatile & simplistic drill to operate. The results and interest we have received has been very encouraging.

Moving forward with the uncertainty around what the future holds for our industry, I think more so than ever No-Till is an attractive avenue to go down. For us with our own farming operation the Virkar has allowed us to significantly reduce our establishment costs whilst maintaining yields.



Winter wheat picture March

## Looking ahead

We are already preparing for the Autumn demonstration season and hoping this time we can finally get the drill out and about on farms. We have had in the past few weeks and moving forward plenty of farmers visiting us seeing the drill first hand and having a tour of our farms and crops that have been drilled using the Virkar, they leave



New Dynamic D coulters

very encouraged by what they have seen.

They say a lot can change in a year, from seeing a video of the drill on YouTube, to now having drills out working across the UK. This machine is now a key part of our farming operation, by future proofing our business by ensuring we have the most cost effective and efficient system in place for crop establishment.

We cannot wait to see where the next 12 months takes us.

## New drill on the Horizon

New for 2020 is the direct disc coulters version of the drill. The Dynamic D has been a project that Virkar have been

working on and thoroughly testing in tough Spanish conditions for 2 years.

The coulters design means it can mount into the same frame as the Dynamic drill meaning you keep the modular design, widths from 4.5 to 7 meters will be available with either 19 or 25cm row spacings.

The coulters arms are maintenance free, sealed bearings and bushed. The coulters design means you get 35cm of travel for contour following, on the move coulters pressure adjustment, and only one manual adjustment per coulters leading to quick set up time in the field. Again, the drill can be specified with 3 hoppers and various other options.



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# NEW HORIZONS FOR SOIL RESEARCH

The UK Soil Observatory (UKSO) is an award-winning and free-to-use online service that enables everyone to view soil datasets from nine research organisations. Russell Lawley (Geo-Properties and Resources Team Lead) from the British Geological Survey explains how the resource has developed to provide significant benefits to the agricultural sector, what information you can expect to find, and how UK farming will play a major role in soil research in future.

The importance of soil to the UK and its role in supporting our environment and livelihoods will likely be among one of the most critical topics of the next decade.

There is still some way to go, but soil-health and resilience are at the heart of the new agricultural policy, and research investment from commercial and academic resources is now rising.

As scientists, we are continuing to sound the alarm about the important connection between soil health, sustainable agriculture and tackling the climate crisis. Each year, more attention turns to the important relationship between soil and climate.

The availability of soil data and the significant increase in technology in agriculture, has been key to the transformation of people's perceptions and understanding of what goes on beneath our feet.

The ethos behind UKSO is that no one should have to start with a blank map when it comes to soils information.

When UKSO started in 2014, it had a tiny number of users, accessing a handful of archived soil maps.

As well as data from the British Geological Survey, other partners contributing include the Natural Environment Research Council (NERC), Center for Ecology and Hydrology, the James Hutton Institute, Cranfield University, Rothamsted Research, Agri-Food and Biosciences Institute, Forestry Commission and Forest Research.

What began as a platform that caters for a wide audience, aiming to provide everyone with free access to soils data for the purpose of educating people about soils, has quickly evolved for use by key industries such as agriculture.

Today, we are approaching 190 online maps - many with regional, if not

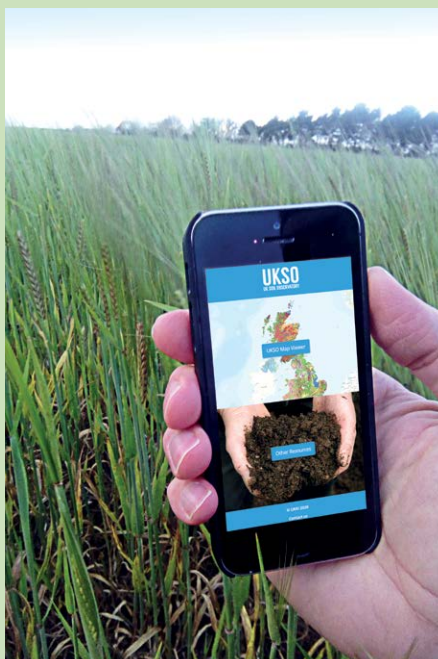
national coverage - and the data is being accessed by a wide range of users every week.

This includes farmers exploring their options to move into viticulture or forestry, to agronomists and contractors checking the 'lie of the land' before considering new territories.

*We provide mapping for England, Wales, Scotland and Northern Ireland with access to over 180 layers of data covering physical, chemical and biological characteristics including type, texture and grain size.*

We are also providing more services for landscape domains and hydrology.

Using UKSO, it's possible to explore soil carbon, soil chemistry, pH, moisture, texture, type and agronomy, even up-to-date surface slope data. The online



maps can all be viewed on the UKSO platform 'Map Viewer' via mobiles phones, tablets, and desktop.

Many farm-mapping software applications can also use the web mapping services directly - for increased convenience, and better integration into farming systems.

It also offers access to a number of resources through the UKSO website, including a series of quick-access static maps and exports from UKSO's Map Viewer which are coupled with contact information and usage.

It houses policies and guides for agriculture and industry and a selection of other useful apps and services which can help you find out more about soils in your area. These resources are only likely to grow in future as the service evolves.

## What can you do with UKSO?

Over 180 layers of data can be viewed using the UKSO map viewer, which can be used to gather information about soil type, texture and grain size and a wide range of physical, chemical and biological properties. Users can also view the data within their own mapping software or apps.

This includes Soilscape, a 1:250,000 scale, simplified soils dataset for England and Wales which shows, in simple terms, what the likely soil conditions are at any point in the landscape by reference to one of 27 different broad types of soil.

The users can benefit from extensive data about their soil chemistry as UKSO draws together data from the National Soil Inventory (NSI).

Other features include soil biodiversity data relevant to topsoil microbes and organic carbon concentrations, as well as topsoil nutrients, soil moisture and soil PH data from the Countrywide Survey (CS). This includes CS topsoil



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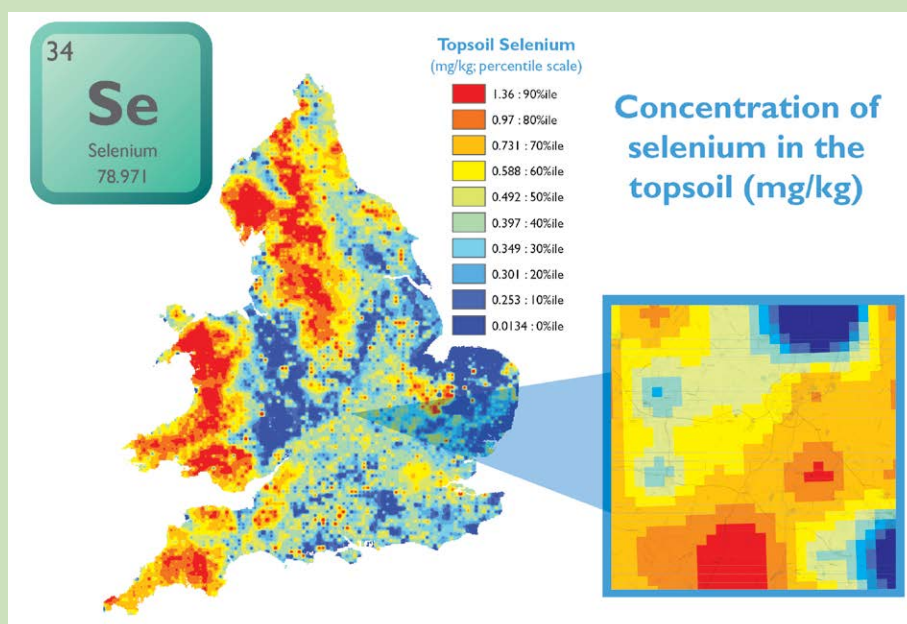
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bulk density data, representative of 0-15cm, and maps covering Great Britain's BioSoil pH data for a range of soil depths.

Planners and land managers can even benefit from surface data detailing for example, ruggedness, slope, and profile curvature derived from Ordnance Survey (OS) Terrain 50 elevation data, a dataset representing the physical shape of the real world.

You can also access an archive of soil-related resources, news and information such as soil apps, publications, events and research projects.

Recent updates and future developments

Right now, a key focus for UKSO is releasing more data for the agricultural sector.

In January 2020, we launched new maps relevant to mixed-arable and pasture farmers directly relevant to ruminant health.

The maps show regional levels and availability of the element magnesium in soil.

Low magnesium status (hypomagnesaemia) gives rise to tetany, or staggers, in ruminants. These conditions are remarkably widespread among ruminants in Europe, often with high fatality rates affecting business profitability.

The data is designed to help understand the natural availability of these minerals in soils, and their likely uptake into plants. It can also inform the

need to plan for supplementary feeds, sourcing grazing or forage from higher magnesium soils, or just for monitoring cattle if necessary.

The research was funded by the Biotechnology and Biological Sciences Research Council (BBSRC) and the Natural Environmental Research Council (NERC). Both organisations have significant research areas devoted to food security issues.

Using UKSO as a readily available toolkit for such data, will continue to ensure that industries like agriculture can benefit from high-quality research as quickly as possible.

### How will UKSO adapt in future?

For agriculture, the upcoming Environmental Land Management scheme will see many changes in how we value our environment. With an increased awareness of soil health and resilience, there are likely to be inevitable changes to environmental regulations.

A key part of future work for UKSO will be to provide an increasing array of data to support decision-making and compliance with changing environmental regulation.

UKSO has already started to respond to such changes. We are currently trialling national maps of slope, so that agronomists who are preparing for changes to agricultural run-off regulations, can start to assess which parcels of land may be increasingly affected by the new rules.

We have responded to the renewed investment in peatland restoration by providing higher resolution peat mapping across Great Britain. The aim is to enable users to assess how much peat is present (or securely sequestered beneath it), assisting effective and responsible land management.

Whilst traditional soil maps are still the most popular layers being viewed, demand has increased for datasets that answer specific questions relating to the land.

We're keen to ensure the service remains highly responsive to user feedback, who really are at the heart of what UKSO provides, and will fuel its future capabilities.

Current feedback is pointing towards a greater demand for ever-higher map resolution and more frequent updates and that's something we're working hard to address.

Over the next 12-24 months, we anticipate that UKSO partners will be refining a number of other datasets. These include:

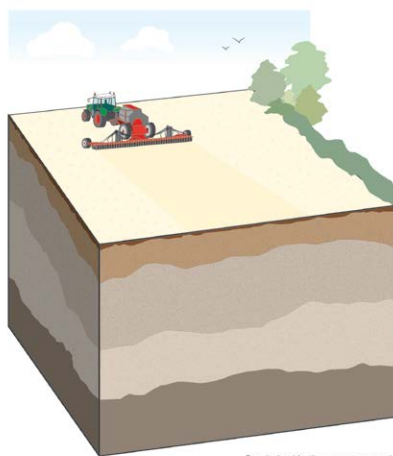
- improved texture descriptions for percentages of clay, sand and silt via laser-granulometry of 72,000 soil samples;
- Revised soil and sub-soil descriptions;
- New, very-high resolution, terrain datasets derived from Environment Agency Lidar survey;
- New trial models of soil erosion and soil compaction susceptibility;
- Improved options for using citizen science (the agricultural sector sharing their experience of their soils) and the potential for storing more data from soil sampling and field trials.

### How you can help UKSO to grow

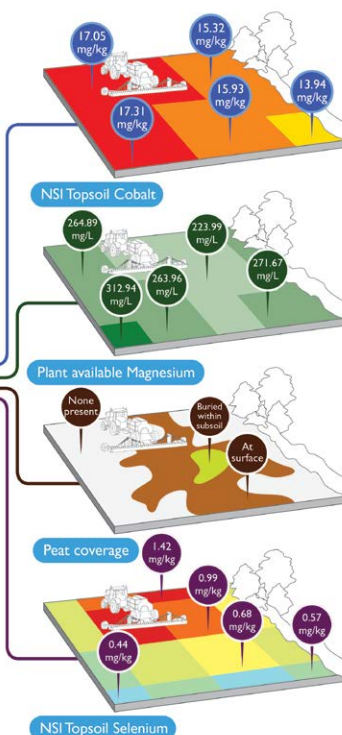
We are keen to continue learning about the needs of the agricultural sector and the specific needs of the direct-drilling community, who have already implemented changes to their land management to help improve soil resilience.

We provide a contact form on the UKSO website ([ukso.org/contact](https://ukso.org/contact)) where you can formulate your feedback and





Data displayed for illustrative purposes only.



- Soil or landscape datasets in UKSO that you find useful, but would like to see updated or improved, which ones and how.
- Suggestions for new datasets, or soil characteristics that would help you make better decisions about your soils, or insight into what your 'go-to' dataset would be for your work.
- Sources of new datasets such as drone, or smart-agriculture telemetry, that you think should be collated into UKSO.

Direct feedback will not only help to continue developing UKSO as user-centred platform, but insights like this can help to support future research. It's important we work collaboratively to ensure that soil health is given the attention it deserves in the climate change debate.

UKSO is funded by the Natural Environment Research Council (NERC), and Biotechnology and Biological Sciences Research Council (BBSRC). For more information visit: <http://www.ukso.org>

help to steer the development of the UKSO.

In particular, we would welcome thoughts from the industry such as:

- The soil or landscape datasets that you think should be in UKSO relevant to your sector, but might be currently missing.

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# CRIMPER ROLLERS



**In 2017 the Rodale Institute talked about the use of crimper rollers in organic no-till. They said:**

"In conventional systems, farmers can practice no-till by using chemical herbicides to kill cover crops before the next planting. Organic no-till, on the other hand, uses no synthetic inputs. Instead, small-scale organic no-till farmers use hand tools, like hoes and rakes. Large-scale organic no-till farmers can utilize a special tractor implement called the roller crimper (below), invented here at Rodale Institute."

## How does a Crimper Roller work?

The roller crimper is generally a water-filled (or solid) drum with chevron-patterned blades that attaches to the front of a tractor. More recently we have also seen them mounted on the front of drills as well. As the tractor drives over the cover crop, the roller crimper mows the plants down, cutting the stems every 16cm. The cover crop, now hopefully terminated, remains on the

ground where it forms a thick mulch that suffocates weeds.

Drills on the rear of the tractor then part the cover crop mulch, drill in seeds and cover them up to ensure soil contact. It generally happens in a single pass, saving vital time and energy for farmers. The cash crop then grows straight up through the cover crop mulch. But since we weren't worrying much about glyphosate in 2017, the concept hasn't gained much traction.

## Timing is everything

The Rodale Institute also told us that cover crops must be terminated at just the right time at the end of their life cycle. This prevents them from a) continuing to grow after being rolled or b) going to seed and spreading. Therefore, unfortunately, one can't use the roller crimper to simply mow down a field of unruly weeds mid-summer—they'll just grow back. You need to crimper roll when the cover crop reaches anthesis—when it switches from being vegetative to reproductive. In a

rye or small grain, this will occur almost uniformly through the field and you'll notice pollen shed. In vetch or legumes, which flower at different times, the rule of thumb is to roll when between 50% and 100% of the crop is flowering.

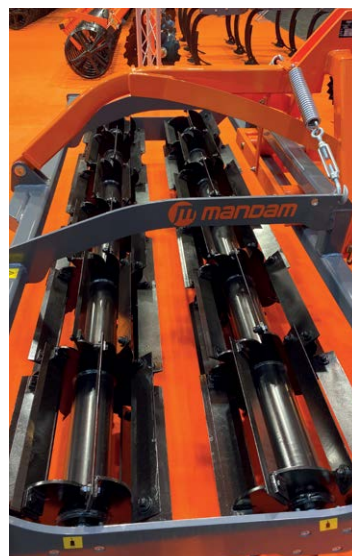
At the time the Rodale Institute even offered plans for making your own. Since then we have seen a couple of companies in the UK produce their own front mounted crimper roller in the UK.

## Fast Forward 3 Years

We are now looking at losing glyphosate, in fact it has already gone in some European countries. When we attended Agritechnica in November last year, crimper rollers were everywhere. It seems the appetite for their adoption, albeit not straightforward, has grown significantly. Especially in Europe. The big question being, is this something you will trial in the next 12-24 months? Here are just some of the other crimper rollers we saw at Agritechnica, some of which you may see at LAMMA 2021.









# FARMER FOCUS

## NEIL WHITE



### The 2020 season in the Scottish Borders

**Neil White's farming is a constantly evolving system which includes a comparison of Mzuri direct drilling with a plough-combi in this difficult season.**

It was a long and wet winter here, crops struggled, but most made it through the relentless rain into a bright, dry but cold spring. When I started strip tilling, in early spring I had to defend my winter crops to my now, late father. He never switched off the part of his psyche that defined good crops by green lines on brown soil. Come April he would admit that the crops looked good and by May, that they had great potential. 'You need to keep your faith' I would say as I believe strip-tilled crops are slower to get going in the spring. This year he would have given me a hard time as things did look bad, but most crops have recovered and some look to be full of potential again. I did however take out my second wheat, sown in great conditions just before the weather broke, and patch some wheat which was ploughed, drilled then flooded. The poorest crop left in is some Pearl winter barley, it is not a resilient crop at the best of times and with the NVZ not allowing autumn nitrogen on cereals I do struggle to get a good crop going into winter.

### Wet weather resilience of direct and combi drilling

It has been very interesting to see how different fields have coped with the excessive wet weather we have had. It is very noticeable that the fields strip tilled the longest recover quickest. I am trying to work round my farm correcting any drainage problems, feeling this is something I have neglected in the past. This is based on a desire to look closely at what I expect from my soils. Reduced tillage has already helped the soils recover their water carrying capacity by keeping them aerobic and the fauna alive, so I must keep the drains running. In the fields where remedial work is done, I still plough to level the ground for spring crops and the difference this year between ploughed and strip tilled is very noticeable. The Mzuri drilling looks far better. It's funny that if the roles were reversed people would use it as a reason not to strip till.



### Direct drill and plough-combi comparison

I have Diablo spring barley and Canyon spring oats which, unusually, were both direct drilled and plough-combi drilled. This makes an interesting comparison. In the plough-based system the extra working of the soil as it dried out has been a massive problem this year as it has caused some very uneven crop emergence. The more I did to the ground, the more time and money I spent, the worse the crop looks. The wettest, very quickly became the driest. I walked over my ploughed and sown oat field and it was like gravel, dry and crisp and it stayed that way for 4 weeks after sowing until the rain came.

In a perverse way it does help convince me to use the Mzuri drill on all my spring crops as those crops look far superior. They were drilled into over wintered stubble, untouched, no cover crop but with weeds sprayed off, the undisturbed soil retained the moisture and the crops never looked back. I put pictures on my Instagram 'Everything is Greenknowe' and a video on Youtube that I would suspect were fake if Mzuri or any manufacturer posted them.

### Deeper front leg setting pays off

I ran the front leg a little deeper on my drill this spring at around 7 inches and the coulter 1.5 to 2 as I was worried the cold soil maybe needed more loosening and lift. I think this paid off as the moisture was accessible around the seed and rooting area and the placed fertiliser gets it off to a good start. I didn't have a dual tank on my original Mzuri and it worked well but the ability to place fertiliser in the new machine has made a very noticeable difference this year.

I often discuss with others the various tweaks or different approaches we use to fix problems that can occur with different systems and it is interesting to see what direction people choose. I have tried to resist buying additional equipment as I believe in the simple system.

Lots of chat is about sub soiling and light disking or cultivation to remove problems, which I resist out of necessity as I do not have the tractors or people it requires at peak times. My approach now is to look backwards and think more about prevention, and while this is not a new thing it is a mindset I am trying to adopt.



I don't think about what the 'system' can cope with, rather what can the 'soil' cope with. I look at the baler, muck spreader and trailers and consider whether it could be done a lot better, and after sowing for a neighbour who runs a CTF system I would love to be able to try that here. I can see myself continuing to chop more and more straw and restricting muck spreading to only suitable conditions, leaving it in the midden if need be. I used to only look at the benefits of these but now I also consider the damage that could be caused.

### Straw rake bought but no grants in Scotland

I have however treated myself to a Mzuri Rezult straw rake this summer. This piece of machinery, like my drill, are bought purely on merit as we have no grants available to us this side of the border. Being a tight Scotsman, only 6 miles from the border, this really bothers me and through my involvement with NFUS any opportunity I have to lobby ScotGov I bring it up. I cannot believe that given all the rhetoric from the Scottish Government, the 'all stick no carrot' approach is the route they choose! I still bought the rake however.

I had been hiring, very cheaply, from a neighbour and I do one or two passes on rape stubbles prior to sowing. I found with hiring I haven't been able to get two passes 10 days apart and I feel it's unfair to take it to my contracted ground as it is very stony. I like this kit, despite the cost, because I do find given the weather, it halves the number of slugs and viable eggs and it does chit seeds in the top layer. I have asked the AHDB if they research this, but I am unaware if they have.

### Prevention is better than cure

I have seen it written that we should 'try to avoid singular solutions to singular problems' so I am aiming for prevention, not mechanical cure. I like my local machinery dealers, but they do drive newer cars than me. I did manage to get rid of a spare 3.5m Kuhn power harrow we had had for years though so it is a one in one out policy on machinery.


I am considering buying in compost for some of my stiffer ground. The geographical area I am in does not lend itself to cheap opportunities for these inputs so we will see. I hear a lot about the benefits it can bring so I think it would be worth pursuing and giving a try.

### Future challenges

The farm next door to me is becoming available for contract farming and being next door, I was always going to be interested. This area is one of the most competitive in Scotland for this type of arrangement so it will be difficult to compete. The fact that I am considering taking more on and bidding what I think is a very competitive figure starts with the day I changed my system.

I cannot fail to mention the C19 pandemic, I hope you are all safe and well. I have to say that we are always aware how lucky we are, the job, homes, rural location and control we have over our social environment but never have we been more thankful than the last 3 months. I hope British farming comes out all the stronger in the end.





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# HOW SEED BREEDING AND KNOWLEDGE INTEGRATION WILL CARRY GROWERS TO A MORE SUSTAINABLE FUTURE

With losses in agrochemistry continuing, more variable growing conditions predicted and the need to move to more sustainable production, individual choices around seed will have an increasingly important impact on crop production efficiency, industry specialists believe.

The most important day of a crop's life is the day the seed is sown and this is likely to be even more important than ever in the future, says agricultural innovations consultant Dr. Tony John.

"Whilst precision farming and robots will do much to improve the efficiency of our production in the future, genetic development will undoubtedly do the majority of the 'heavy lifting' in meeting the demands of sustainable and responsible intensification in the future," he says.

"Whilst much of this will be down improved traits and performance available, a lot will be due to the knowledge and data associated with the seed chosen."

With over 25 years experience in international agricultural research, director level positions in commercial agronomy and a current role advising the UK government's Department of International Trade (DIT), he believes

integration of biology and data at farm level will become increasingly important.

"Seed and genetic development will have a fundamental role to play in helping producers meet the challenges of the future and will go a long way to replacing the level of inputs used to date.

"Genetics have the opportunity to replace the sprayer in its current form in many instances in the future, especially when used in combination with the other technologies that are, or will become available, as Agriculture 4.0 develops in the future."

Data, or more specifically, integrated data, is king, he believes

"Systems that collect data and integrate it across all our farming operations have the potential to radically improve our production efficiency.

"Such technology also offers the opportunity for the transfer of knowledge at a scale we have not seen before.

"But at the heart of all these exciting developments lies the fundamental performance of what we sow in the ground in the first place and this is undoubtedly the next frontier of development as new breeding techniques speed up the process of traits from lab to field."

Helping growers mitigate against future challenges

KWS UK knowledge transfer manager Dr. Kirsty Roberts agrees saying significant progress is being made in the development of traits and characteristics needed to help growers mitigate against the challenges of the future.

"Sequencing of the wheat genome means we can better identify the genes controlling specific traits and with marker



KWS UK knowledge transfer manager Dr. Kirsty Roberts

assisted breeding and genomic selection, we can increase the speed and efficiency of breeding.

"High throughput phenotyping - inside in glasshouses and outside by via drones or tractor-mounted - is transforming the way breeders work.

"Across the globe, KWS is now using robots and flying drones to continuously collect data in the fields and to evaluate this using artificial intelligence (AI).

"Ongoing investment in this area means we are not only improving the amount of data we are now capturing it also means we are able to analyse it much more efficiently than before.

"This in turn produces more accurate and faster breeding results plus an improved development process overall."

So much so that Sowing for Peak Performance (SPP) is now a fundamental breeding objective that underpins all KWS genetic development now and into the future, she says.

"SPP is based on the premise that 80% of what your crop can deliver is locked into the seed you buy and its match to





your own individual growing conditions.

"Whilst you can fine-tune this with the correct Nitrogen levels, using fungicides wisely to protect it from disease and paying attention to basic management principles, once you've made your seed choice your production potential is largely set.

"This seed choice is a primary decision that every grower makes every year and it will become increasingly important in the future."

## Soil and cultivation method key

Seed choice could interact with cultivation method and soil management far greater in the future, she believes.

"The less time you spend applying agrochemicals and fertilisers in the future, the more you are saving on labour, diesel and machinery wear and tear and, ultimately, replacement.

"The less time and money spent on managing crops the less time you will hopefully spend in the tractor cab.

"Less travel means less potential damage to soils and less time and money spent trying to correct the compaction problems associated with multiple wheelings and carrying out operations is unsuitable conditions.

"For example, varieties that mature earlier result in earlier harvesting which in turn means you have more chance of avoiding the worst of the autumn

weather and more time to prepare land properly in a manner that reduces soil damage to a minimum.

"It also gives you a greater choice of crop options, whilst varieties with greater flexibility over drilling date avoid the problem of potentially undrilled fields that could be exposed to soil erosion over the winter.

"In the future, we could have varieties less reliant on specific seedbed conditions with the real possibility of seed optimised for zero and minimum tillage operations."

Tony John believes systems of production that are kinder to soils than current ones have to be a priority.

"Reducing compaction through excessive machinery travel is key but we will also have to focus on cultivation practices that are kinder to soil and nutrition practices that build the organic content," he says.

"This could come from smaller machinery for applications rather than less travel or more vigorous varieties exerting greater competition against weeds which in turns reduces the need for heavy duty cultivations.

"Building up the nutrient status of the soil could also come through greater understanding the interaction between varieties and the root biome.

"Developing a wider range of crops that fix N from the atmosphere will be another important contribution of

enhanced genetics in the future, as will understanding more about soil's role in carbon capture."

## Significant cost benefits

KWS product development manager John Miles says functional traits such as disease resistance, standing power and earlier harvest date can already simplify management and reduce production costs to a much greater degree than many currently believe.



KWS product development manager John Miles

"Secondary factors such as savings in diesel, labour, machinery replacement and better soil condition can multiply the benefits many times over and help producers meet the requirements of integrated pest management (IPM) demands and environmental legislation much easier.

"It's too easy to look at good standing power, for example, and think it's a trait that might save you a bit on growth regulators, but when you look at the risk with regard to the potential effects of lodged crops, the cost benefit implications are much more significant.

"There are the initial saving on PGRs, but with lodged crops, costs can escalate per hectare when you start to factor in extra diesel, labour and machinery hours.

"One of the easiest savings to be made will be trimming fungicide rates according to risk which is where using varieties with high levels of disease resistance can be worth up to £20/ha, he says.

"With sprayer costs being in the region of £10 - 15/ha and a day spent spraying likely to cost you around £120 in direct labour costs, the economic implications





of reductions in applications can be highly significant.”

It's the same with regard to standing power and ease of harvesting and throughput, plus the more traits you have in a variety the greater the benefits, he points out.



“Focusing on what a variety brings to your management in terms of functional traits alone could produce costs benefits equivalent to up to 20% of yield.”

This is borne out by the £231/ha additional benefits estimated for KWS Extase from combined potential savings in fungicides with premium retention and all the other benefits that go with these, he explains.



“This is before factoring in the cost advantages of earlier ripening and earlier harvesting and its effect on timeliness throughout the critical autumn period.

“At approximately, £75 - £80/ha for seed on-farm, this suggests around a 300% return on investment is possible from functional traits alone before higher yields are accounted for.

“Whilst developing new varieties and producing seed is always costly and time consuming for breeders, these gains represent sizeable opportunities for growers. These gains are likely to be even more in the future.”

New trials look at varieties and cultivation methods

A new trial set up by KWS aims to identify which varieties perform best in min-till and no-till situations and compare this to conventional cultivation methods.

Over 20 popular winter wheats are being tested at a range of sites with early indications suggesting clear differences between different varieties, says John Miles.

“Generally the individual varieties within the tilled plots were looking much more even by early summer compared with the no-till plots with top performers and faster maturing varieties such as Extase and Parkin looking visibly further ahead than others.

“In contrast the ones where no-till was used were more inconsistent within plots



with some showing significant holes in the cropping which would result in yield loss.

“Crop density was probably around the 550 ears/m<sup>2</sup> in the tilled plots. Due to challenging establishment conditions in autumn 2019, the no till plots saw significant plant losses which look to have resulted in ear numbers below 300 ears/m<sup>2</sup>

Although full results will not be available until after harvest, an early summer assessment suggests the varieties doing the best are the ones with the highest tillering ability and strong early speed of movement in the autumn allowing better plants to establish, he points out.

“The stand-out varieties in the no-till plots are Zyatt, Extase, Firefly, Parkin and Kerrin – all of which established well and kept ahead through the Spring but were also noticeably more consistent across their plots than many other varieties.

“Whilst all varieties were grown at 350 seeds/m<sup>2</sup> seed rates of 450, 550 and 650 seeds/m<sup>2</sup> are also being looked at to see if there is a correlation between variety type, seed rate and cultivation method.

“There's a real possibility that in the future we will be able to identify not just the best varieties to grown in a no-till or min-till situation, but also the most effective way to grow them in terms of drilling date, seed rate and likely agronomic interventions.”





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# WHAT SHOULD THE AGRONOMY SERVICE OF THE FUTURE LOOK LIKE?

Written by Richard Harding, Procam

In a year where recent events have triggered a rethink in many areas of our lives, one major question is where to get advice that aims to future-proof the farm business for the long term.

Having been involved with farms practicing conservation agriculture (CA) or regenerative agriculture (RA) for over 10 years, it has increasingly felt like there is a disconnect between what the farmer requires from an agronomist and what the existing agronomy model offers. As Mark Dewes, a recent Nuffield Scholar, wrote in his article for the last issue of Direct Driller, “out-sourcing of pesticide management to agronomists has contributed to a disengagement of farmers from their own agronomic decision making”. It also assumes a chemical is likely to be the primary solution. I would go further and say UK agriculture and wider society is obsessed with buying the solution to a problem rather than seeing themselves as being the solution.

One topical subject, for example, is Cabbage Stem Flea Beetle. How many farmers have you heard say “Flea Beetle is a real problem on my farm and there are no longer any reliable chemical solutions”? An alternative perspective would be, “We’ve grown oilseed rape too often as an industry

and that is causing an explosion of Flea Beetle. So, I’m going to change my rotation”. Of course this is easier said than done, but it drives home the point that we are the problem as much as the solution.

*Before continuing I should confess to being an eternal, yet realistic optimist in relation to the future. I firmly believe we need to take more inspiration from nature and acknowledge that nature holds within it many sophisticated solutions to the agronomic and environmental challenges we face.*

Rather than dwell too much on the problems we all face - loss of chemical actives, loss of direct financial support for agriculture, climate change, etc. - let’s consider how an agronomy service of the future can be part of the solution.

In our solution we need to go beyond organic, stop demonising a particular production system or label, and keep an open mind as to where we might find the answers to the challenges we face. Being the solution is about having a future-proofed and resilient farming system, or, more appropriately, a future-proofed rural business. This acknowledges the diversity of a typical modern farming business. CA or RA are longterm systems and the emphasis needs to shift from yield and margin over input costs to maximising the annual net farm income (NFI), rotational gross margins or even straight return on investment (ROI). While we are comfortable with the terms fixed and

variable costs, sometimes we can obsess about variable costs because they are very visible. We can tend to ignore fixed costs because they are more hidden. The term “fixed” gives the perception they are more difficult to change than is the reality. It just requires more thought and planning.

For example, a New Zealand dairy grazing system can outperform a UK conventional all year round calving housed system when viewed from a ROI perspective. However, as always, things are more complicated than that. The dairy system example relies on the assumption that land isn’t the limiting factor.

Before considering the agronomy service of the future we must consider how research is traditionally disseminated. Currently it is largely top down with research predominately coming from research organisations and government bodies. CA and RA require a different approach. Peer-to-peer and a bottom up approach is more suitable due to the longer-term nature of the research required and the fact that there is less commercial interest in the solutions which benefit the farmer and consumer most.

One organisation working hard to deliver research relevant to a more resilient farming system is Agricollogy. Agricollogy is a network whose purpose is to share practical information on sustainable approaches with farmers and growers. It is a free platform, open to everyone. This is a great example of a less top down approach to knowledge transfer.

Organisations such as Groundswell have done much within the industry to facilitate CA and RA knowledge transfer through their annual conference in Hertfordshire, packed



Flea Beetle. The current and obvious reaction to seeing an image of Flea Beetle for most farmers is understandably anger and frustration.



with inspiring farmers from all over the world. BASE (Biodiversity, Agriculture, Soil, and the Environment) is another great example of a farmer-led organisation promoting peer to peer knowledge transfer. All these organisations are doing incredible work. So how do we translate all this knowledge into a more resilient and viable farming system moving from a niche to mainstream UK agriculture?

The farmer, having amassed all this knowledge of alternative systems, still requires - at the beginning at least - the skills of an agronomist who understands and has experience of CA or RA. A common comment at the Groundswell conference is, "This is an inspiring event but how do I now find the right advice to support continual system change on my farm"? It is hugely important to support the farmer on the ground during a transition from one system to another. Changing a system also changes the agronomic requirements: as the system evolves the weekly/ fortnightly crop walking becomes less essential, being replaced by a more strategic monthly/ quarterly visit, or advice could even take the form of an annual review depending on the confidence of the farmer. One of the biggest benefits of working with an enlightened agronomist for anyone implementing change is to provide the farmer with support and reassurance when surrounded by peers who may be critical of some of the farming practices they are undertaking.

This approach based on natural systems is something that will require a different approach to risk, financial planning, and resilience. We should be under no illusion: these systems certainly won't be for everyone. The critical point is that the overall long-term farming goals should be woven into, and will affect, every agronomic decision that is taken. As every situation is different, one size definitely doesn't suit all.

*Whatever the situation, for the agronomist of the future to exist we need to acknowledge two key changes. We must first truly value the agronomic advice in the same way that the advice of a land agent, accountant, or other professional is valued. As with these professional services, the cost is more than repaid from the resulting benefit. Replacing a chemical solution with more cultural methods of control will add management time, transferring the value from a product to a professional's time which must still be paid for. However, the savings outweigh the cost.*

One potentially contentious systems approach example is disease control in oilseed rape (OSR). In 2018 a CA approach to growing an OSR crop involved the following principles. Firstly, a long rotation was a given, direct drilled OSR with companion crops. Secondly, reduced fungicide and herbicide was used when compared to the farm standard, with judicious use of the BASF/AHDB sclerotinia monitoring tool. This resulted in a slightly higher gross margin, up £62.50/ha when compared to the farm standard, with an increase in overall net margin of £193/ha for the CA systems approach. However, the management time involved was greatly increased when it came to sclerotinia monitoring and increased time crop walking compared to the standard approach. Had the weather changed suddenly and sclerotinia significantly affected yield this improved margin could have easily turned into as significant



Oilseed rape (OSR) grown with CA principles outperformed the farm's standard Hybrid OSR net margin by £193/ha.

a loss. [Is it worth saying something here about long-term research on such systems, that shows that such losses are, over time, absorbed, and profits overall increased, but that a long view is needed, that is able to manage short-term losses? And so a factor in choosing such a system is whether the business is in a position to take the long view, or whether it has reasons to have to focus on minimising potential short-term loss?]

To conclude, the agronomist of the future needs to be much more deeply involved in the farm business than may traditionally have been the case. Providing advice on both variable and fixed costs alongside long-term strategic planning. To future proof the farm business will require regionalised bottom up research facilitated by the agronomist, seeing chemistry as the last resort. In addition to the research sources described above, another form of research is a facilitating of physical and financial benchmarking of farms against their immediate peers who are operating similar systems, where no subject is out of bounds in the pursuit of truly sustainable progress. With such facilitation the agronomist of the future provides support, generates collaboration, and furthers research, benefiting all parties involved and pursuing lasting ecological solutions.

# AGRICOLOGY

## SUSTAINABLE PRACTICAL FARMING



Agricology, a regular contributor to Direct Driller, is just one example of an organisation promoting sustainable knowledge transfer.

# DRILL MANUFACTURERS IN FOCUS...



Jeff Claydon, who developed the Claydon Opti-Till® System, discusses the progress of winter and spring crops on his family's farm in Suffolk and how the TerraBlade inter-row hoe is used in conjunction with herbicides to help minimise weeds and diseases. This article was written during the first week of May, following the wettest winter since national records began in 1910 and a very dry spring.

The COVID-19 situation has made consumers much more aware that food is one of life's most basic requirements and not something to be taken for granted. It has also highlighted the complexity of the finely tuned supply chain which delivers a continuous supply of high-quality food to retailers' shelves for them to purchase. This presents the farming and food sectors that have Farm Assured standard and Red Tractor status with a real opportunity to better inform and educate them on this critical topic.

Continuous pressure from the supermarkets over many decades has forced food prices down in real terms, so as an industry we have had to respond by cutting costs and becoming more productive to remain profitable. But that has become increasingly difficult to do and going forward the situation will require careful consideration, because there is no point in chasing a low-cost system if yields are compromised as far more will be lost than saved.

With profit margins under pressure, a shortage of skilled labour and more frequent extremes of weather, the financial risks attached to farming have increased substantially. Never has it been more important to operate an establishment system which is effective in all conditions and provides sufficient capacity to allow crops to be drilled at the right time, in the right conditions.

## DESPITE EXTREME WEATHER OUR CROPS LOOK FANTASTIC



Jeff Claydon in a crop of 'Aspire' winter oilseed rape during the third week of April 2020. The crop was drilled on 10 August using a seed rate of 4kg/ha and has received 180kgN/ha.

Without those attributes it impossible to produce high yields and generate the financial returns necessary to farm profitably and sustainably.

### A challenging season for many

This season's extremes of weather highlighted the drawbacks of moving too much or too little soil. Many who relied entirely on a plough-based or

min-till system are now questioning the relevance of multiple tillage operations, whilst the serious pitfalls of a no-till approach have been very evident. In both cases, less-than-ideal establishment, poor germination, and less effective weed control will ultimately reduce yields and profitability.



Winter beans were established on the Claydon farm in November 2019 using a 6m Claydon Hybrid drill. Despite atrocious weather at the time, followed by weeks of wet weather, they were in excellent shape in April. The week before this photograph was taken Jeff went through them with a Claydon Straw Harrow to dislodge emerging weeds, leaving them on the soil surface to dry out and die.





*This crop of spring oats had been drilled just four weeks previously on 24 March 2020 at 130kg/ha using the Claydon Opti-Till® System. Before drilling, 35kgN/ha was applied in liquid form, 150kg of DAP was placed below the seed and to follow a further 50kgN/ha went on after crop emergence.*

I am pleased to report that this has not been the case on the Claydon farm, where the Opti-Till® System provides much-improved timeliness and flexibility. All our crops are established with a 6m Hybrid T6c which comfortably averaged 40ha a day, so all 280 hectares of winter wheat, beans and oilseed rape went in as planned in just 70 hours. The winter wheat was in the ground by 31 October and the last winter beans were drilled on 19 November.

Wider crop rotations, combined with a 50:50 split between wheat and break crops, have helped to spread the workload. After harvest we had plenty of time to carry out an effective stubble management programme with our 15m Straw Harrow and 6m TerraStar. This encouraged multiple flushes of volunteers and weeds, any remaining green material being killed off with a single application of full-rate glyphosate in October/November. For spring crops this left fields clean but with a shallow layer of surface tilth which provided ideal conditions over the winter and prevented the surface from capping.

We drilled the remaining 46ha of spring crops directly into this perfect growing environment at the end of March. Following a week of dry weather our spring oats went in on 24 March, the day after 'lockdown' started in the UK, even though the soil temperature was just 5.5°C and significantly below the 7°C average for January.

In the four weeks that followed we had just one rain event and the 2mm which fell evaporated quickly. In early April there were more frosts

than during the whole of the winter and these, together with very cold winds, stunted the oilseed rape. It is much shorter than normal, but prolific amounts of flowers and seed pods are evident, so plenty of sunlight will penetrate the canopy and hopefully help to ensure good yields.

Without Opti-Till® our crops certainly would not be at the stage they are now. The system greatly improves timeliness, reduces establishment costs by up to 80%, creates well-structured, supportive soils, encourages high worm populations, promotes biodiversity, and ensures excellent drainage. This results in sustainable, high yields, greater resilience to extreme weather events, numerous environmental benefits, and improved profitability.

The key is the Hybrid drill's patented leading tine which lifts and aerates the soil, creating fissures that alleviate localised compaction, improve drainage, allow the soil to absorb heavy rainfall without capping and provide space for strong rooting structures to develop. The separate seeding tine places seed within the band of soil which has just been lifted and loosened, providing ideal conditions for rapid emergence, and encouraging strong rooting structures to develop.

Drilling seed in bands provides an ideal environment in which worms thrive and because their burrows and capillaries are left undisturbed this aids drainage and water movement throughout the soil profile during growing season. Plant roots are also left largely undisturbed, which adds to the



*With the Claydon Opti-Till® System soil density is retained over at least 50% of the field, which supports field traffic throughout the season and allows crop protection products and fertilisers to be applied at the optimum time. Despite almost incessant rain over the winter and five passes with a 17-tonne self-propelled sprayer between drilling this crop of LG Skyscraper winter wheat on 30 October and when this photograph was taken in mid-April no ruts were created.*

soil biota and improves its structure, organic matter depletion is minimised due to nominal soil disturbance, while moisture and nutrients are preserved.

Setting any drill up correctly according to prevailing conditions is always important for optimum results, but it has been critical this season. In the autumn it rained almost every day and so we slightly reduced the working depth of the front tines to prevent the tractor's wheels from slipping excessively in the extremely wet conditions. This also helped to maintain a reasonable forward speed and achieve enough soil shatter, without bringing wet sticky soil to the surface. In the spring, when the soil had dried out on the surface but remained wet underneath, we also ran the leading tine 6cm to 8cm below the seeding zone to draw up humidity into that area.



*Worms are critical to any sustainable farming system because they help to take down residues from the previous crop, whilst their burrows allow water to penetrate and aerate the soil, leading to deep, strong, healthy root systems which allow the crop to fulfil its full potential.*

Despite atrocious weather, with only three rain-free days from October until mid-March, crops established well and when I went around the farm this morning even the headlands looked exceptional. Our customers throughout the UK and overseas have reported that the Opti-Till® System has also produced excellent results. One of them called me to say that they had operated their 6m Claydon Hybrid around the clock to make best use of a period of dry weather in the autumn, drilling 80ha in a 24-hour period without the need for any form of pre-cultivation.

## Tidying up in spring

With all our winter and spring-sown crops in excellent order we have been





*The very heavy Hanslope Series chalky boulder clay soil on the Claydon farm is one of the most difficult in the country to manage, but after the extremely wet winter, a spell of dry weather in April provided ideal conditions to mole drain some areas at 2.5m centres. Jeff points to the barely visible incision in the soil where a mole leg passed through this crop of spring oats.*

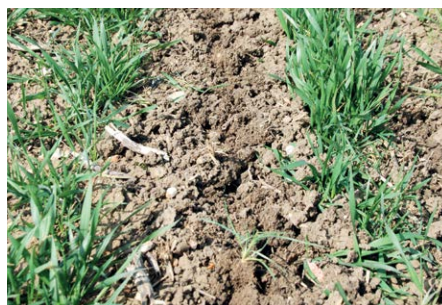
making extensive use of our Claydon TerraBlade, a low-cost, mechanical method of controlling weeds growing between the rows in all combinable, band-sown crops. Keeping these areas clean during the early stages of crop growth reduces competition for nutrients, light, air, and water, enabling the young plants to grow strong and healthy, improving the availability and utilisation of soil nutrients and ultimately boosting crop yields.

The TerraBlade is an additional weapon in the agricultural industry's weed control armoury at a time when the efficacy of some herbicides is decreasing, and the cost of control is increasing. It eliminates weeds reliably, safely without using chemicals and clears up any that were missed by ag-chems, or where such products cannot be used. This greatly reduces the return of weed seeds, the overall weed burden and the risk of more resistant types developing.



*A 6m Claydon TerraBlade inter-row hoe operating on the Claydon farm in Suffolk*

On farms that drill early, crops may be sufficiently well developed in the autumn to start using the TerraBlade then, and the operation can continue in the spring whenever soil conditions



*On the left is a crop of wheat where the Claydon TerraBlade has just been used. The one on the right shows how the weeds which had been growing between the rows on the undisturbed soil were eliminated almost completely and have died off completely. Routine use of the Claydon Opti-Till System to establish crops over the last 15 years has left the soil in such good condition that it easily supports the weight of a tractor equipped with a Claydon TerraBlade, even early in the season.*

allow, up to the stage where the crop might be physically compromised by further passes.

A trial by Agrii UK in an area where grassweeds had become problematic after years of conventional crop establishment found that a combination of Claydon stubble management and herbicide programmes achieved an exceptionally high level of control. In the area which received no treatment, Agrii researchers counted over 900 blackgrass seed heads per square metre. In the surrounding area, where a combination of ag-chem treatments, Claydon Straw Harrow and Claydon

TerraBlade passes were used, the number was just 13/m<sup>2</sup>, a 98.5% reduction.

The benefits of the Opti-Till® System are clearly resonating with farmers and this has been reflected in the high number of enquiries that we have received in recent weeks as many decide to reevaluate their approach before the autumn.

The COVID-19 lockdown meant that we were unable to welcome the hundreds of existing and potential customers who normally visit our open days in May, so this year we decided to film a virtual open day so that we could highlight just out well our soils and crops are looking. You can view it by visiting the Claydon website ([www.claydondrill.com](http://www.claydondrill.com))

To learn more about the Claydon Opti-Till® System and how to improve your farm's performance contact your local Claydon dealer, go to [www.claydondrill.com](http://www.claydondrill.com) or call the Claydon office on 01440 820327.



*This Agrii UK trial in 2018 highlighted the effectiveness of the Claydon TerraBlade in controlling weeds. In the area to the right grassweeds where had become problematic after years of conventional crop establishment Agrii researchers counted over 900 blackgrass seed heads per square metre. To the left, a combination of Claydon stubble management and herbicide programmes reduced the number to just 13/m<sup>2</sup>, a 98.5% reduction.*





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# FARMER FOCUS

## ANDY HOWARD



A few weeks ago I was really falling out of love with growing wheat. Like all difficult times you get the chance to re-assess what you do and I believe we need a complete re-think of wheat growing in the UK. Since my last article in the December edition it continued to rain, about 680mm between the end of September and the beginning of March. The deluge gave us a final goodbye on March the 7th by raining all day and flooding the farm.

It has been a difficult time watching crops go under water and springs appear and kill patches of wheat. Now we have having a very dry spring and crops are looking stressed due to poor roots systems. Please put your hands up if you farm on heavy ground and are relaxed about planting high seed rates of wheat at the end of October this year? Then (if its survived the winter) apply a fungicide 4 times to keep out disease, also apply large amounts of nitrogen fertiliser to try and meet milling specifications and finally spend £100/ha on herbicides to try and fail to control grass weeds. I cannot imagine many hands being raised. (apart from the input suppliers).

### Thinking of wheat bushes with 100 tillers

While drilling spring crops I was listening to a podcast by John Kempf where he was interviewing Dr Norman Uphoff about The System of Rice Intensification. In developing countries, they have re-designed Rice cultivation with dramatic yield increases and lower input costs. This has been done by planting very-low seed rates, so each plant has plenty of room above and below ground and so rooting and tillering is increased. They use as much compost at planting as possible to improve the soil biology. There are other changes they made but these two mentioned are the most important here. Since their success with Rice they have transferred the theories to other crops including Wheat.

So, I started to think how we could adapt this system to the UK and remembered about the Marc Bonfils method of wheat growing where he was getting remarkably high yields with similar techniques. I also remembered a picture of wheat shown by Neil Fuller where he had planted wheat at 10 plants per square meter and the plants had 100 tillers. In summary I



believe we should be planting wheat as early as possible with very-low seed rates. At the same time apply compost or an extract at planting.

This will give us wheat bushes with large root systems and many tillers which will find nutrients from deep in the soil and so require a lot less nutrition. Due to the open canopy disease will be less of an issue. This would ideally be on an already established permanent legume living mulch.

Marc Bonfils was achieving 15t/ha with a similar system with very low inputs. So why didn't it take off? My guess is scalability. The open canopy would give weeds more of a chance and they were probably hand hoed. With Weeder Robots on the horizon, interrow hoes and hooded sprayers this hopefully will not be an issue. I am also hearing people screaming "what about BYDV or Wheat heading in December?" My answer is a large healthy plant will not be attacked by aphids and variety choice is key. A lot of modern varieties have spring genetics within their genome. A variety with winter only genetics would have to be chosen.

Will it work? I do not know but it cannot be any worse than the direction wheat growing is going. I think we need to try. How good a wheat crop looks around here is directly correlated to how early it was drilled, the earlier the better. Marc Bonfils was planting his wheat into his standing wheat crop in June as wheat tillers best at 20-25 degrees Celsius. The table below shows the differences between the Bonfils Method and Conventional







## Conventional Bonfils

### Plants per M2

350  
1.5-4

### Grains per ear

20-30  
40-60

### Ears per plant

0-3  
100-150

### Weight of grains

Low  
High

### Earlets per plant

12-15  
35

The spring crops overall established well. They are looking good considering the conditions, but they are rushing through the growth stages. We have 5 different intercropping trials in our spring crops. (pictures attached).

The bean intercrop trials are with PGRO. We are testing undersowing clover in beans, different row configurations to see if there any differences in disease and a copy of the bean/oat seed rate ratio trial we did last year.

With the Diversify project we are trialing different rates of oats mixed with either peas or lentils and see how low we can go and still get a good enough scaffolding to reduce lodging. All these trials should hopefully give us some valuable information for next years growing season which will hopefully be better than 2020!

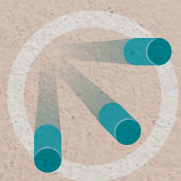
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# WATER FOCUS

## AFFINITY WATER



**New technologies for understanding the benefits of regenerative agriculture and cover crops**

*Sophia Burke, AmbioTEK CIC, Mark Mulligan, King's College London and Shaun Dowman, Affinity Water*

Affinity Water is a drinking water supply company in the south-east of England. Supplying water in an area designated as being under 'serious water stress', it is critical that the company manages its water resources sustainably now and into the future. When it rains, land management can have a big influence on the quality and quantity of water that reaches groundwater aquifers. Given that much of the land perched above the aquifers is agricultural, there is a great opportunity for water companies, like Affinity Water to work with farmers to better understand and enhance the benefits that good soil management can have for the water environment. Good soil health delivered through regenerative farming, no-till or conservation agriculture can offer many benefits such as increased water retention, improved infiltration, reduced run-off and less pollution.



*FreeStation measuring rainfall, soil moisture and soil temperature. Low cost, mass produced components are used throughout and can all be sourced via [ebay.co.uk](http://ebay.co.uk). The parts for this model (that sends data over mobile networks) total to £130.*

Measuring the impact of soil management practices on the water environment can be difficult, especially when attributing effects upon, and rewarding, the actions of individual farms across a large catchment, but through field trials, Affinity Water have been developing their knowledge and understanding in this area.

Affinity Water are utilising new technologies developed at King's College London and installed and maintained by AmbioTEK CIC. In a number of small-scale field trials they aim to understand how regenerative agriculture and different cover crops can help reduce runoff and nutrient loss as well as the influence they have on infiltration and potential aquifer recharge.

The study uses FreeStations, which are low-cost DIY IoT (Internet of Things) - linked environmental loggers. They measure environmental data every 10 mins and send hourly averaged data to a website where anyone can view the data in near real time, along with the local 5 day weather forecast. FreeStations have many options for environmental sensing, including soil moisture, soil temperature and weather (rainfall, solar radiation, wind speed and direction, temperature and humidity). All designs and parts lists are available for all at [www.freestation.org](http://www.freestation.org) so you can easily make your own environmental logger. The outputs work with online analytical tools that we call //Smart: that allow users to calculate many derived properties of what is measured (including flood and drought mitigation) in real time.

FreeStations have been built and deployed all over the world, for example Colombia, Peru, Burkina Faso, Ghana, India and Bhutan.



*Soil pit with two soil moisture probes in place to better understand water infiltration into, and movement through, soil.*

The measured soil moisture and rainfall for one of the sites is shown below (Figure 1). There is a clear soil moisture response to the measured rainfall, followed by a relatively rapid decline with drainage and crop water use. Measuring these parameters in real time on different cover crop mixes and comparing it to a plot left bare builds an understanding of the effect of cover crops on infiltration. Interestingly, the results from this year's trials highlighted that very little water was 'lost' through evapotranspiration in the cover crop plots over the autumn/winter months. It is sometimes assumed that cover crops may 'compete' with the interests of a water company and will use water that may otherwise be directed down into the aquifer, but this study suggests that this is not the case. The



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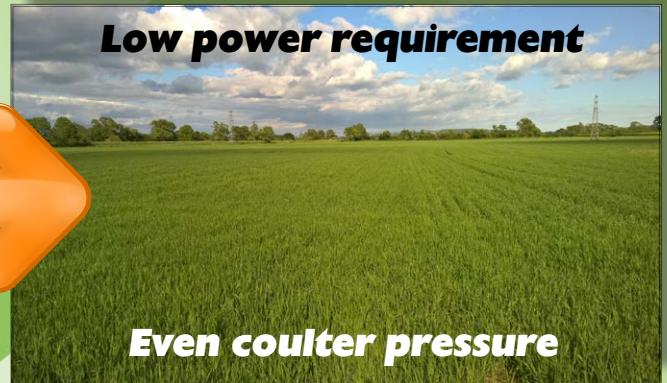
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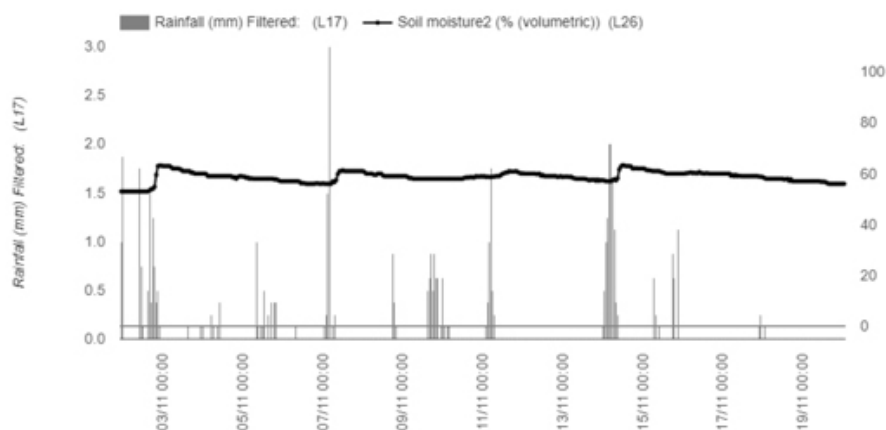


Figure 1. Hourly logged rainfall (mm/hour) and soil moisture % under Oil Radish, Royston, Nov 2019.

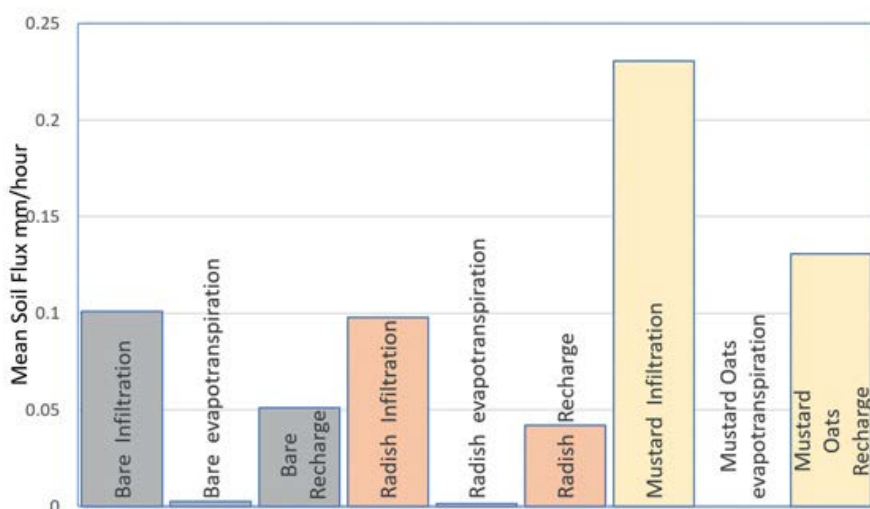


Figure 2. Summary of the water flux rates of 3 different plots, Folkstone, Oct-Feb 2019/20.

results also highlight that a mustard/oat cover crop may allow greater water infiltration when compared to a straight radish mix (Figure 2). Further work is needed to confirm this.

### How can new IoT-linked monitoring technology be used by farmers in the future?

Landscapes of the future will be intensively monitored in real time by farmers, companies, environmental authorities and governments with the aim of improved management and early warning to the benefit of all. Internet-connected technology is already transforming our knowledge of soil, water, climate, food production and the production of public goods (ecosystem services), which are nature's contributions to people provided by farmland. Regulators and



FreeStation weather station

legislators are looking to incentivise management for improved provision of public goods, such as clean water and carbon. However, there are still challenges in understanding which public goods land provides to whom, how this varies spatially and over time and how management practices (such as tillage, choice of cover crops) impacts upon them. We can understand a lot by combining satellite data with computer models but these need to be combined with networked on-the-ground sensors such as FreeStations, collecting site-specific detailed data.

Land provides both private goods for the market through the produce grown but also public goods in the ecosystem services provided. For example, changing land management will affect how much of the rainfall can infiltrate for use by the crop, and how much is ponded on the surface, which generates runoff, nutrient loss and soil erosion, and can also contribute to flooding downstream and to dry season flows. Since these services have real benefits to local, downstream and even global populations, public funds can be put to sustaining their provision whilst private funds underpin the markets for farm produce. If internet connected sensors, coupled with satellite remote sensing can quantify how land management on a farm mitigates flooding or drought downstream, or provides clean water, carbon or any other valuable ecosystem service this can contribute to more targeted payments for environmental land management

### What do farmers want to monitor / measure on their land?

At present FreeStations measure soil moisture (with multiple probes at different depths), soil temperature, water quality and weather (rainfall, temperature, solar radiation, wind). Are there other variables you consider critical? If you are interested in installing or even building a DIY FreeStation, please check out [www.freestation.org](http://www.freestation.org) or contact us at [sophia.burke@ambiotek.com](mailto:sophia.burke@ambiotek.com).



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THE FUTURE OF EFFICIENT CROP ESTABLISHMENT

# INVESTMENT IN MANUFACTURING AND KNOWLEDGE IS HELPING MAKE AMMONIUM NITRATE FERTILISERS FIT FOR A CARBON-FOCUSED FUTURE

*The carbon footprint of all agricultural practices is under the spotlight as never before, and with Nitrogen fertiliser one of the mainstays of production, it is not surprising much debate continues around the use of manufactured N.*

Navigating through the often conflicting demands of population growth, food production needs and environmental requirements is far from easy, says Dr. George Fisher of CF Fertilisers.



Dr. George Fisher of CF Fertilisers.

"It's a balance between using Nitrogen as efficiently as possible on-farm to produce the food we need, whilst making sure this is done in such a way to limit harm to the environment with products that are manufactured as cleanly as possible.

"Over the next 50 years global population will increase by 30% to 9 Billion people, food production will need to double to feed an increasingly hungry world and the demands placed on farmers and growers will be unprecedented.

"Yet, all this is happening against a backdrop of growing awareness of the need for us all to limit our impact on the environment, cut back significantly on greenhouse gas emissions and manage the world's finite resources more carefully.

"And with climate change reducing the area of land in temperate areas where current food crops can grow, the need to achieve the highest food production

efficiency from every hectare possible will be greater than ever.

## **Fertilisers can double crop yields**

It's an unavoidable fact that over the last 60 years, Nitrogen application has driven the food production revolution,

Dr Fisher says that, without fertilisers, the world would only be able to feed about half of its people. Modern fertilisers can double crop yields.

## **Research data from trials**

In practice, fertiliser is a crucial element to achieving profitable crop yields. CF trials consistently show optimum N applications producing over 5.0t/ha more wheat compared to zero N application plots.

"For example, in milling wheat trials carried out by arable research contractors Armstrong Ltd, applying zero N to trial plots produced 4.2 t/ha whereas applying the optimum N rate of 254kg N/ha produced 10.4t/ha.

"Whilst optimum N rates are key, the type of fertiliser used can also have a profound effect on how it is utilised by plants.

"It's important to ensure that as much as possible of every kg of Nitrogen fertiliser applied ends up in plants to produce food and is not lost from the system in terms of leaching or loss to the air."

## **Nitrogen fertiliser use efficiency (NfUE) critical metric**

The Clean Air Strategy 2019 has focused peoples' minds on Nitrogen fertiliser use efficiency (NfUE) with a suggested move away from urea to Ammonium Nitrate (AN) or inhibited urea products to reduce ammonia

emissions, he explains.

"NfUE gives growers a clearer picture of the impact their fertiliser choices are having on their production efficiency and can highlight where potential environmental concerns might result.

"In simple terms, it allows us to review the amount of Nitrogen applied to crops and calculate how much is actually recovered by the crop.

"Efficiency values for crops typically range between 50% to 80% but it is clear that better quality, AN based solid fertilisers are at the top end of this scale whereas urea-based products, including liquids and blends, tend to be at the lower end."

In independent trials, Nitram (34.5% N) outperformed straight urea in terms of NfUE across all trials conducted in two very different production years and at all yield levels, Dr. Fisher points out.

"Looking at the data from six trials shows an average NfUE for the AN of 74% compared to 66% for urea.

"This difference of 8% NfUE is the equivalent of an additional 16% total loss of Nitrogen from urea and in crops. With an application rate of 200kg/ha N this would be equivalent to a loss of 32kg/ha N.

"In other words, using Nitram resulted in crops recovering an extra 16% or 32kg/ha N than they would have done with the same application rate of urea."





Even in 2018 when poor weather meant all treatments on all trials had a relatively poor recovery of Nitrogen, Nitram still outperformed urea, he says.

"NfUE analysis dispels the continued sentiment that whilst urea volatilises N to the air, AN leaches to groundwater so the overall environmental impact from both products is similar.

"It's just not the case. The N losses through volatilisation from urea are far greater than any perceived losses with AN through loss via the soil. Urea has the potential to leach nitrate-N via soil processes in addition to losing N as ammonia.

"Even with inhibited urea-based products designed to reduce loss of Ammonia to the air, volatilisation is still an issue."

### **Trials underline AN benefits**

High quality Ammonium Nitrate (Nitram - 34.5%N) achieved an average Nitrogen Fertiliser Use Efficiency (NfUE) of 70% compared to 60% for UAN and just 63% for UAN treated with the latest polymer-based inhibitor products, in ADAS trials carried out in 2019.



*Dr. Mike Armstrong*

In practical terms, the better NfUE from Nitram AN produced an extra 0.4t/ha of milling wheat over crops using a urea fertiliser as their only source of Nitrogen in trials carried out by Armstrong Ltd.

At all fertiliser rates, Ammonium Nitrate (AN) outperformed, explains Dr. Mike Armstrong.

"There was a significant yield advantage in favour of AN across all plots in the trial. Even where urea was used as an early application and then followed by AN, there was a 0.25t/ha drop in yield compared with crops given all their Nitrogen as AN.

"We wanted to look at all possible scenarios of urea use versus AN so as well as a direct comparison of the two, we also wanted to test the idea that urea can be a safe, lower-cost early application.

"An application of 50kg N/ha of urea was applied in these instances with remainder of the fertiliser application being made up of 34.5% Nitram AN."

A range of application rates up to 360kg N/ha were used with the optimum rate found to be 254kg N/ha.

"At this rate, the AN crops were producing 10.3t/ha whilst the urea ones were at 9.9 t/ha."

### **Major steps in manufacturing efficiency**

While focusing on choosing the right product to maximise NfUE and reduce loss on N to the atmosphere another key component is the carbon footprint of manufacture, CF Fertiliser's' director of public affairs Debbie Baker points out. "For our part, we've made major steps in reducing the greenhouse gas emissions associated with our fertiliser production, worked hard to produce accurate carbon footprints for all our products and made significant steps forward with recycling throughout all our processes.



*CF Fertiliser's' director of public affairs Debbie Baker*

"CF Fertilisers has over 50 years experience in production and supply of the highest integrity fertiliser products.

We manufacture Ammonium Nitrate (Nitrogen) Fertilisers at our sites at Ince in Cheshire and Billingham in Teesside. At Ince, we also combine Nitrogen with the other plant nutrients Phosphorus, Potassium and Sulphur to create true granular compounds that meet the wide variety of soil type and crop

requirements found in the UK."

### **Sustainable Nitrogen Production**

Of the four million tonnes of Nitrogen-based fertiliser products used in British Agriculture every year, with CF manufacturing and supplying up to 35% of this.

"You can't get away from the fact that fertiliser production is an energy intensive process," Debbie Baker explains.

"But over recent years CF Fertilisers has invested heavily in ensuring that our manufacturing is as efficient as possible and has the least impact on the environment. It's an area we are committed to investing in for the long-term too.

One such investment has been to install state-of-the-art nitrous oxide (N<sub>2</sub>O) abatement technology on the nitric acid plants at Billingham.

"N<sub>2</sub>O is an unavoidable by-product of nitric acid manufacture and is a significant greenhouse gas. The nitric acid is a key base for Ammonium Nitrate production. Over the last few years, we've invested £9M in our manufacturing facilities to reduce our production of N<sub>2</sub>O emissions by 3000 tonnes every year.

"As a greenhouse gas, N<sub>2</sub>O is 300 times more powerful than CO<sub>2</sub> in terms of it's effect on the environment, so that's equal to 900,000 tonnes of CO<sub>2</sub> .

"This is equivalent to the whole of the 30% CO<sub>2</sub> reduction required by UK agriculture by 2022, so it's a sizeable amount and indicative of the effort and resources we have put in to make sure our own production is as sustainable and environmentally acceptable as possible.

"All told we've reduced the carbon footprint of Nitram production by 40% since 2010.

### **Working with the Carbon Trust**

To make the major improvements in manufacturing and emissions reduction as practically useful as possible to customers, CF has produced business-to-business (or cradle to farmgate) fully audited and certified carbon footprints for its entire range of fertilisers as well as the ammonia and nitric acid used

in the manufacture of its Ammonium Nitrate.

To ensure these carry maximum credibility and are readily recognised by everybody as 100% independently verifiable, the company took the decision to work with the Carbon Trust to achieve this, Debbie explains.



"Not only does this mean they have undergone rigorous independent scrutiny, they have also been calculated using the standards set out in the robust and internationally recognised PAS 2050 protocol.

"The resulting footprint represents the true carbon emissions for fertiliser production from the raw materials right up to delivery to the farm gate."

CF Fertilisers product carbon footprints were first certified by the Carbon Trust in April 2013 and are reassessed every two years. The footprints for process chemicals are expressed as kg CO<sub>2</sub> e per kg of product, whereas fertiliser products are given as kg CO<sub>2</sub>e per kg Nitrogen (N).

"Fertiliser usage in on-farm Nutrient Management Plans is considered on the basis of N requirement, so this approach allows the simplest comparison between our products for a given crop requirement.

"The process doesn't end there, though. In using the carbon reduction label, CF Fertilisers has promised to reduce the footprint for process chemicals and Nitram, demonstrating an ongoing commitment to carbon reduction."

### On farm benefits of carbon-focused thinking

The investment in manufacturing, research and knowledge sharing is starting to have real benefits for farmers moving forward, says Dr. Fisher.

"Emerging legislation, such as that coming out of the Clean Air Strategy,

will make using urea increasingly difficult in the future and with its use being very dependent on the weather, it also puts a much greater element of risk into your business.

"Every producer, whether livestock or arable, should now carry out and follow a Nutrient Management Plan and Carbon audits will become increasingly important in the future.

"Some milk buyers are already asking their suppliers to provide this information and one of the biggest elements of this is your fertiliser use.

"It's something we have been aware of for some years now and whilst the international standard figure is 6.6kg of Carbon for every 1.0kg of N you use, with CF Ammonium Nitrate (Nitram) it is almost half this at 3.4kg for every 1.0kg of N used.

"This is a result of the investment we have made in de-carbonising the manufacturing process."

### Little and often applications improve fertiliser use efficiency

Little and often applications of Nitrogen can boost milling wheat yields by nearly 0.4t/ha without causing dilution of grain protein content, new research from ADAS is suggesting.

**While yield from 260kg N/ha applied as four applications at one site produced a yield of 11.73t/ha, this rose to 12.11t/ha with the same grain protein content when the same amount of fertiliser was applied as seven applications, explains ADAS crop physiologist Dr. Kate Storer.**

The trials were carried out in Terrington, Norfolk, and Wharram-le-Street, Yorkshire. The Norfolk site was on a silty clay loam with the variety Skyfall after oilseed rape whilst the Yorkshire site was on a silty clay loam over chalk, using the variety Elicit after beans.



N-Min soil testing was carried out to ascertain soil N resources with a total Soil Nitrogen Supply (SNS) of 92kg N/ha recorded at Terrington. N-Calc was then used to produce an estimate of 260kg N/ha applied N would be needed to achieve yield and quality targets.

Fertiliser was applied as high quality Ammonium Nitrate (Nitram 34.5%) with the standard plots receiving an initial application of 50kg N/ha on 22 February followed by further applications of 80kg N/ha at GS 31, 80kg N/ha at GS 32 and a final one of 50kg N/ha at GS 37/39.

The L&O plots received an initial application of 25kg N/ha on 22 February followed by a further application of 25kg N/ha in early March and then four applications of 40kg N/ha at GS 30, 31, 32, 33 and a final one of 50kg N/ha at GS 37/39.

The second trial at Wharram-le-Street in Yorkshire used a similar approach with a lower total N application of 230 kg/ha over six splits, she explains.

"The L&O timings were designed so that they fed the crop as it grew and avoided excess N in the soil early in the season.

"At Wharram-le-Street the dry conditions after some of the later L&O applications may have delayed N uptake in those plots, with lower Normalised Difference Vegetation Index (NDVI) values seen in the L&O treatments, but there was no negative effect on yield."

That said, at harvest, analysis showed there was a trend for higher NfUE in the L&O plots at both sites. It is likely most of the additional N uptake in the L&O crops took place as they were actively growing in spring and early summer, Kate Storer believes.

"There was an increase in N straw concentration in the L&O plots suggesting the greater N uptake efficiency resulted from more N being taken up by plants during stem extension and ear formation.

"As well as improved production opportunities, it is possible the greater N uptake from the L&O approach may also reduce the risk of nitrate leaching during the following winter, so there are potential environmental benefits too."





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# INNOVATIVE FARMERS LIVING MULCH FIELD LAB

By Jerry Alford. Innovative Farmers and Dominic Amos, Organic Research Centre

This Innovative Farmers project brings together organic and conventional no-till farmers to investigate the potential for implementing a long-term system with the aim of maintaining a perennial living mulch of white clover whilst growing an annual combinable cash crop. The benefits are widespread, from reduced inputs for conventional farmers to a reduction in cultivations for the organic farmers in the group. This is where the trial is most fascinating because it is a coming together of two farming systems who want to get the best out of their systems, whilst using the best of other people's systems.

**Organic farming is well known for having a set of principles based around a systems approach with minimal external inputs and conservation ag also has a set of principles it adheres to, being diversity, cover crops and minimal soil disturbance. The trial combines these principles and with sponsorship by Organic Arable, research input from The Organic Research Centre, technical advice from Cotswold Seeds and coordination from AHDB it is a trial that has a broad base of interest.**

The basis of the trial is a permanent clover understorey which provides mulching, fertility and soil protection into which annual combinable crops are planted. There are two very important services the mulch will provide; weed suppression and nitrogen accumulation. In addition, the system should enhance soil physical characteristics, self-regulation of pests and diseases and increased biodiversity, both above and below ground. The living mulch system makes use of practices already common with cover cropping and elements of intercropping including undersowing and relay cropping. There are 6 farmers involved, farming from Shropshire to Suffolk, organic and conventional and each have different soils, systems and equipment. The one similarity is they are all using the same clover mix of 70% wild white and 30% medium leaf white clover as the understorey mix supplied by Cotswold seeds.

The Innovative Farmers programme takes farm trials already being carried out by farmers and introduce more structured experimentation to merge science and practice. It also brings groups of farmers together to create more of a "collective experiment" To that end the farmers will all grow the same mulch and should all include a control plot that represents current standard farm practice. This will provide a relevant comparison for agronomy, production and economics allowing new conclusions to be drawn about the effects of the new living mulch system. Without controls, effects on crop yield or weed control cannot be established. Data will be collected from living mulch and control plots at key times over the next two growing seasons and will constitute measurements of cash crop, cover crop and weed biomass, and soil mineral nitrogen as well as yield and grain quality supplied by the farmers. Establishment of the clover has been difficult and variable this spring with the very dry April and May. The clover will be monitored and following harvest this year may require a "top-up".

As this group of farmers has developed, the amount of experimentation that has already been carried out has become apparent with one of the organic farmers growing cereals with a trefoil understorey for some years. For him, the slightly lower yield that has been achieved has been balanced economically by the ability to grow more combinable crops in his rotation without so many fertility-building breaks and a slight increase in the protein content of the triticale. Another farmer has tried wheat sown into a mulch of either red or white clover with rye grass which ended up offering too much competition with the cereal and the trial was eventually taken as a wholecrop for silage. For other organic farmers, undersowing has been a feature for many years and in long term organic systems, white clover is a common 'weed' and so it makes sense to utilise it rather than fight it. Direct drilling into a grazed off ley has been a common

organic farmers experiment, but often with mixed outcomes.

**For the conventional farmers, reduction in chemical inputs, particularly nitrogen, are an important consideration with the drive for zero carbon farming putting fertiliser inputs in the firing line. Profitability rather than production at all costs being an important factor in their business planning. This means conventional no-till will have both economic and environmental drivers to reduce inputs.**

For others, attempting to get something out of a disaster has led to an opportunistic undersowing experiment. Field lab member Marcus Struthers from Courteenhall Estate, Northampton, explains -We had a failed WOSR field (7ha) last year which we drilled with white clover and took it through till the autumn with fantastic establishment. This we drilled directly into it around December time, which was later than we wanted but the weather held us back, surprisingly though this field has been looking the best on the farm all season, with minimal inputs and only the 2 chemical passes to date. Due to the results we have seen this year, with a relatively small area we have increased it this spring under sowing 35 ha of Spring Barley with white clover and another 11.5ha with a clover and black oat mix.

**For us it is an exciting time, being able to cut chemical applications, introduce rousing where necessary, weed suppression, increase soil health etc.**

The different farmers in the group are also seeing different potential problems, and the benefits of an interactive approach using webinars (due to Covid-19) and WhatsApp has allowed discussion.

The wet autumn and winter of 2019/20 have delayed this trial from its original start date and so we are just at a start-up stage, with the dry spring affecting mulch planting. Again, different experiences come to play with a more relaxed view from organic farmers who



are used to undersowing but are also used to not doing anything to growing crops when they are drilled. Different techniques are also apparent here with some mulches direct drilled into existing crops, and others drilling with spring crops following rain. In one case the clover is being grown under a buckwheat crop, which is itself an experiment. Following crops will mainly be wheat or oats, although any combinable crop including maize, can in theory, be used. However, the most vigorous and competitive winter crops such as rye or oats may make most sense particularly in the early stages of the new system as this will maximise the competitive ability of the crop against both mulch and weeds. Research indicates that it may take a few seasons for the new system to bed in and in terms of nitrogen cycling and crop availability, this looks to be higher in the second season.



The difficulty will be reducing competition on the germinating crop at the critical seedling period. Research shows that the dominant biomass when growth starts in the spring tends to be the winner, and so a relay cropping type approach is envisaged with the autumn crop being drilled as the mulch slows its growth due to reducing temperatures and day length. The key here is that a winter cereal will continue to grow through this period, tillering and developing its root system whilst the clover remains dormant. This may explain why the organic farmers who grazed their direct drilled crops off in the winter had mixed results. The concept

of critical weed free period (i.e how long weed competition needs to be absent in order not to reduce grain yield) has been well established for decades. The key to achieving a functional living mulch system with a tolerable yield reduction will involve maximising the competitive ability of the cash crop while selectively weakening the cover crop at key stages. With the mulch mix already selected for its complementarity as an intercrop, the organic farms have only cash crop species selection, drilling date and drilling method to influence the cash and cover crop dynamic. Of course with herbicides and nitrogen fertiliser, conventional no-till farmers have two additional tools at their disposal to help hand the competitive advantage to the cash crop, boost yield and control weeds if the mulch doesn't offer enough of the service provision the farmers are looking for, namely weed control and N-accumulation.

For the experienced no-tillers, weed control is not seen as an issue because experience says that minimal disturbance leads to less weeds germinating whereas the organic farmers see a strip till type system being advantageous, possibly keeping mulched and cropped strips in the fields to minimise competition to the future crops. Certainly, research has shown that the longer the mulch can be kept from the base of the cash crop, the lower the yield reduction will be. Providing a channel for the growth and development of the crop at least during the foundation and early construction phases is likely to be important with the clover a stolon former it will close in any gaps and provide full groundcover by harvest. One of the benefits of an established perennial mulch may be improved trafficability and one of the farmers involved is considering a spring wheat like Mulika drilled in January that will give enhanced early vigour and establishment to grow away from the mulch before it gets going in the spring.



**Control of the mulch growth is a key component of the trial and there are 2 stages which are important, prior to or just after drilling and during the spring when the crop will need to gain both water, and nutrients, in direct competition with the clover. One area being looked at is the possibility of mowing between rows (cf. inter row hoeing) to mulch the clover but there are crimpers and rollers being used elsewhere which achieve the same objective. It is important to release some of the nitrogen produced by the clover at times when the crop needs it, because clovers do not release the nitrogen without a reason and will stop producing nitrogen if there is too much available. For conventional farmers there are chemical, including fertiliser, options to manage the clover mulch but these are not possible for the organic farmers.**

Autumn grazing with sheep is seen as the preferred option for those farmers with livestock but mulching the crop, crimping or rolling on a frost are alternatives that will suit stockless systems. The advantage of the living mulch approach is that there is no soil disturbance to stimulate weeds and the living plant will continue to suppress further germination. There are obviously potential problems, and areas where we need more knowledge-what about grass weeds and in particular blackgrass? What about perennial weeds? And what effect will the mulch have on crop yields and will the economics only work with organic prices. These can only be resolved by research and this is where the Innovative Farmers field labs are so effective, small scale projects which test hypotheses and look on tramline or plot scale with researcher input in trial design, data collection and interpretation.



 **ORGANIC**  
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# FARMER FOCUS

## TOM SEWELL



Well first things first! I just re-read my last article and how things have changed in just a few months! In many ways the whole world has changed. Since writing my last article on the 25th February the whole country has entered lockdown, the rain has stopped falling from the sky (although its been wet here today on 10th June!) and the memory of Caroline Flack calling the world to “be kind” is a long distant memory in the year like no other.

I’m not sure we have ever had two completely contrasting periods of weather back to back as we have done this past 8 months. From wet and flooded to baked-out, rock hard fields this season has been difficult and challenging.

Once the weather did start to dry the fields we made a start with spring planting beginning with some winter beans that we sowed in the spring to finish a block where the weather stopped us last November. We have treated these as a cover crop that we may harvest. Having something growing is certainly better than bare stubbles and although only short, the recent rains may help them see the combine rather than the drill next into the field!

We moved onto a block of spring barley next that we planted into a cover crop that had been grazed by sheep over the winter. In hindsight we were probably a few days too early as the soil was still a little tacky and we can see far better establishment and crop development where the tractor tyres mineralised some nitrogen and the crop got away quicker. Perhaps a year for a low disturbance tine drill over a very low disturbance disc?!

We also drilled spring oats, spring wheat, spring barley and spring beans for contracting clients which has generally worked well.



The Novag drill that we have here for demonstration and evaluation arrived a week after we finished drilling so has just been hitched up to the tractor and parked in the shed since. I did get it out alongside the cross-slot today to compare the two machines. Having not used the Novag yet I obviously can’t comment on its performance but I can make some observations about build quality, spec and initial thoughts.

You can see from some of the photos here that there are many similarities and a few subtle differences between the two machines. The cross slot was built on the farm 7 years ago, with the help of Paul and James Alexander at Primewest, and has been faultless since then with wearing metal being the only thing we’ve had to change in that time. It’s a 21 opener machine running at 225mm/9” rows giving an operating width of 4.8m. We generally operate at around 10kph and its pulled with a 300hp JD8520. One of the real benefits of the Cross Slot is that it folds to 2.5m for transport so it’s the same width as a grain trailer! When folded it has all of the openers on the vertical, so maintenance is both safe and very easy, particularly when changing discs and







blades. Our drill has a seed only hopper that holds 2 ton of wheat seed. The build quality is superb, very heavy duty, well made and will last for many years.

*Initial impressions of the Novag are that it is a superbly finished and presented drill. The machine we have been sent is a 25 opener drill on 250mm/10" rows with both seed and solid fertiliser tanks which will drill at 6.25m. There are also 2 other hoppers. One for slug pellets that are spread behind the drill from 4 outlets and another hopper for small seeds which can be metered into the Venturi and planted with seeds in the large seed tank.*

At 3m wide the drill is wider and more imposing. Some of the openers remain in the horizontal position when the drill is folded but the hydraulic wing hooks that automatically secure the wing sections as the drill is folded are a thing of beauty! There is also a function on the drill which enables some of the openers to be lifted to reduce the operating width. This could be useful for steep fields and where tractor horsepower and traction is limited and is a very good feature in what looks like a superb machine. It will be very interesting to see it perform in the field after this harvest. The machine will be available for demonstrations around the country, organised by Clive Bailie, so please contact him if you're interested in seeing it at work.

Speaking of drills we have also added a low disturbance tine drill to our fleet! A 4m Horsch sprinter on Dutch openers will give us another option and some back-up with more land and more contracting coming up. As we all know timeliness and good planting conditions are essential with no-till and I'm not sure any of us have too much capacity?

With the farm looking the most variable I've ever seen

it the coming harvest will be one to forget I think. We do have some lovely looking Extase as a first wheat and a few November sown winter beans but oilseed rape has been an expensive disaster this year and a crop that we won't be growing next year. Coming up with a balanced rotation going forward will be a challenge and I'm sure I'm not alone in that?!

Can I wish you all a very safe harvest both for you, your families and your staff.

I wonder how things will have changed the next time I write?!



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# DRILL MANUFACTURERS IN FOCUS...



## DRY SPRING HIGHLIGHTS CLEVER DRILL DESIGN

**The Mzuri system is widely recognised as Europe's principal one pass strip tillage system, unrivalled in cultivation, reconsolidation and seed placement accuracy. Ben Knight demonstrates why.**



Ben Knight

As Mzuri's farm manager and knowledge exchange officer, I get to see a lot of Mzuri drilled crops around the country as well as those established by conventional and min-till methods. One thing that has struck me this Spring is how well Mzuri Pro-Til established crops have coped with the relentless dry weather.

On the Mzuri trial farm, the jovially named 'Peopleton Umbrella' struck again and saw us with no measurable rain since the Cheltenham festival. Thankfully, the Pro-Til's ability to cultivate, reconsolidate and seed into the perfect nursery seedbed, surrounded by structured soil, gave us the edge when it came to preserving moisture and supporting crop growth sans rainfall. Despite this, both our Winter and Spring crops look well and benefited from rooting into moisture, preserved by previous crop residue and have gone on to produce, healthy viable crops. However, you don't



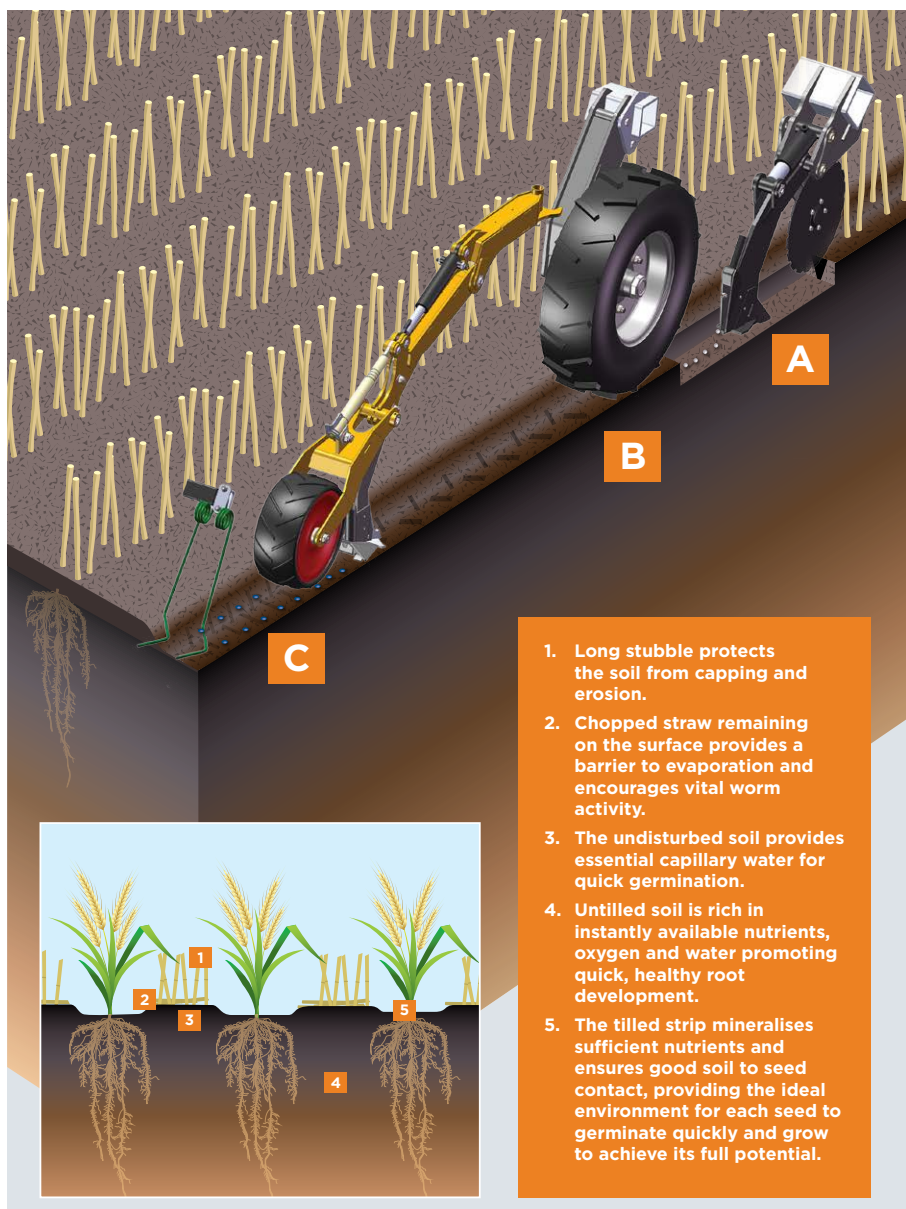
*At the time of writing during the second week of June, our Spring Barley had received no rainfall since it was drilled on 2nd April but established evenly and went on to grow into a healthy crop from headland to headland.*

have to go far to find crops that weren't so lucky. I've seen both conventional and min-till crops in surrounding areas struggle with the drought from a combination of either moisture loss at drilling, or a lack of sufficient seed to soil contact and poor reconsolidation.

This is why I can see the value in the Pro-Til's cleverly designed features that allow us to prepare and seed into the perfect nursery seedbed, without compromising

establishment or soil health. It is the collection of unique features that are laid out below and overleaf that makes the Mzuri Pro-Til an incredible tool for consistent crop establishment across a range of seasons.

I'm pleased to see so many Mzuri users reaping the rewards of the Pro-Til's clever design and what is proving to be a reliable crop establishment system time and time again.





### Benefits of the Mzuri Pro-Til

- Targeted tilth promotes even germination across the whole field, particularly noticeable on the headlands.
- Excellent seed to soil contact and dual reconsolidation removes air pockets and ensures quick, healthy root development - eliminating hairpinning and other common direct establishment problems.
- The uniform growth of the crop makes timely herbicide application easily achievable.

- Soil compaction and erosion is reduced by eliminating conventional cultivations – the same tramlines can be used year after year.
- Staggered tines and high trash clearance allow for drilling into high biomass cover crops, meaning crop residue can be left in the field, on the surface, providing organic matter and resources for micro-organism activity.
- Tillaging only a targeted area will make dramatic savings in

cultivation costs with huge reduction in fuel and labour costs.

- The Mzuri non-inversion tillage system will increase the soil's organic matter and worm population; this will in turn further improve the soil structure and fertility.
- The physical condition of the soil will quickly improve to a more friable structure with a better balance of air, minerals, humus and water.

### It's all in the design

#### Zone A – Cultivation

The serrated disc cuts through the surface straw allowing the residue to flow freely to either side of the tilled strip. The auto-reset tine, coupled with replacement point and wing, cultivate the seeding zone to ensure a clean strip of moist, friable soil, free from surface residue. Band placement of fertiliser below the seed reduces the fertiliser requirement and ensures early

nutrient accessibility, providing essential support for quick, strong and healthy establishment.

#### Zone B – Reconsolidation

A key feature with the Mzuri's unique design is the fact that all of the machine's weight is evenly spread across all of the cultivated strips, fundamental in reconsolidating the tilled strip to remove air pockets, widely recognised as very necessary to ensure quick, healthy root development.

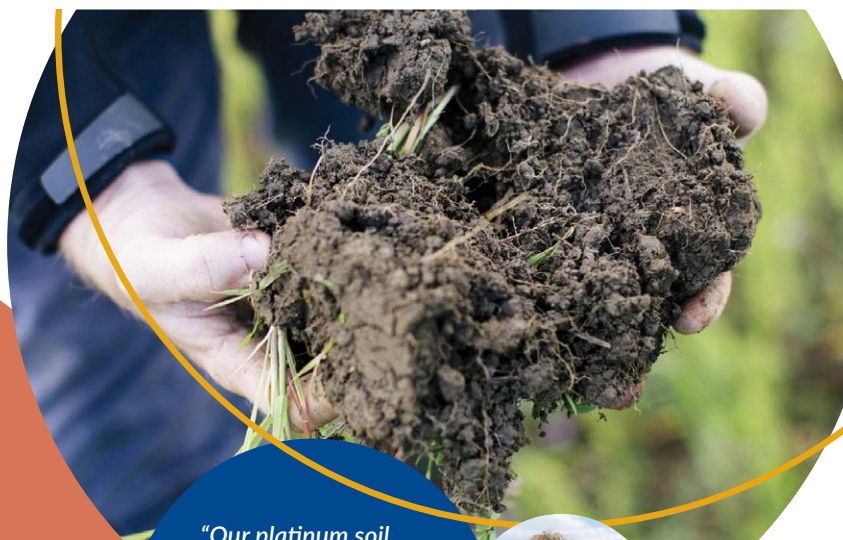
#### Zone C – Seeding

The coulter tool bar works totally independently to the cultivation zone, ensuring easy adjustment and constant seed depth control. Each coulter hydraulically exerts pressure to each of the seed depth wheels to ensure accurate seed placement and excellent seed to soil contact for quick and even germination. Each coulter arm features a patented pivot to provide optimum seed placement within the tilled zone.



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FUTURE PROOF FARMING



# WEED SUPPRESSION WITH COVER CROPS: IT'S ALL ABOUT BIOMASS

Written by Dr. Bob Hartzler and Meaghan Anderson of Iowa State University

One important benefit of cover crops to our production system is providing an alternative selection pressure on weed populations. Cereal rye has the best potential to suppress weeds because it accumulates more biomass than other cover crop species. Weed suppression is closely related to the amount of biomass at the time of termination (Figure 1).

in both waterhemp emergence and growth (Figures 2-4). The low rye biomass treatment reduced waterhemp growth more than it did emergence, whereas the high biomass treatment dramatically reduced both emergence and growth. Waterhemp emergence was delayed more than two weeks in the high rye treatment compared to

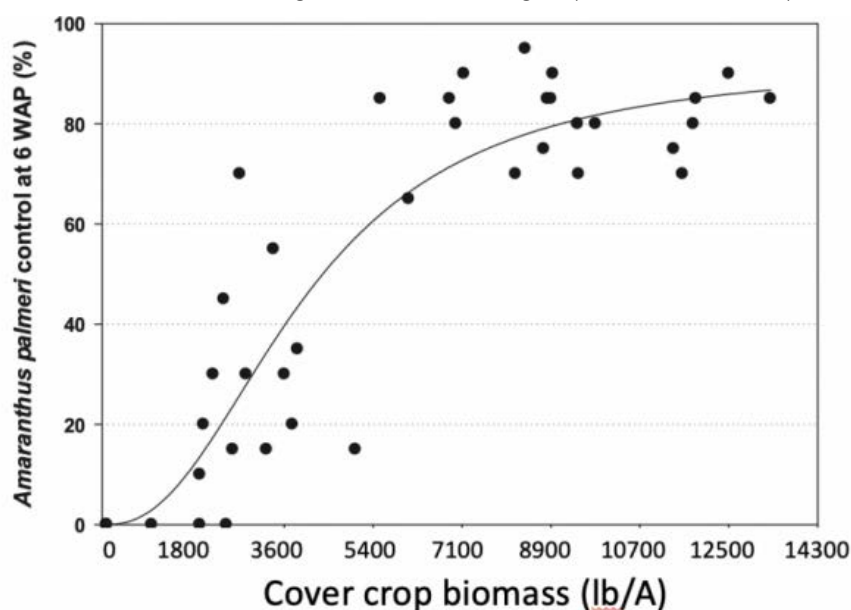


Figure 1. Influence on cover crop biomass on weed suppression. Webster et al. 2013. Crop Protection.

The importance of biomass on weed suppression can be easily observed in a demonstration evaluating suppression of waterhemp by cereal rye developed for the 2020 Farm Progress Show. Treatments represented no cover crop, an early termination when rye was 6-8 inches tall (900 lb/A), and late termination when rye was flowering (10,000 lb/A1). Three weeks after planting there were dramatic differences



Figure 2. No rye cover crop



Figure 3. 900 lb/A rye biomass



Figure 5. Waterhemp seedling that emerged in high biomass treatment.



Figure 5. 10,000 lb/A rye biomass.

the 0 and 900 lb rye treatments. In the high residue treatment, \c seedlings had to navigate through an inch of mulch to reach full sunlight (Figure 5).

Hypotocotyl needed to elongate 1.25 inches to get through the rye mulch.

Many factors influence the biomass produced by cereal rye, most important are planting date and termination date. Rye's tillering ability reduces the importance of seeding rate except in situations with late planting. A minimum seeding rate of 1-1.5 bu/ac is typically recommended. Increased seeding rates will provide more consistent stands when rye is seeding using an airplane or other broadcast methods, as well as when seeding occurs in October or later.

For most farms, cover crops provide an opportunity to achieve more consistent weed control and lower selection pressure for herbicide resistance, rather than allowing significant reductions in herbicide use. Farmers desiring to reduce herbicide use must manage the cover crop to maximize weed suppression. Target early seeding dates, typically before late September. Seeding with a drill typically results in the most consistent stand across crop fields. Termination timing should be delayed past mid-May to ensure rye biomass is maximized for the most persistent weed suppression.

110,000 lbs/A of rye biomass is higher than typically achieved in Iowa. The rye was drilled after harvesting corn for silage, and termination was delayed until mid-May.

Conversion chart - 1  
bushel/acre = 62.77  
kilograms/hectare

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# FARMER FOCUS

## CLIVE BAILYE



**If I was ever to write the script for a farming based horror movie I think the title may simply be “2020” ! Last time I wrote it was December 2019 and we were only 60% through our autumn drilling campaign. Well behind our usual planned October finish. The new 12m Horsch Avatar had been parked up and our farm workshop Co6 and front hopper tine drill was working in any available dry spell to complete the remaining workload. The Avatar coulters had been impressive in the unusually wet conditions, not blocking in conditions where I’m sure our 750a would have but ultimately its limiting factor was the weight of the seed cart on wet soils.**

With a full 12/36m CTF system in place here any soil damage caused by weight on wet, fragile, soils is at least confined to a known and small % of the land which, if necessary, can be targeted to repair. However, repair means soil disturbance I would rather not do so the lightweight and balanced CO, able to run a low tyre pressures seemed the better choice in the extreme conditions.

Also of note was the correlation between how long a field had been farmed under conservation agriculture principles and ability to drill, the longer term soils not only able to carry the weight of establishment machinery far better but far less prone to smear against the disc of the avatar or the tine of the CO.

Despite lacking the versatility of a disc when it comes to dealing with huge amounts of green cover and surface trash, on our soils a tine is better when soil is wet, and the less consolidated surface seems to give better establishment later in the season. Over the years of evolution of our tine drill we have experimented with various tine solutions. When first converted we used the Metcalfe points, I was attracted by their narrow profile of just 12mm and low price tag compared to others but quickly found on our stoney soils that the tungsten wear tile would often break off long before the point was worn out and that narrow profile led to very rapid seed tube wear and issues flowing larger seeds like peas and beans. I set about creating my own modified

version, initially this was just a wider version (15mm) using a Ferobibe wear tile that could be replaced with a farm workshop Mig welder. Unlike the tungsten, soil flow still created wear issues with the seed tubes so later protective side plates were added but I was never 100% happy with the design.

In 2019 I had the opportunity to try some Bourgault VOS openers, initially we fitted the twin row 100mm points, the quality was impressive and they worked well but 100mm was too much soil disturbance for my liking so we moved to the 19mm single shot point which seem absolutely perfect, low disturbance yet wide enough to flow even the largest of bean seed and with no seed tube to wear with it being internal to the point. I think this will be the solution we stick with going forward, they were pushed to the limits this year in conditions I hope to never see again, in combination with the Horsch Partner front hopper I think they were the only reason that on February the 15th we finally managed to complete 100% of the “autumn” wheat and bean establishment workload.

*Having the right tools for the job and the right soil is only part of the picture, without the commitment, skills and tenacity of good staff no farming system can ever be successful, The herculean effort made by everyone here this season was exceptional, they worked at every available opportunity, safely and efficiently with their usual attention to detail. The sense of achievement by all, against the odds and conditions felt like sweet victory making the second part of this horror story even harder to swallow ...*





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SINCE 1856**





Despite the difficulties of autumn at least our OSR area all looked good, locally a lot of crops had been destroyed by CSFB not long after drilling, yet ours had all made it through winter and although not exceptional looked 'alright'. As soil temperatures warmed and first nitrogen was applied though it became clear all was not good. Closer inspection revealed stems badly infested with CFSB larvae, there was no way the crop was going to yield, although hard to accept it was a write off and clearly best replaced with a spring crop of linseed creating a significant increase to our spring workload but at least with our low input, low risk approach to OSR the financial impact of losing the crop was minimised with just farm saved seed, a herbicide and 1/3rd of the nitrogen applied we can simply call it a cover crop and move on !

*The future of OSR on this farm is doubtful, we seem to have got away without CSFB issues longer than some but it was inevitable it would hit us eventually, pests do not respect farm boundaries or hedgerows so regardless of IPM or soil health on individual farms there is nothing an individual farmer can do to remain immune to this problem.*

Unlike many I believe the ban on neonicotinoids is not entirely responsible for this issue. In fact, I think this is a clear example of how unsustainable modern agriculture has become when an entire crop can seemingly no longer be grown. The blame in my opinion for this loss sits firmly at the feet of poor rotation, agronomy and often blatant, historic, disregard of IPM. After all I am certain the Romans who bought this crop to the UK farmed without seed

dressings and pyrethroid. Yet in just one generation we seem to have made something possible for thousands of years, impossible. If that doesn't make you question the overall direction of modern farming and its impact upon our environment, then it should, what crop will we be crossing off the options list next I wonder if we don't change? Blackgrass problems anyone?

In mid-March the rain that had started on September 20th finally stopped rather ominously on Friday 13th of March. A total of 580mm had fallen through that time and only 8 days had no rainfall at all making it even more remarkable that we had somehow got that autumn workload complete. Soils started to dry, and we were soon able to get the spring crop establishment completed in good time and condition. Grateful to finally get some dryer condition to work in establishment was quick and simple compared to the trials and tribulations of the winter. We joked about a drought ..... and then it happened!

It was 82 days later, on June 3, when we had our next rainfall. At this point the wheat was almost dead. Tillers had been dropped and yield potential irreparably capped, spring crops had emerged and developed slowly, I think in some cases had we cultivated to establish them they maybe never have emerged at all. The farm really did not look great, the only consolation being a country in covid 19 lockdown at least I didn't have to look at it very often!

I'm the first to criticise farmers for moaning, let's face it, if you can't deal with unfavourable weather then farming probably is not the best occupation to choose. I prefer to focus on things we can control as managers rather than things we can't. I chose to accept this season as a challenge, if you can win a game of poker with a bad hand then surely you can still make a margin growing crops with bad weather?

*The simplicity of the low fixed cost structure business I have set out to build*







*suddenly felt more prudent that ever with a small payroll and machinery fleet to finance the next focus was on adjusting the variable costs to fit potential.*

Fortunately we had applied 60% of the planned N to our wheat early, as the hot, dry conditions persisted it was fear of scorch and damage that led the decision to apply no more but ultimately as tillers aborted it was yield potential finally made the 60% into 100% of planned application. It was a similar story for other inputs, a cheap fungicide application made at T1 timing became all that was needed to keep wheat clean until the rain finally returned in mid-June. Spring crops needed just fertiliser and herbicides; I don't think we have ever had a year where our usually very busy sprayer has been parked in the yard quite so much.

The result has been an extremely cheap year, ultimately a very simple year. Although we are unavoidably heading into a lower output harvest than we have seen here for many years I think this could be one of the best farm management years I have had, there is not a single decision I think I would change this year, not a single opportunity missed and I don't think I have ever been able to say that before. I'm looking forward to harvest and remain hopeful that this farming horror story could just have a happy, ie. profitable, ending!

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The mower and harrow combination work by consolidating two passes into a single operation, saving users time and diesel.

*Stubbles are chopped and distributed evenly across the full working width whilst the trailed harrow shatters residue to significantly reduce slug habitats, providing a cultural control method and reducing chemical applications.*

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When following the RT Series rotary mower, stubbles can be topped, distributed and the surface stimulated to promote a flush of weeds and



volunteers ahead of Autumn drilling in one pass.

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# FARMER FOCUS

## DAVID WHITE



**Thoughts and lessons learned from the season. Where to start???**

Well the earth on the farm went from very wet over winter to very dry. April was the sunniest it's been since 1929 I believe, with the drought being broken towards the end of the month by some very welcome rain. We have been treated to the clearest air and the bluest skies that anyone has seen for many decades. It's a shame that it's taken a global pandemic and shutdown of industrial operations and carefree travel to make the change to the environment that we have been aware is needed for a while now.

May continued dry and we start to think that we need some vapour trails and upper air pollution to create conditions for rain to happen again!

Whilst we do all we can to improve soil health and structure and increase SOM to improve drought resistance still on light land the effect of insufficient precipitation combined with high temperatures and high winds have drained yield potential.

So thoughts turn to combating drought and coincidentally on the internet popped up an article The Drought Myth, An Absence of Water is Not the Problem by William Albrecht. [www.appropedia.org/Drought\\_Myth](http://www.appropedia.org/Drought_Myth)

which discusses the role of nutrition in combating drought. I have been adding trace elements to spray applications at every opportunity but have still found that the absence of water is a big problem. More work needed here. Even the more specialist bio extracts appears to have made no difference.

Soil structure and subsoil is no doubt very important and I'm always reminded of this by the route of a pipeline which crossed a field well over twenty years ago. The crop is always stunted and looks hungry (see pic) but the same soil was replaced in the trench that was removed, just in a different order.

On the worst field I have for "hot spots" (see pic) the



Hot spots



Pipeline route

difference in crop changes dramatically in just a few inches. You would not think it was possible as we expect roots to roam for moisture and nutrition on top of their increased efficiency through association with Arbuscular Mycorrhiza Fungi. I will taking soil samples from 0-300mm and 300-600 analysed to see what differences can be found.

*On top of how we physically farm the soil we are trying to reduce crop inputs, jump off the treadmill of nannying crops with insurance PPPs and let crops on our healthier soils with an increased number of beneficials stand up for themselves.*

I have had success with this approach again this year with insecticide free crops of wheat and rape but less success with reducing fungicides.

Learning where we can successfully cut back is still a work in progress.

I refuse to be persuaded to apply a T0 to wheat preferring it to stand on its own feet but it's surprising how quickly patches of yellow rust started to appear on my varieties of GP1 wheats. These being Zyatt, Solstice or Skyfall or a blend of the three. A T1 needed to be applied very swiftly, and to keep on top of the problem a well timed T2. Nothing saved there then!

Autumn insecticides are avoided when ever possible but we do need to be aware of the risks from the green bridge between crops, and on one field of wheat the aphid population that inhabited the volunteer oats and possibly were living in the excessive amount of wet chopped straw has infected the wheat fairly badly despite a poorly timed (with hindsight) insecticide application. As part of our IPM we really need to be able to get aphids tested to see what disease they are carrying and have regional data on this.

Spring seedbeds were a challenge following the excessive



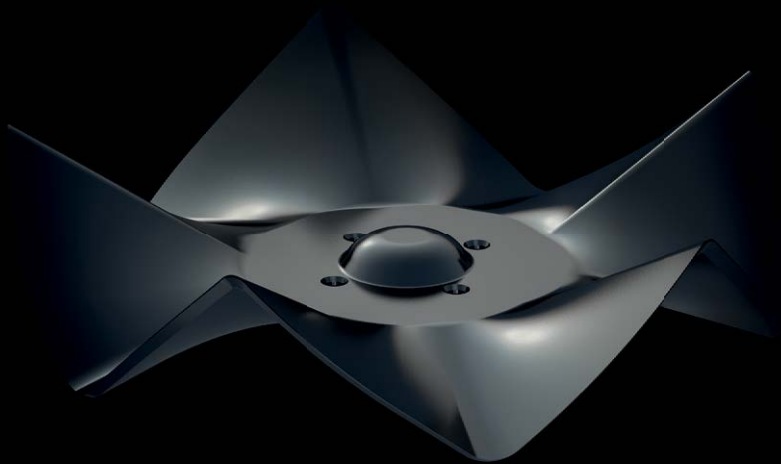


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amount of winter rainfall but as a rule better (drier) where the cover crops had been left growing until early February than sprayed off before Christmas, in this case to get a second flush of Blackgrass. The ground does need to be dry enough to crumble into the slot or at least not mush back together again after the seed is placed and in the early sprayed off field it was not. With hindsight again I should have moved this a couple of inches deep to let it dry but had no machine for the job other than going over it with the Horsch tine drill. To that end I've found and purchased a super cheap new 3mt disc and packer machine which I'm fitting a seeder box to. This will perform three tasks, 1. covercrop establishment, 2. light movement of any seedbed to dry it if necessary and 3. mechanical covercrop destruction to reduce reliance of, or number of lts/ha required, in producing a clean environment to drill into of glyphosate. This is something I trialed in late autumn 2018 with a very lovely but expensive Lemken Rubin machine with some success.

Headlands. I'm surely not the only one that has headlands that look better than the field! I haven't quite worked out why this is but on a traditional cultivation system headlands were always the poor relation, especially in a wet year.

*Thoughts around this are, better consolidation, in a no-till system is this*

*possible? Fewer slugs due to consolidation. An effect of some type from the surrounding flora. Extra nitrogen due to me not cutting back the rate enough on the headland setting, but half of the N is applied as liquid! Drilling more slowly, or something else. Thoughts appreciated via Twitter or Farming Forum/BASE UK forum if you can please.*

So to sum up. The farm doesn't look too bad and with a well timed rain and a little less heat and wind in May it would have looked very good. I can't blame the no-till system, now it's fifth year here, for any crops that look less than perfect other than some spring barley and that was down to poor judgement on the day by me. The better well bodied land has the better crops due to holding more moisture than the land with sand under it. The ability to choose either the disc or tine drill depending on circumstances has been invaluable with the JD750a doing a fabulous job in green catch crops and the Horsch Dutch conversion likewise into wet chopped straw on wheat after oats or second wheats. In fact the no-till system afforded me the ability to drill 130% of planned wheat area in what was one of the most difficult autumns we can remember.

Finally the desire to farm using many fewer artificial inputs is very laudable but there are risks when we back to rein back too far.

What is holding us back at the moment is the risk/reward balance, something organic farmers have much better sorted and to help progress Regenerative Agriculture more quickly premiums that support the way that we are farming would be helpful.



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# FIELD LAB: ORGANIC WHEAT VARIETIES PART 2 – THE RESULTS

## Results and Discussions - Spring Assessments

Variety	Crop Cover Feb (%)	HSD	Crop Cover Mar (%)	HSD	Crop Cover Apr (%)	HSD	Height Mar (cm)	HSD	Height Apr (cm)	HSD	Rel. Biomass Mar (%)	HSD	Rel. Biomass Apr (%)	HSD	GS Apr (BBCH)	GH Apr (BBCH)
AWC1	19 ab		25 a		38 a		19.2 a		33.5 a		88.3 ab		91.7 ab		32.2	1.0
AWC2	14 abc		29 a		44 a		11.5 defg		23.3 ij		71.7 bcd		58.3 ghij		30.0	3.0
AWC3	20 a		33 a		42 a		16.0 abcdef		28.8 bcde		80.0 abc		80.0 abcdef		31.2	1.8
AWC4	10 c		26 a		38 a		11.7 defg		27.0 cdefghi		61.7 d		70.0 cdefghij		31.3	2.2
Costello	20 a		32 a		42 a		13.2 cdefg		24.5 ghij		76.7 bcd		75.0 bcdefghi		31.5	2.7
Cougar	17 abc		33 a		45 a		12.7 defg		22.7 j		66.7 cd		54.2 j		30.0	3.2
Crispin	17 abc		27 a		35 a		16.8 abc		28.7 bcdef		88.3 ab		78.3 bcdefg		31.2	1.7
Crusoe	12 abc		24 a		36 a		12.8 defg		27.2 cdefghi		65.0 d		69.2 defghij		31.5	1.8
Edelmann	17 abc		33 a		41 a		11.2 efg		29.2 bcde		71.7 bcd		86.7 abcd		31.2	1.7
Ehogold	12 abc		35 a		41 a		10.5 fg		31.0 abc		75.0 bcd		90.0 abc		31.5	1.5
Evolution	11 bc		28 a		39 a		11.0 fg		23.3 ij		61.7 d		55.0 ij		30.3	2.0
Extase	16 abc		33 a		43 a		15.8 abcdef		28.5 bcdefg		86.7 abc		83.3 abcde		31.3	2.2
Halfreda	12 abc		34 a		52 a		9.7 g		24.7 fghij		68.3 bcd		71.7 bcdefghij		30.5	3.0
Maris W	20 a		34 a		36 a		18.8 ab		31.3 ab		100.0 a		100.0 a		31.5	1.8
Montana	11 c		25 a		44 a		13.3 bcdefg		27.5 bcdefgh		73.3 bcd		75.0 bcdefhi		31.0	2.2
Mortimer	14 abc		28 a		36 a		18.5 abc		29.3 bcd		89.2 ab		76.7 bcdefgh		31.8	1.8
Moschus	9 c		28 a		41 a		11.3 defg		25.2 efghij		65.0 d		63.3 efghij		31.2	2.8
Revelation	13 abc		28 a		39 a		11.7 defg		24.7 fghij		65.0 d		57.5 hij		30.3	2.5
Siskin	15 abc		28 a		36 a		13.7 abcdefg		28.5 bcdefg		80.0 abc		75.0 bcdefghi		31.3	1.8
Skyfall	16 abc		34 a		41 a		12.3 defg		24.0 hij		75.0 bcd		60.0 fghij		30.8	2.3
YQ	15 abc		24 a		41 a		11.5 defg		26.8 defghi		63.3 d		66.7 defghij		31.0	3.0
Zyatt	17 abc		31 a		36 a		16.7 abcde		27.2 cdefghi		78.3 bcd		73.3 bcdefghij		31.2	2.2
Trait	positive		positive		positive		positive		positive		positive		positive		neutral	neutral

Table 1 - Crop trait values from spring assessments, around BBCH 30-32 for variables of crop ground cover, crop height, crop relative biomass, growth stage and growth habit. Colour scale indicates above average and below average (pale green is above average, pale red is below average for traits deemed positive in Spring e.g. crop cover, crop height, biomass). Bold green and red represent the highest and lowest values respectively for the trait. Traits deemed neutral (can be desirable or undesirable depending on crop management and cropping system) e.g. growth stage and growth habit are coloured orange on a colour scale ranging from pale to bold for lowest to highest. For neutral traits of GS and GH, above average values are written in green and below average values are in red. Variables followed by the same letters are not significantly different according to Tukey's HSD test.

The above table shows different crop traits that can be easily measured around stem extension, a key growth stage

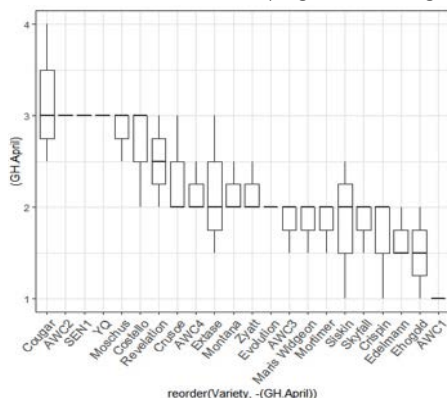


Figure 2 - Boxplot showing growth habit in April (BBCH 31) of each variety assessed using a 1-5 scale where 1=erect and 5= prostrate. SEN1=Halfreda.

average positive spring traits, whilst Evolution performed consistently below average across these traits. Many other traits contribute to yield and quality and it should be noted that despite it's apparent deficiency in terms of spring vigour, Evolution was the highest yielding variety in the plot trial.



Figure 3 - Montana in April showing farmer votes (white pegs) for their favourite variety.

## Growth Habit

A relatively simple assessment to perform, varieties can be classed according to five growth habit groups from 1 (erect) to 5 (prostrate). This trait may have implications for the crop management as shown below in the farmer rankings with different weeding strategies dependent on certain growth habits e.g. erect types may be better for inter row hoeing. The trait may also provide an indication of competitiveness, with erect types generally taller and the prostrate types generally providing greater groundcover. Which of these traits may be most useful will depend on a number of factors including the farm (soil, weed community etc.) and the year.

At a field lab meeting in April, farmers were given the opportunity to vote for their favourite variety based on the phenotypes in front of them. Most of the farmers expressed a preference for

signalling the end of the Foundation Phase and the start of the Construction Phase. Several of the traits relate to crop vigour in the spring, which is desirable for organic farming, offering greater competition from the crop against weeds and for resource capture. Extase and AWC3 showed consistently above

Variety	Votes	Reasons
Montana	6	even spread, good coverage, green, free of disease
AWC1	6	tall open, good for inter row hoeing
Costello	1	fills out, more biomass, green
Ehogold	1	vigorous, canopy size, weed suppression, low disease
Maris Widgeon	1	good cover, green
YQ	1	diversity, cover

Table 2- Farmer Preferences

varieties with high biomass and good groundcover. Montana and AWC1 (Mv Fredericia) were voted the best varieties though for different traits. Montana was selected for its good ground cover, greenness, even spread and moderate height while AWC1 was selected for being tall and open making it suitable for inter row hoeing. This result illustrates the difficulty in selecting a one size fits all variety or so called ideotype for organic farming. The farm and crop management will heavily influence which variety is best suited for that system.

Late flowering/Early milk Assessments in July

Key traits measured in July around late flowering/early milk give an indication of varieties with mostly positive attributes for example disease resistance for the three main foliar diseases, good crop cover and high ear numbers. While ear density is usually the most important of the three yield components, it is not strongly linked with yield here, with grain number per ear and individual grain weight (size) also important. Some varieties with a large number of ears also had rather small ears (i.e. lower grain numbers per ear) and smaller grain. Crop height is generally regarded as an important trait in organic production with taller crops usually deemed desirable

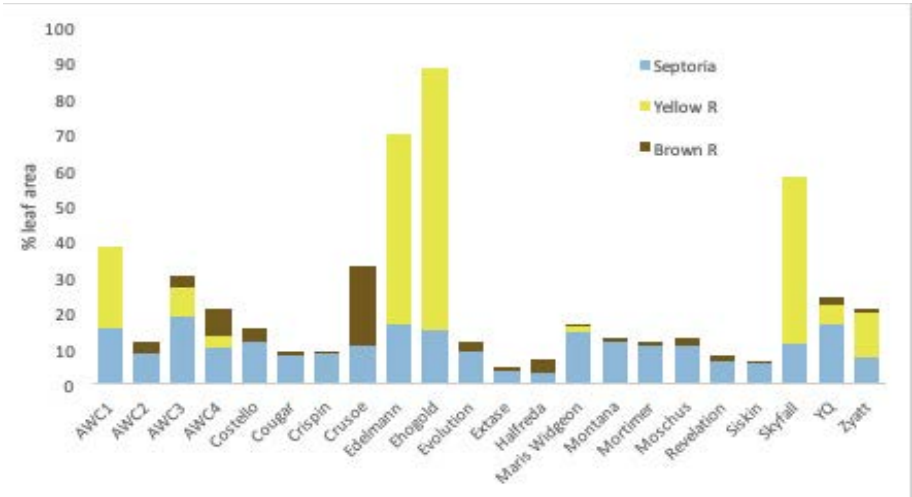


Figure 4 - Disease severity levels recorded at flowering (BBCH65) measured on a whole plot basis for leaf 1 and leaf 2.

for their additional weed smothering and competitiveness. Of course, crop canopy and cover are also important and height in and of itself may not always be beneficial if the canopy is also very open allowing weeds to compete. For this reason, final height has been treated as a neutral trait particularly given farmers comments about lodging and certain mechanical weeding practices (e.g. weed surfing) that may put taller crops at a disadvantage, or at least make them less desirable. On highly fertile ground taller crops may lodge with associated reductions in yield and grain quality possible. However, in certain

circumstances where there is a large and competitive weed community, taller crops can be the difference between satisfactory and very poor yields.

Disease

The chart above shows the mean disease severity for the three most important foliar diseases. While disease is often considered by organic arable farmers to be of less importance than either nitrogen and/or weeds in terms of yield limiting, all things being equal, varieties with higher disease resistance will always be desirable. Increased nitrogen availability in conventional trials limits the relevance of so called “untreated” data as there is a known link between nitrogen and disease susceptibility, particularly for Septoria (Loyce et al 2008). Having said that, untreated yields and the relative yield compared to control varieties, used by the RL can be a useful indicator of overall disease tolerance or resistance, with those untreated varieties showing the lowest relative yield reduction compared to treated controls likely to be suitable for organic production. In fact, the best performing varieties in terms of yield also tended to show the lowest mean disease severity e.g. Crispin, Siskin, Evolution, Revelation, Halfreda.

Varieties with high relative untreated yields on the Recommended List will have high disease resistance and are likely to be highly desirable for organic farming though this data comes from the testing regime for the RL with full fertiliser and herbicide inputs, offering only limited relevance to organic farmers. What is clear is that having a high relative untreated yield is not enough for varieties since they must

Variety	GS (BBCH)	Crop Height (cm)	HSD	Crop Cover (%)	HSD	Weed Cover (%)	HSD	Septoria (%)	HSD	Yellow Rust (%)	HSD	Brown Rust (%)	HSD	Total Disease (%)	HSD	Ear N.o. (ears/m <sup>2</sup> )	HSD
AWC1	74	92 bc		55 abcde		24 a		16 ab		23 c		0 b		39 cd		418 abc	
AWC2	75	81 defg		53 abcde		13 a		9 abcd		0 d		3 b		12 efg		405 bc	
AWC3	76	85 cde		42 e		20 a		19 a		8 cd		3 b		30 def		422 abc	
AWC4	75	80 defghi		55 abcde		23 a		10 abcd		3 cd		8 b		21 defg		392 bc	
Costello	77	70 i		49 abcde		19 a		12 abcd		0 d		4 b		16 defg		523 a	
Cougar	73	74 fghi		58 abcd		23 a		8 abcd		0 d		1 b		9 efg		354 bc	
Crispin	74	80 defghi		44 de		24 a		9 abcd		0 d		1 b		9 efg		409 abc	
Crusoe	75	73 ghi		44 de		26 a		11 abcd		0 d		23 a		33 de		394 bc	
Edelmann	78	100 ab		58 abcd		11 a		17 ab		53 b		0 b		70 ab		454 abc	
Ehogold	76	105 ab		52 abcde		13 a		15 abcd		73 a		0 b		88 a		389 bc	
Evolution	74	80 defghi		51 abcde		19 a		9 abcd		0 d		2 b		12 efg		407 abc	
Extase	76	74 fghi		47 bcde		23 a		4 cd		0 d		1 b		5 g		404 bc	
Halfreda	75	87 cde		62 a		11 a		3 d		0 d		4 b		7 fg		459 ab	
Maris W	76	105 ab		61 ab		18 a		15 abcd		2 d		1 b		17 defg		351 bc	
Montana	77	80 defghi		52 abcde		20 a		12 abcd		0 d		1 b		13 efg		388 bc	
Mortimer	76	83 cdef		55 abcde		21 a		11 abcd		0 d		1 b		12 efg		463 ab	
Moschus	76	88 cd		59 abc		20 a		11 abcd		0 d		2 b		13 efg		424 abc	
Revelation	76	74 fghi		48 abcde		20 a		7 bcd		0 d		2 b		8 fg		431 abc	
Siskin	74	74 fghi		51 abcde		17 a		6 bcd		0 d		0 b		6 fg		429 abc	
Skyfall	78	71 hi		46 cde		17 a		12 abcd		47 b		0 b		58 bc		433 abc	
YQ	76	98 ab		53 abcde		26 a		17 ab		5 cd		2 b		24 defg		337 c	
Zytatt	74	76 efghi		44 de		22 a		8 abcd		13 cd		1 b		21 defg		406 abc	
Trait	neutral	neutral		positive		negative		negative		negative		negative		negative		positive	

Table 3 - Trait data gathered in July around BBCH 75 for variables of growth stage, crop height, crop and weed cover, disease severity (Septoria, Yellow rust, brown rust and Total) and ear number. Colour scale indicates above average and below average (pale green is above average for traits deemed positive e.g. ear number and crop cover, and below average for traits deemed negative e.g. disease severity and weed cover. Bold green and red represent the highest and lowest values for a trait dependent on whether positive or negative. Traits deemed neutral (can be desirable or undesirable depending on crop management and cropping system) e.g. growth stage and height are coloured yellow on a colour scale ranging from pale to bold for lowest to highest. For neutral traits of GS and Height, above average values are written in green and below average values are in red. Variables followed by the same letters are not significantly different according to Tukey's HSD test.



have a high relative treated yield in order to be considered for the RL. This means that varieties that show a promising relative untreated yield, and therefore potential suitability for organic farming, can be rejected on the basis that yields are not high enough compared to control varieties under treated (with fungicide), high input conditions. This is clearly an issue for the organic sector with the variety Mortimer offering evidence of this bias. Mortimer has performed consistently well in the organic plot trials for the last two years showing good disease resistance and high yields and has shown promise in terms of its untreated relative yields in NL trials. However, due to its below target treated relative yields the variety has fallen from commercial production despite it's high disease resistance scores and potential for organic farming.

An argument could be made for a small additional RL that only required high relative untreated yields for varieties to qualify as this would keep additional disease tolerant varieties in circulation and would increase the amount of

relevant data for Organic farmers and for those farmers looking to decrease chemical inputs. At present, very disease resistant varieties can easily fall away without showing high fungicide treated yields and the RL is therefore facilitating this loss of naturally disease resistant material. This idea could be taken a stage further to include untreated in terms

Variety	Votes	Reasons
Hallfreda	5	green, clean, good canopy
Maris Widgeon	2	tall, good cover
Revelation	1	high expected yield
Siskin	1	high expected yield

Table 4- Farmer Preferences July

of nitrogen fertiliser to provide relative yields that would give an indication of those varieties better able to access soil nitrogen.

The 2018/19 season was a challenging one for yellow rust with the two varieties Ehogold and Edelmann were found to be particularly susceptible (Table 3). Severe yellow rust on these two varieties badly affected grain fill and led

to a poor yield performance. Both these varieties are organically bred and were included to compare their performance against conventionally bred material given that organically bred material may show greater adaptation to organic cultivation, given its selection under organic conditions. However, these varieties were imported from Austria and show that continental varieties



Figure 5 - Hallfreda in July showing farmer votes (blue pegs) for their favourite variety.

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can be susceptible to UK races of rust and these varieties must be well tested to confirm resistance in the target production environment before bringing into commercial production in the UK. That said, the conditions were perfect for yellow rust with a mild winter, followed by a warm spring and overnight dews leading to an epidemic. During 2019 higher than expected levels of yellow and brown rust were seen in some varieties. It is not yet clear if the reported cases of high yellow and brown rust disease levels in 2019 indicate the initial emergence of new rust races or exceptionally high disease pressure at some sites due to optimal environmental conditions.

Voting for preferred varieties at a trial meeting in July allowed farmers the opportunity to pick varieties based on a different set of traits and selection criteria than at the meeting in April. Varieties showing good canopy cover, a high green leaf area, low disease levels and a high expected yield (based on ear number and size) were most desirable. Hallfreda, the near market line from Sweden was the winner, mostly thanks to it's very green and clean appearance and good canopy cover due to its high levels of disease resistance and later maturity.

Yield and Quality data

The average yield of the plot trial in 2018/19 was 3.60±0.08 t/ha. Whilst Tukey's HSD scores show very few varieties are significantly different from each other in terms of yield (see Table 5), the varieties do tend to fall into a below average yielding generally higher quality group (particularly with respect to protein) and an above average yielding generally lower quality group otherwise summarised as a genetic yield (Y) and quality (Q) cluster. Yield and Protein show the typical inverse relationship. The two groups are generally considered as wheats for milling (Q) and wheats for feed (Y). Looking at Table 5 can help show varieties that may buck the trend such as AWC1 (Mv Fredericia) that comes top of the below average yielding Q group whilst showing high quality for all three variables measured. Hagberg Falling Number (HFN) is a standard measurement for milling quality but is highly linked to crop phenology and ripening making it an awkward variable to include given that the logistics of a plot trial mean all varieties must be

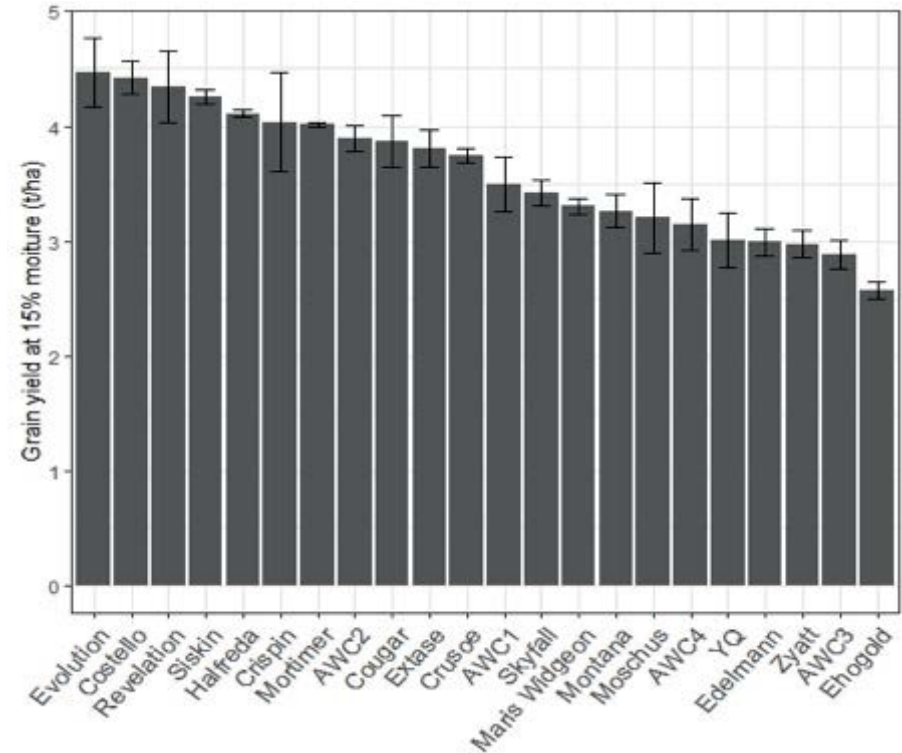


Figure 6 - showing mean grain yield of all 22 varieties. n=3, error bars show standard error of the mean.

harvested together. This means, that earlier ripening varieties will have a bias against them as they will likely come to maturity several days before the trial is harvested. While still useful as an indicator of quality, this fact should be considered when comparing HFN data.

Ehogold illustrates this point well as the earliest ripening of the varieties tested and with high bread making quality attributes, it had one of the lowest HFN numbers.

Investigation of Traits

Variety	Yield t/ha @ 15% m.c.	Tukey's HSD	Specific Weight kg/hl	Protein %	HFN s
Evolution	4.47 ± 0.30	a	68.9	8.2	242
Costello	4.42 ± 0.14	ab	73.5	6.9	319
Revelation	4.35 ± 0.31	abc	69.6	7.1	291
Siskin	4.26 ± 0.06	abcd	72.3	6.8	336
Hallfreda	4.11 ± 0.03	abcde	72.4	7.4	354
Crispin	4.04 ± 0.43	abcdef	73.4	6.6	338
Mortimer	4.02 ± 0.02	abcdef	71	7.5	298
AWC2	3.90 ± 0.11	abcdefg	70.1	7.4	260
Cougar	3.87 ± 0.22	abcdefg	68.8	7.3	285
Extase	3.81 ± 0.16	abcdefgh	72.3	6.9	308
Crusoe	3.75 ± 0.07	abcdefgh	70.6	8	317
AWC1	3.50 ± 0.23	bcdefghi	73.8	8.5	329
Skyfall	3.42 ± 0.11	cdefghi	69.6	7.5	344
Maris Widgeon	3.30 ± 0.07	defghi	73.4	8.4	270
Montana	3.26 ± 0.14	efghi	72.9	8.4	359
Moschus	3.21 ± 0.30	efghi	74.4	9.4	341
AWC4	3.15 ± 0.23	fghi	71	8.8	282
YQ	3.01 ± 0.24	ghi	73.9	8.7	288
Edelmann	2.99 ± 0.12	ghi	76	9.8	327
Zyatt	2.98 ± 0.12	ghi	71	9.2	293
AWC3	2.89 ± 0.12	hi	72.8	10.5	302
Ehogold	2.67 ± 0.08	i	75.6	11.4	266
Average	3.60 ± 0.08		72.2	8.1	306

Table 5 - showing mean yield ± standard error and quality data for all 22 varieties. Numbers in pale green are above average, numbers in pale red are below average. Numbers in bold green and red represent the highest and lowest values for that variable respectively. Yields followed by the same letters are not significantly different according to Tukey's HSD test.



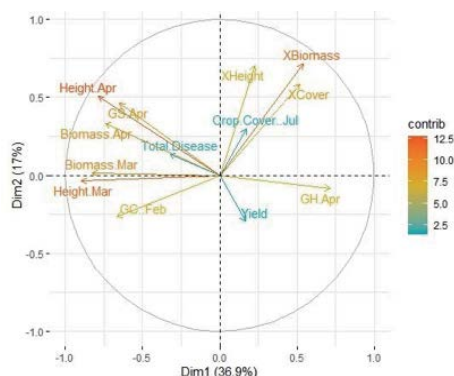


Figure 7 - Principle component analysis (PCA) of traits measured during 2018/18 plot trial. NB. Varieties Ehogold and Edelmann excluded as anomalous due to yellow rust and height data skewing the analysis.

Figure 7 shows the principle components that explain the most variation in the dataset from the 20 varieties (excluding Ehogold and Edelmann) and the 3 replicates assessed (60 plots) based on all measured traits. These principle components correlate with certain traits which are plotted on the figure and the strength of the correlation indicated by the colour (contrib: red = high and blue = low).

Of all the traits measured the height in March and April, and the relative biomass

and the change in relative biomass (the difference between biomass in March and April: XBiomass) are the variables most strongly correlated with PC1. These may be considered a measure of spring vigour. Height in March and biomass in March also strongly influence PC1 while growth habit in April (GH April) also influences PC1. PC2 most strongly correlates with the change in biomass (XBiomass) and the change in height (XHeight). Variables in blue (i.e.

yield, crop cover in July and Total disease) have a weaker influence on the principle components. Note that some variables have been excluded entirely from the PCA given their very weak influence on principle components.

We can also look at how the different traits correlate with one another, by looking at the angles between the trait vectors. The smaller the angle the more positively correlated while the larger the angle the more negatively correlated.

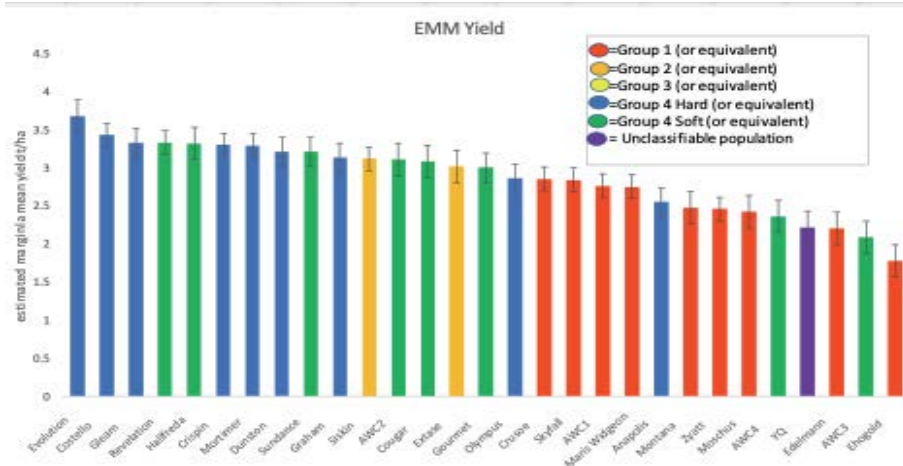


Figure 8 - Estimated marginal means (EMM) combining data from the organic wheat plot trials in 2017/18 and 2018/19. Grouped according to NABIM class. Error bars show standard error of the mean.

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Trait vectors at 90 degrees are unlikely to be correlated. Observing the above PCA shows that yield doesn't appear to be strongly correlated with any traits. The only trait that comes close is the growth habit measured in April with a small suggestion that more prostrate growth habit may be linked with a higher yield, but this is a very weak correlation and can essentially be disregarded. Yield is negatively correlated with total disease, growth stage in April (GS.April) i.e. more forward varieties, and height in April (which will in part be influenced by phenology, since the earlier varieties will be further through stem extension and hence taller). The varieties with more biomass in April also appear to be negatively correlated with yield.

## 2017/18 and 2018/19 Variety Yield

Estimated marginal means correct for bias due to differences between year to provide a more accurate aggregated mean yield for each variety to enable comparison of varieties averaged across years when certain varieties appeared in only one of the years. The 2017/18 trial yielded a grand average of 2.3t/ha compared to the grand average of 2018/19 of 3.6t/ha. This represents a yield in 2017/18 of 64% the yield of 2018/19.

This approach has been useful in identifying varieties potentially unsuitable and hence worth dropping from the variety trial. For example, Anapolis as a group 4 falls outside the clustering of the rest of the group 4s that are higher yielding, and falls within the lower yielding, higher quality cluster

of the group 1s. Similarly, new group 1 equivalent milling varieties like Ehogold and Edelman don't appear to offer more productivity than the current collection of group 1 varieties including Crusoe and Skyfall. AWC1 (Mv Fredericia) does look to have potential for organic production after two years with good productivity and excellent quality. The varieties Mortimer and Hallfreda as hard and soft group 4 equivalents respectively also look to have good potential for organic production on a commercial scale, showing good productivity within the cluster of high yielding group 4 types.

## Individual site findings; The Farm field scale trials

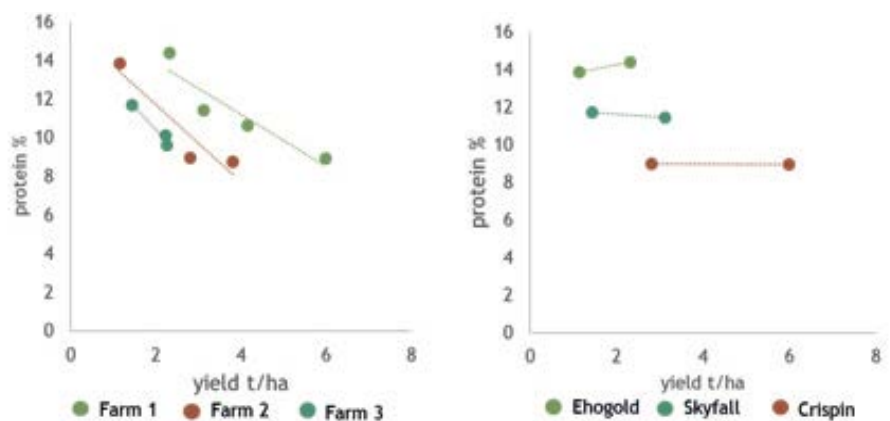


Figure 9 a and b - Comparison of varieties with-in farm yield protein performance (left), compared to varieties yield protein performance across farms (right)

The three farms that each grew a selection of three to four varieties for comparison at a field scale, did so utilising farm management practices to give a more reliable estimate of commercial performance. This was linked with a wider varietal testing network supported

by the LIVESEED project. When looking at the varieties grown in each individual farm, these tended to align along a yield-protein trade-off. However, observing any individual variety across farms, there is an evident change in yield with a reasonably constant protein content. Thus, the yield protein trade-off, generally seen as a big limitation especially for organic production, does appear across varieties within an individual farm, but not necessarily within a variety across farms (Graph 9 b). These trends are being analysed across the wider Liveseed farm network, hoping to shed light on optimal environments and management systems to help maximise wheat yield and quality. These results could help organic farmers plan their target market and hence



Figure 10 - Photos from L to R Crispin, Ehogold and Revelation from the field trial at Farm 2



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# AHDB STRATEGIC CEREAL FARM WEEK

Sharing AHDB's Strategic Farm demonstrations and practical 'how to' resources virtually

## AHDB's Strategic Farm Week goes digital

Usually, summer sees each AHDB Strategic Cereal Farm host open their doors to those interested in learning about the research programmes put into field scale demonstrations on-farm. However, due to Government restrictions, this year's programme took place in a purely digital format comprising videos, webinars and a podcast.

The webinars during the week covered a range of topics including monitoring crop development, pests and diseases, reducing chemical inputs and masterclasses on crop establishment, soil structure assessments, mole drainage and soil loosening. Experts from AHDB and across the industry led the sessions including pioneering farmers Simon Cowell and Tim Parton, and soil expert Philip Wright.

This year, Strategic Farm East host, Brian Barker from Lodge Farm, Suffolk and Strategic Farm West host Rob Fox at Squab Hall, Warwickshire, were joined by a third. Farm manager David Aglen, is the newcomer having joined the Strategic Cereal Farm programme earlier this year, extending the network up to Scotland for the first time. Having yet to start trials at Balbirnie Home Farms, David is interested in looking at regenerative agricultural practices, plant and soil health and carbon offsetting through the Strategic Farm Scotland programme.

David said: "There is little research going on into regenerative agriculture in the UK currently. This is the direction we want to take our business so working with AHDB offers the opportunity to harness the research available and get more work done to help us and the industry succeed in moving towards our goal."

At Brian Barker's farm, a lowering inputs demonstration is one of several demonstrations taking place, which was showcased during the week alongside research looking at cover crops,

perennial flower strips and boosting early crop biomass.

Lower input, higher margin farming, regenerative farming and soil management all came together in one of the key webinars of the week in which Brian Barker, Tim Parton and Simon Cowell took part, see the featured article.

Farm manager, Rob Fox is overseeing a separate set of demonstrations in the west of the country looking at soil cultivations, the impact of summer catch crops and pests and natural enemies.

*This season has been a particular struggle for Rob, who at one point was considering throwing in the towel altogether. Following a season of heavy rainfall, he struggled to get crops in the ground, let alone establish his demonstrations. As a result, a significant portion of the research programme at his farm had to be written off.*

Since then Rob has soldiered on having endured, along with the rest of the country, a prolonged dry spell; going from one extreme to the other.

"It's been a tough growing year meaning we've had to reduce what we had planned for the season.

"It's not all been bad news though as we've been able to add in an additional demonstration looking at summer catch crops. We've planted two different mixes: one is a bought-in mix of phacelia and fodder raddish, the other is home saved spring beans and spring barley. The aim is to see if they are any benefit to the following wheat crop."

Attention now turns to later in the

year, as the summer approaches and harvest 2020 beckons. AHDB looks forward to your joining us to hear about the results from all the harvest 2020 demonstrations at Lodge Farm and Squab Hall in the autumn.

To access any of the content from Strategic Farm Week 2020, including watching back the webinar videos, please visit: <https://ahdb.org.uk/sfweek2020>

To find out more about the host farms please visit the dedicated webpages using the links below:

- Strategic Cereal Farm East (Lodge Farm): [https://ahdb.org.uk/farm-excellence/strategic\\_cereal\\_farm\\_east](https://ahdb.org.uk/farm-excellence/strategic_cereal_farm_east)
- Strategic Cereal Farm West (Squab Hall Farm): [https://ahdb.org.uk/farm-excellence/strategic\\_cereal\\_farm\\_west](https://ahdb.org.uk/farm-excellence/strategic_cereal_farm_west)
- Strategic Cereal Farm Scotland (Balbirnie Home Farms): [https://ahdb.org.uk/farm-excellence/strategic\\_cereal\\_farm\\_scotland](https://ahdb.org.uk/farm-excellence/strategic_cereal_farm_scotland)

## How to decide when to lower inputs



Chris Leslie

AHDB's Knowledge Exchange Manager for Scotland, Chris Leslie, hosted the "How to decide when to lower inputs" webinar, as part of Strategic Farm Week in June 2020. Here he talks through some of the key findings and topics of conversation from the webinar, featuring farmers Simon Cowell, Tim Parton, Brian Barker and David Aglen, along with Catherine Harries, AHDB.



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Changing systems, changing mindset and learning to work with nature were key themes throughout this webinar exploring the topic of lowering inputs. This topic is one that is being looked at across the three AHDB Strategic Farms through their demonstrations and six year programme.

All of the farms are at differing points on the road to regenerative agriculture, the system of farming principles and practices that increases biodiversity, enriches soils, improves water quality, captures carbon and enhances ecosystem services.



Agriculture is disruptive by its very nature. However, our three Strategic Farmers as well as Tim and Simon, aim to work alongside nature and put soil and the environment at the forefront of their farming system using tools such as IPM and no-till. Tim Parton stated right at the beginning of his presentation, that "I find when you work with nature, rather than fight nature, it works".

A key part of moving towards this system is to find ways to farm with less inputs. For Simon Cowell, this has included a range of options that have been put into place on his heavy clay farm in Essex, such as: stopping growing

oilseed rape, the introduction of perennial crops such as lucerne and aiming to overlay crops through the rotation to support soil biology and mycorrhizae.

This change of the rotation has enabled Simon to halve the nitrogen used on farm, from when he was in the previous system of growing solely wheat and oilseed rape.

Simon admits that "it's difficult to back off and say I'm not going to spray any fungicide or put on any phosphate fertiliser" and understands that every farm is set-up differently, with some paying high rents and mortgages.

However, the importance of getting your soil in the right condition before you start to reduce inputs was a key part of the solution. For Simon, he has been able to speed up this process by using home-made compost to enable the biology to function and for the nutrients to circulate and more.

Simon noted that his preference is to not focus on the margins of individual crops instead, "it's about the whole rotation that we're considering, its better to not think about each one individually. It's a longer term thinking all together", he says.

Brian Barker also discussed how he is looking at how far he can reduce inputs in his crops at the Strategic Farm East. As one example, a demonstration taking place this year on-farm is looking at reducing plant protection products and fertiliser to see what impact this will have on pest and disease pressure, crop yield and net margin. The farm has applied a reduced input programme in a field of winter wheat and will compare the results with a conventionally managed

crop at harvest.

The work is part of Brian's ongoing interest in looking at how far it is practically possible for farmers to reduce inputs. Last year he tested the natural resistance of winter wheat varieties by applying three different fungicide application programmes to see which gave the best margin.

"This is all about changing mindsets as we're going to have to look at alternative ways of protecting our crops. In this demonstration field, we ploughed it due to previous blackgrass populations, planted naked KWS Siskin seed, applied a pre-emergent herbicide, no insecticide, one PGR at T1 and only spent £14/ha on fungicides at T1 and tebuconazole at T3 due to rust coming in late," said Brian.

*"Weaning myself off using inputs hasn't been easy and it'll be interesting to see how this crop does. Last year the yields held up quite well; the wheat that received the lower input programme produced the best cost of production by a long way and yield held surprisingly well. Lack of moisture is clearly going to be significant this season which was similar to last year."*

For farmers starting on the journey, this thinking, following the Strategic



**AHDB Strategic Farm Week**  
**1 – 5 June 2020**





getting to a place where the soil starts to work for you rather than against.

No one piece of machinery holds the key, with all involved in the discussions having different types of machinery on their farms. It has more been the use of synthetic inputs and often a lack of organic nutrition, which has created the current reliance on inputs.

We need to start to examine how we look after our soils, so that our crops can remain green for longer when the next dry period appears. It is by doing this that inevitably allows us to reduce our artificial inputs. This webinar was just a start of the discussion and the conversations and research will undoubtedly continue.

To watch the webinar session back, please visit the AHDB Cereals and Oilseeds YouTube channel or link through from: [ahdb.org.uk/sfweek2020](https://ahdb.org.uk/sfweek2020).

For all of the details about the demonstrations taking place at the Strategic Farms this year and the results to-date, please visit the webpages at: <https://ahdb.org.uk/farm-excellence>.

Farm work and asking the questions of research, along with building soils might be a good place to start.

Given the extremes of the last two seasons, some farmers have looked into going back to cultivations when transitioning to a regenerative agriculture system – something that was eluded to several times during the course of the

webinar by both Tim Parton and Simon Cowell.

Managing these extreme weather patterns is often the difficult part when in transition, as you learn to work with or understand the natural systems. It is acknowledged that it is incredibly hard work and often years of change to take soil from a conventional system before

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# COVER CROPS ON TRIAL



AHDB's Technical Knowledge Exchange Manager, Harry Henderson, takes a look at the results from the recently published Maxi Cover Crop research findings and discusses what lessons you can take-away for your farm system.

**Cover crops. You've read the articles of untold benefits of soil restructuring, drainage improving nutrient building, weed suppressing, disease controlling, yield enhancing, resilience building, environment saving, superhero cover crops. You've seen the videos online of drills working in bonnet high cover crops without issue and crimper rolls seemingly doing away with agro-chemical control. It must be a no-brainer to get involved in cover crops.**

But on the 11th May this year the AHDB issued a press release and a 111 page report of a 3-year cover crop trial with the standout comment being; Cover crops were associated with an average gross margin loss of £150/ha across two consecutive arable cash crops. How could this be? I phoned a couple of my colleagues and they said 'It is the experience of many farmers starting out using cover crops'.

Clearly, a further look into the report is necessary and this publication is the place to do it. Does the report have gaps? Sure. Does the report highlight real findings and put some realism into what is an ever-evolving story? Definitely.

So, the AHDB funded a three-year "Maxi Cover Crop" project, which aimed to maximise the potential agronomic, economic and ecological benefits from cover crops through investigating different cover crop options and crop management approaches.

In a recent survey of UK farmers, the most cited reasons for not growing cover crops were:

1. They did not fit with the current rotation
2. Expense
3. Difficulty of measuring their benefit to crop production.

The Maxi Cover Crop project has shown that:

- Early establishment (August rather than September) is important to maximise the benefits of cover crops, particularly to ensure good crop cover and nutrient recovery. Typically, the different cover crops yielded between 1 and 3 t/ha above ground biomass and took up between 30 and 50kg N/ha, although up to 90 kg/ha N was recovered following early establishment at one of the sites.
- Highest N recovery was achieved by using either species that were able to fix N from the atmosphere (i.e. clover and vetch) or establish good above or below ground biomass, early in the season (e.g. radish, phacelia and rye).
- **Rye produced the largest root length early in the season. Phacelia also rooted well although the roots were slower to develop. By the time the cover crops were destroyed (February), phacelia had produced the greatest amount of roots, particularly in the topsoil, and it also had the narrowest roots, suggesting it explored more of the soil for a given root biomass compared to the other cover crop treatments. There was no relationship observed between the amount of cover crop rooting and rooting of the following spring cash crop.**
- Soil structural improvement from a single year of cover cropping was difficult to detect. However, at two of the tramline trial sites with medium textured soils, penetration resistance, bulk density and visual structural scores were lower (i.e. 'better') where cover crops had been grown indicating improved soil structure and workability. Earthworm numbers were also

increased where a five species mix (comprising phacelia, oats, oil radish, clover and buckwheat) had been grown.

- Cover cropping on heavy textured soils was shown that it can result in increased topsoil moisture content, probably as a result of the vegetative cover preventing evaporation from the soil surface.
- Late destruction and incorporation of a high cover crop biomass (< 1 week prior to drilling) resulted in poor seedbed conditions for the establishment of the following cash crop, which led to lower crop yields.
- Cereal cover crops (as a single species) should not be grown ahead of a spring cereal cash crop. At the experimental sites, spring barley establishment, rooting to depth and grain yields were all reduced following oat and rye cover crops. The reason for this is uncertain, but N immobilisation, and pest and pathogen carry-over ('green bridge') have been cited as possible causes.
- A buckwheat cover crop may enhance P availability to the subsequent cash crop. At the experimental sites, there was a trend for higher phosphorus concentrations in spring barley grain following a buckwheat cover crop compared to the control (volunteer/weeds). It is uncertain what the mechanism is for this, as rooting by the buckwheat and total above ground biomass production was low compared to the other species evaluated.
- A single year of cover cropping does not improve gross margins. Nearly all the cumulative (2 year) margins calculated across the sites (20 comparisons) showed a reduction in margin from growing a cover crop compared to no



cover crop (ranging from + £64/ha following oil radish on a clay loam to - £476/ha following a two species mix on a clay soil). The lower margins were caused by an absence of sufficient yield increases to compensate for the additional seed and establishment costs. The benefits from changes in soil physical properties or nutrient dynamics are unlikely to appear within the 2 years of the project so the longer-term use of cover crops over a full rotation (including more than one year of cover cropping) is required to fully assess the impact on margins. Moreover, non-tangible benefits such as improved water quality, erosion control and enhanced biodiversity should be considered as a wider public good.

Tackling that headline statement of £150/ha loss. The operation costs, while representative, are at the top end of where costs tend to be.

Operation	Typical operational cost (£/ha)
Plough and press	58.60
Tine / disc cultivator	42.85
Disc	21.55 – 32.25
Press	23.00 – 27.10
Straw Harrow	19.95
Slug pelleting	2.50
Strip till drill	32.85
Direct drill (disc)	38.55
Direct drill (tine)	32.85
Cultivator drill	38.55 – 41.25
Roll	10.65 – 10.95
Fertiliser spreader	6.65 – 6.80
Sprayer	8.75 – 9.30
Combine	99.60
Plough and press	58.60
Tine / disc cultivator	42.85

The Monitor Farm average for combining is £66/ha for example. And disc based direct drilling varies from £19 to £30/ha depending on how much land you cover with it. So

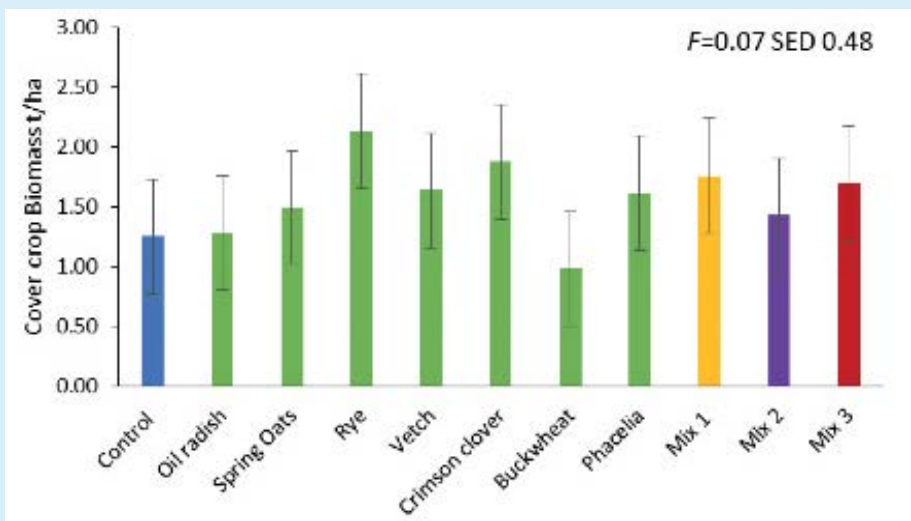


Figure 1. Cover crop above ground biomass prior to destruction (cross site averages). Note the control treatment biomass comprised weeds/volunteers; buckwheat biomass was determined at an earlier sample timing to the other treatments, before it was destroyed by frost.

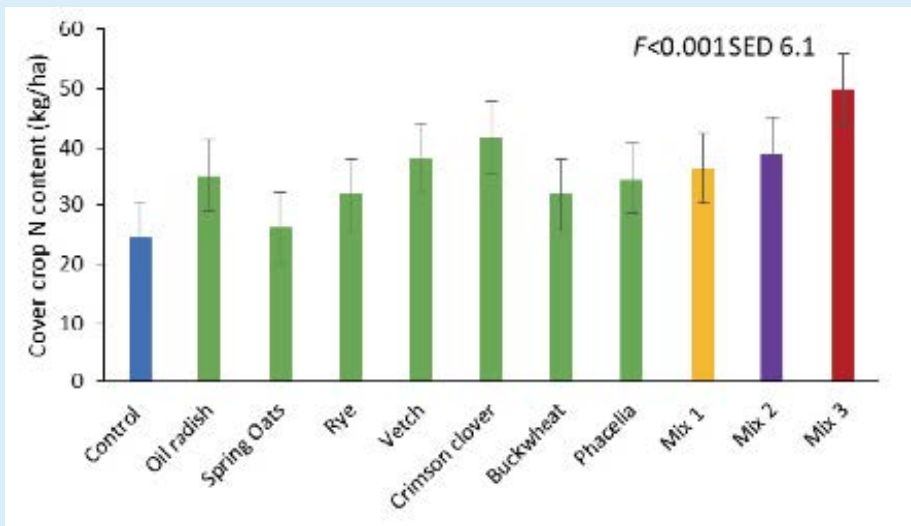


Figure 2. Cover crop N uptake (cross site averages). Note the control treatment biomass comprised weeds/volunteers; buckwheat N content was determined at an earlier sample timing to the other treatments, before it was destroyed by frost.

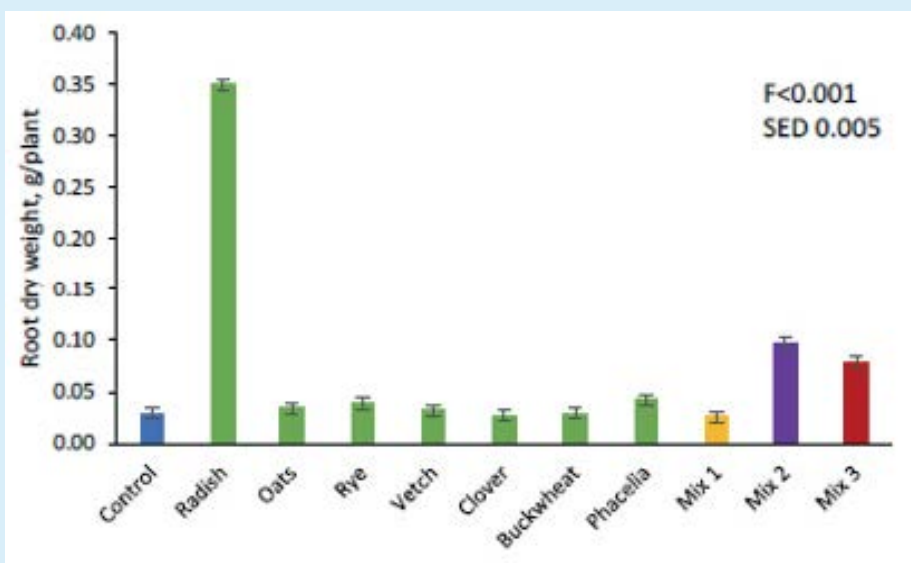


Figure 3. Cover crop root biomass, dry weight grams per plant, after c. two months growth. Cross site averages. Results are an average of 10 plants per plot (12 for mix 2) and include the radish taproot, with results expressed on a per plant basis. 5 plants/species, 4 plants/species and 2 plants/species were sampled from mix 1, 2 and 3, respectively. Sampling was undertaken prior to destruction of the buckwheat by frost.

operation costs used in the trial are 30% more than you'd hope to face.

As an illustration, at the Kneesall, Nott's trial site, the spring oats had the lowest cumulative margin of £879/ha due to a yield reduction of 1.43 t/ha compared to control, (stubble and cereal re-growth) which may reflect the rotational conflict of growing a cereal after a cereal cover crop. The highest cumulative margin was from the oil radish which was £1256/ha, which reflected the higher spring barley yield and low seed costs compared to the other treatments. The control cumulative margin was £1192/ha. The cost of establishment of the cover crop ranged from £65/ha (spring oats) to £118/ha (mix 3 - spring oats, crimson clover, oilseed radish, phacelia and buckwheat).

It's perhaps unfair to expect a cover crop to return on investment from yield improvement alone. Especially in year one. As we have realised at many a Monitor Farm meeting, building soil resilience is a career long objective and adopting cover crops should enable lower machine costs, much lower than used in the trials. Cover crops should also extend working windows and improve surface drainage, but again these are long term aspirations rather than quick fixes.

With all field trial work, while questions are answered, more questions are raised. That well-worn phrase 'more research is needed' certainly stands true in this case. And arguably a greater look into adopting cover crops into a system of changes on the farm, to lower cost, reduce reliance on inorganic solutions and improving overall farm resilience is needed.

Future research suggestions included:

- Understanding the fate of N recovered by cover crops – when this N is released and how much is released. The ability to predict mineralisation rates for different cover crop species grown on contrasting soil types in different agro climatic zones will improve fertiliser recommendations for subsequent cash crops.
- Evaluating alternative methods

Treatment	£/ha margin (2018) (2019)	£/ha margin cost £/ha	Cover crop margin	Cumulative £/ha
No cover	715	478	0	1192
Oil radish	845	478	67	1256
Spring oats	463	481	65	879
Phacelia	746	452	88	1110
Mix 1	698	452	95	1055
Mix 2	785	497	105	1177
Mix 3	653	494	118	1029

*Margins based on spring barley at £175/t; winter oilseed rape at £325t; nitrogen at 55p/kg N (2018) and 59p/kg N (2019)*

### Spring Barley

*Establishment costs at £148/ha; seed costs at £80/ha; fertiliser costs at £77/ha; spray costs at £112/ha and harvesting costs at £100/ha*

### Winter Oilseed Rape

*Establishment costs £230/ha; seed costs £60/ha; fertiliser costs at £100/ha and spray costs at £138/ha and harvesting costs £100/ha*

Species	Seed rate (kg/ha)	Seed cost (£/kg)	Typical cost (£/ha)	Justification for inclusion
<b>Straights (individual species):</b>				
Oil Radish	10	2.91	29.10	Deep rooting and fast growing brassica
Spring Oats (Canyon)	50	0.55	27.50	Cheap and fast-growing cereal
Rye (Inspector)	50	0.71	35.50	Data required for this fast-growing cereal under UK conditions
Vetch (Amelia)	60	1.48	88.80	Large-seeded legume
Crimson Clover (Contea)	10	4.52	45.20	Small-seeded legume
Buckwheat (Lileja)	70	1.84	128.80	P uptake; frost sensitive
Phacelia (Natra)	10	5.03	50.30	Deep rooting, N uptake, semi-frost sensitive
<b>Mixes:</b>				
Spring oats (83%) and Crimson Clover (17%)	36	1.58	56.88	Relatively cheap basic benchmark mix
Oilseed Radish (30%), Phacelia (20%) Buckwheat (50%)	20	3.37	67.40	Compaction alleviation: different frost-sensitivities to provide varying cover
Spring Oats (53%), Crimson Clover (11%), Oilseed Radish (11%), Phacelia (6%) Buckwheat (19%)	37.5	2.15	80.63	To evaluate whether added biodiversity gives additional benefit

for destroying cover crops rather than relying on glyphosate (e.g. grazing, chopping, crimping, rolling). Understanding the limitations of techniques for

managing contrasting cover crops is important to improve guidance for cover crop management and the implications for subsequent cash crop establishment and



effects on soil properties and N supply.

- Evaluating the long-term (multiple cycles of cover cropping) benefits of cover crops. What are the benefits for soil organic matter, soil biology and associated soil properties.
- Quantifying the economics of growing cover crops and the potential income from livestock grazing or the reduction in inorganic nitrogen fertiliser application in the following cash crop.
- This study showed that rye and to lesser extent spring oats resulted in slower development of spring barley early in the season and lower yields at harvest. Further work is required to understand the cause of the cash crop yield reductions (e.g. nutrient availability, disease pressure, etc) and whether cover crop mixes can be developed that do not lead to reduced yields.

This has implications for EFA's which require cover crop mixes to include a cereal and non-cereal.

- In this study, there was some evidence suggesting that buckwheat may enhance P availability to the following cash crop. However, further work is needed to understand the mechanism for this, and given the cost of buckwheat, how much of a cover crop mix needs to be buckwheat for this benefit to be achieved.

While there's lots still to understand, it is a no-brainer that covered soil is good for farming, the environment and will pay dividends in the long term. So a longer term look into cover crops would be the best as the next steps for research.

All three AHDB Strategic Farms in Warwickshire, Suffolk and Fife, Scotland will address cover crops over their 6-year programme and incorporate them into each farms long

term thinking. Make sure you check in either online with the results from these farms as they come through, or in due course, in person.

For further information on cover crops and to download the project report, scan the QR code below:



For further information on the Strategic Farms, visit: scan the QR code below:



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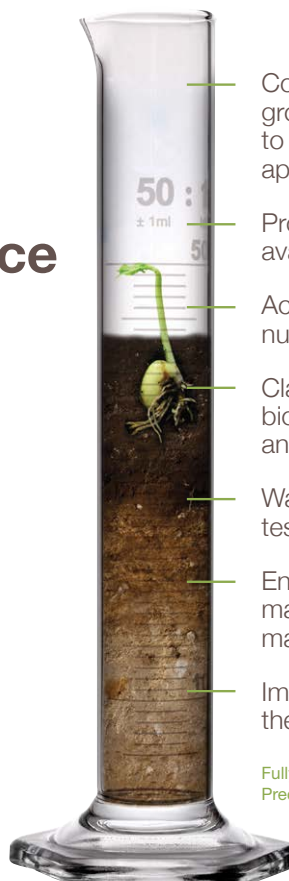
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# DRILL MANUFACTURERS IN FOCUS...



## NEW FLEXIBLE SEEDING OPTIONS FROM KUHN

### Supplementary seeder range adds versatility

KUHN has introduced a range of supplementary seeders that can be fitted to its Venta, Espro and Aurock pneumatic drills to facilitate progressive practices such as companion cropping or apply fertilisers, granular herbicides or slug pellets whilst drilling.

The smallest model in the SH seeder range is the SH 1120, with a 110 litre hopper. In this case, air from the drill's main fan is used to direct product into the venturi to enable it to be applied with seed from the main tank.

The larger SH 1540, SH 2560 and SH 4080 models, with 150, 250 and 400 litre hopper capacities respectively, are equipped with their own electrically driven fans and apply product via splash plates behind the main seeding lines.

All models use KUHN's Helica volumetric seed metering system, as used successfully on their range of mechanical drills, to maximise the accuracy of output. Application rates are controlled through the ISOBUS system in relation to the forward speed of the tractor.

"The SH seeders are an effective way of adding great versatility to KUHN pneumatic drills," says KUHN UK Product Specialist Ed Worts. "With the main drill sowing seed in the usual way, the SH seeder can be used to sow a secondary seed, such as a companion crop used to

suppress weeds, add soil fertility or act as a pest deterrent, for example.

"The SH seeder can also be used to apply starter fertiliser, slug pellets or a granular herbicide such as Avadex, such is its versatility and adaptability.

"In the case of the Espro RC and Aurock RC, which have split hoppers as standard, the SH seeder adds a third application possibility. This allows a variety of applications to suit individual requirements and reduces the need for expensive seed mixtures."

On the larger SH 1540, SH 2560 and SH 4080 models, application rates between 2.2kg/ha and 130kg/ha can be accurately achieved alongside the application from the main drill.

### Adaptable seeder offers cost effective establishment option

A cover crop seeding unit, compatible with a wide range of minimum tillage cultivators and capable of applying all types of seed, or fertiliser, at rates from 1 to 430kg/ha, is available from KUHN Farm Machinery.

The SH 600, equipped with KUHN's Venta metering unit and with the option of 16, 20 or 24 outlets from the distribution head, is designed for uniform seed spread across a 3-9 metre working width. Seed is distributed via discharge plates located in front of the cultivator



KUHN's SH 600 seeder can be fitted to a range of cultivators to create an effective crop establishment option.

roller to achieve optimum soil-to-seed contact.

Precise and simple application rate settings are achieved using KUHN's Quantron S2 control terminal, which aligns output with forward speed. Quantron S2 also monitors seed level and controls fan speed and metering unit speed.

With a 600 litre hopper, the SH 600 has big bag capacity, and the machine is fitted with a ladder and walkway to allow safe and easy access when filling.

The SH 600 is specifically designed to operate with KUHN's Prolander, Performer, Optimiser XL and Cultimer L 1000 minimum tillage and stubble cultivators and is sufficiently adaptable to work with other makes of machine.



The SH seeder range includes four models with hopper capacities ranging from 110 litres up to 400 litres.



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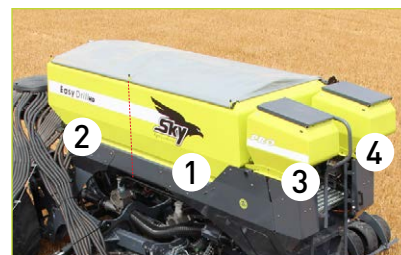
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- ISOBUS ready



Versatile



4 hoppers / 2 depths



2 separate air circuits



Tandem coulter system

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# FARMER FOCUS

## ADAM DRIVER



**What a season we have had! Its years like this when we can really learn a lot about our farming system and what we are trying to do.**

So, it went stupidly wet stupidly quickly. We have had some really easy seasons in the past 5 years where we have been able to drill later for blackgrass control. Can we start drilling earlier again with low disturbance drills now we are on top of the problem? I hope so. Should we be growing catch crops in front of winter crops? I think this can really help mitigate some of the issues with heavy rain, catch crops will pump water in the autumn. It is often claimed they do this in the spring however from personal experience this is not true. For the autumn I think it is far more plausible as the plants are generally growing pretty fast. Soil structure, of course is at the forefront. Better soils infiltrate more water and hold machinery (even big heavy stuff) far better than fluffy cultivated stuff. Good soil structure is at the core of what we are all trying to do and a season like this highlights that even more. There were many horror pictures of soils washing away due to poor soil management on social media. It gets dismissed as the "weathers fault". Not a good enough excuse for me I'm afraid. Seeing these kinds of pictures and the excuses that went with them were frankly worrying and highlighted the lack of ownership UK farmers have of their problems.

**Drainage is something that has come up again with a season like this. With no tilling on hanslope clay soils I think good drainage can be the difference between success and failure. We do a lot of mole draining, often in the spring and the better drained fields look so much better for it in both winter and spring crops. Some of the old drainage systems are starting to really show their age now so we will be looking at ways to either repair or replace them. I have an appointment to view a tractor mounted trencher next week. Afterall, there is loads of free time when you aren't making dust with cultivators for months on end!**

The spring as we all know, was equally ridiculous. There is no way a soil should go from being absolutely sodden to being too dry to germinate a crop in 5 days as some were reporting. Soils just aren't working properly in many places around the country, including some of my own. These extremes of weather do appear to be becoming more regular. We need more resilient soils in order to deal with them.

I discussed with a friend the other day about the regen journey we are both on. He pointed out as farmers we are so used to be able to instantly buy a piece of kit, a chemical or a fertiliser that gets us out of muddle or solves a problem, or it has in the past. What we are doing now is a much longer game. We need to focus on the core principles and not revert in panic if something goes wrong. Over time as we build our soils, gain a better understanding of the soil biology and the

intricate ecology we are working with and share knowledge. Our soils will improve and shelter us from these extremes of weather and volatility of the industry.

What is the solution to all this? Keep learning, keep pushing, keep trying. There are no magic bullets!

*A quick update on crops. OSR, this looks okay and will be ready for harvest in about 7-10 days (its 28th June today). I don't expect it to break any records but has been grown very cheaply, it should offer a reasonable margin with minimal capital risked. Wheat looks average to poor. Spring crops are a mixed bag but generally pretty good. Winter barley looks well and will be harvest next week. I am looking forward to getting this years crop out the way, chasing the combine with the muck spreaders and drill planting OSR and cover crops.*

UK agriculture is at somewhat of a cross roads. A red blue pill, blue pill moment. Whilst it used to be "conventional vs organic", the regenerative group has formed. I have started to try and view the way we farm as treating causes not symptoms, conventional farming has always been about treating symptoms. This has worked well for a long time and done its job. However, we are on a treadmill in which we externalize all of our problem solving. This exports a lot of money from farm businesses. Gene editing is now being pushed by many farmers and the farming lobby groups as some kind of saviour to post Brexit farming. They promise amazing advances such as nitrogen fixing wheat, disease resistant crops, drought tolerant crops (why we need drought tolerant crops in the UK proves how bad our soil management is!), gluten free etc. These are supposed to be provided by small UK companies. This is all well and good, but how will those companies avoid the clutches of bio-tech giants they could theoretically put out of business? It is a lovely thought that small UK seed breeders will provide wonderful traits for the benefit of the population, but I fear they will be bought out very quickly by corporate power of the bio-tech companies. What GE (and GM) are essentially trying to do is fix problems from our reductionist approach to agriculture. The Green Revolution was touted as a scientific marvel but here we are, with the same problems and awaiting more answers to be provided to us. GE is just a continuation of the treadmill, the treatment of symptoms rather than causes, how long until GE traits get resistance? Not long if you look



at what's happened to chemicals and GM. I will be called a luddite and anti-science for saying all of this, however was it not Albert Einsetin who defined insanity as, "doing the same thing over and over expecting different results"? We are also constantly told we need to 'feed the world', this is one of the biggest marketing plays pushing conventional reductionist agriculture and farmers fall for it day in day out, thus staying on the treadmill. The problem of feeding the world is not one of production, it is of distribution, politics and economics.

On the other side we have regenerative agriculture. I view this as a systems-based approach harnessing nature and understanding soil biology and plant nutrition. We all know farming has been based around the physical and chemical since the green revolution, the biological side of things has been completely forgotten until recently. Great in-roads are now being made by farmers around the world and in the UK. The problem many have with this is the simple trials we are so used to, for example X fungicide works better than Y fungicide on this variety do not work on the highly complicated ecology and biology of the soils we are trying to harness. If a trial does not say 'do this' we don't do it, its not scientifically proven right? By taking this route we begin to understand how to solve problems. Why does this crop of wheat need five fungicide sprays? Because it is nutritionally unbalanced because the soil biology is not working, because we have pumped it full of ammonium nitrate. Why do we get this weed? Because we have made the growing environment perfect for it because of our agricultural systems. Of course, none of this is quick fix, as said before there are no magic bullets. But an approach to farming that revolves around harnessing the resources we have, soil, air, water and sun in a sensitive manner for me is the only way forward. We need to be using less chemicals. They are expensive and have unknown side effects, especially to the soil biology and nutrition we are trying to work with. We need to use less soluble fertiliser. Nitrogen use efficiency is very poor on UK farms and it has consequences for the environment. Most importantly for me, as a professional farmer running a business, all this stuff is very expensive. If we can even reduce the amount of bought in inputs by a quarter to half that we use over the next five years imagine how different financial results will look?

*Which pill to take? The red pill is a continuation of the treadmill of reductionist 20th century farming where we buy in our solutions which only treat symptoms. Year in year out we do the same thing until resistance or revocation stops us. We then hope we can buy something new to replace the previous failed solution. Great for the people selling the gear, not so much for the farm finances.*

The blue pill revolves around finding out the how to solve the causes of problems ourselves. It requires study and knowledge exchange, a degree of bravery and a totally different mindset.

It is taking ownership of our production system. It is a mixture of art, science and gut feeling. It is a slow burner and you will not instantly see dramatic results. Over time, as proved by a growing number of farmers in the UK it does work.

**The future is incredibly exciting for us. Things like BPS going become trivial when you really start to change your mindset into a regenerative one. If only the industry as a whole spent as much time and money on researching how to harness and improve soil and biology as we do moaning about the loss of neonics and demanding GE, just imagine where we could reach as a collective.**

Bring it on, lets make our own luck and reclaim ownership of our agriculture.

### Some useful extra reading

'Chasing the Red Queen' Andy Dyer

'Altered Genes, Twisted Truths' Steven M Druker

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# FARMER FOCUS

## GEORGE SLY



### A lot learned from a tough year!

Our farm in the South Lincs fens is partially above and partially below sea level. Last winter certainly had its challenges, we had flooding on some fields, flooding in my parent's house and no winter crops on the farm. It was a long winter to ponder decisions for this spring. But in times of despair its often a good point to reflect on how to make changes and adapt for the season ahead. Drainage is something we will be looking ever closer at, but not in the form of all new plastic pipes. We have fantastic drainage systems in the Fens and I can only feel for the farms in the west with the floods.

Our wheat harvest was pleasing and disappointing in many ways. I have realised how important timing is on spraying, having only farmed 2 years I must admit to being a little blasé on timings. All of our wheat was no-till after forage Maize or Beet and we did have Septoria and Fusarium issues which I believe cost us 1-2T/Ha overall. It had potential to be one of our best yields. As a machine maker and Farmer I should tell everyone its all perfect, but we all know that is not true!

Our Sugar Beet and Maize proved to be a big success in terms of margin. Maize for us is a crop that we are using to try and supercharge soil health. As hard as that is to believe we utilise August until end of April to grow big cover crops,



*Rape with clover understory*

maize being a fast growing C4 plant means we can almost have the best part of the year doing soil improvement work but still make the return we need. Using strip till we keep harvest damage to a minimum and usually don't require any herbicides, insecticides or fungicides other than Roundup at 3L. If we can drop the Nitrogen its organic electricity!

Running a multitude of businesses has its stresses and strains and I have certainly realised how stressful farming can be. In 2-3 years having the hottest summer ever, longest drought, biggest flood etc etc. But we are very lucky to be working in nature.

### Clover Companions with row crops – can it replace synthetic nitrogen? Ongoing work...

We have finished a 2 year cycle with clover in row crops. Starting with Rape, then maize and we will now try some wide spaced winter cereals. We used a broad leaf white clover. We established it in June (after forage triticale) then drilled rape 25cm left or right of it, then harvested the rape. We then grazed with sheep hard. Then established Maize into it after trying various chemical and mechanical suppression techniques. Im really encouraged by it, we have seen some rather unexpected positives and negatives. But we will keep this 2 hectare trial running for 7-10 years in



*Maize with inter-row mulch, no herbicides*





Maize with clover understory

the hope we will find a system that can work long term. (photos of clover in rape and maize)

## AGROFORESTRY: decision made!

After a long dreary damp winter, I looked at various options for our farm to plan it from now until 2060 when I hope to hand it on to my son. I am 34 years old, and such a decision takes a lot of thought. After many deliberations and a lot of research I have decided to put the farm into an Agroforestry system, incorporating Perennials (Trees and shrubs) with Annual crops. This will be implemented starting in Winter 2020-2021 with the first 30 hectares, and we aim to complete the planting by 2027. The system design for agroforestry has taken me almost 5 years to plan, initially having being inspired by Stephen Briggs farm nearby and a lot of inspiration from Martin Crawford and the late Martin Wolfe. I was lucky to be able to visit some farms practicing agroforestry in the UK, France and the USA to gain some experience and learn about some pitfalls to avoid.

*Many people have said to me, George that sounds very risky. But I look at what we do now as reasonably high risk. Another interesting fact when planning the Agroforestry, big is not necessarily better. It would work better if we had maybe 200 acres less for my system. May this be an opportunity for farm sizes to decrease again? Probably not... but it was interesting to come to the thought of reducing in size.*

Our system will involve 24 metre alleys of annual crops or rotated pasture with 4 metre under strips. We will lose around 9-11% of our land in total to the tree strips and

grass strips. When I say lose... they are far from a financial loss. When the planting is complete we will be growing I believe 3-4X the human consumable calories/nutrition per hectare compared to our current system, we aim to be energy positive and carbon negative (meaning we will sequester more carbon than we emit and we will generate more energy than we consume). We will produce fruit (for drying and fresh), nuts (whole, cracked, oil, flour), berries (dried), medicinal extracts, cereals, meat, energy and building materials. We will monitor the nutritional output per hectare, calorific output per hectare and hopefully link all of that to some metrics/tracking/indices.

**Protein... There is a lot of talk about Veganism, anti-meat etc. One reason we will plant nearly 2000 nut trees is that I want some of my customers to be vegan. I am not vegan, I will never be, but I want to embrace veganism and produce products to welcome them. At the same time we will turn our most successful crop (grass) that we cant digest into meat. We hope to integrate poultry in 2026 and rotate them around the agroforestry lanes.**

People have said to me, what would that do to the value of our farm? For one I have decided I wont move (even if the sea comes over the wall in 2050) I am here to stay for my life. When you realise that, the value of the farm is irrelevant, and decisions get a bit easier. It will be my son's issue. Secondly, a diverse, rich, balanced eco system is a very saleable asset and its value will grow in the future. The fens is a funny old place, flat, drained, to a certain extent man made. But it has its charm!



Martin Wolfe's Agroforestry visit

We plan to market the above ground carbon privately to industry as-well as offsetting our emissions from other businesses we own.

In future articles I hope to write more about the tree species we have chosen, why and how we plan to market them and in what form. Anything I have learned and will learn on our farm is available to others and always will be. We have such exciting fortunate possibilities in UK farming for the next 50 years and we should be excited and smiling even if it's a bit tough at the minute.



# SOIL WORKSHOPS AT THE OXFORD REAL FARMING CONFERENCE 2015

Editor Mike Donovan recalls the talk on soil at the 2015 Oxford Real Farming Conference by Bruce Bell of the Scottish Agricultural College. Delegates were asked to bring soil samples so Dr Bruce might analyse them, and the event proved so popular the room in the Town Hall was packed. Unfortunately many farmers thought it a competition to find the best soil and so he was confronted with some examples of the best in the country. A few, including your editor, decided to take samples of poor soil, and the advice was very helpful.

## Visual evaluation of soil

Bruce Ball specialises in soil physics and soil management at Scotland's Rural College, and concentrates on compaction, structure, and porosity.

Bruce says "Visual evaluation is something any farmer can do, without involving expense." Evaluation can suggest remedial action.

Bruce told his audience that soil is made up of 45% minerals; 25% air; 25% water; 10% organic material; 10%

roots and around 8% humus. Ratios vary through poor structure and soil type. Evaluation involves extracting and inspecting a block of soil.

He said Tom Batey, a farmer who has been an inspiration to him, tells people to "observe and let the soil tell its story".

Comparing soil from the the centre of the field with a block taken from under the fence line, corner, or other area of the field not rolled over with a tractor and/or heavily treaded by cattle

is a useful exercise to see the damage which has been created over the years.

Soil block extraction Dig at least a spade spit deep, and more if the field has had some deep cultivating and heavy traffic on it. The block needs to be about 6ins wide and be lifted out carefully and placed on a plastic sack. If the soil is hard it might be necessary to get the block from the side of a previous hole.

What to look for If the block has a uniform structure the signs are good,

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Bruce Ball, SAC, gets his hands dirty in the soil workshop, but unfortunately many farmers presented their best rather than their damaged soils which were in many respects less interesting.

but you need to take more than a passing glance. Soil that has been affected by traffic and other use will have horizontal layers of different structure. The depth of these layers needs measuring and noting down.

Breaking the soil in the block reveals more information. The first stage is to move the block on the bag gently and see how and where it fractures. This can show layers which may not be first visible, and you can then pick out lumps from different depths of the soil and take a look at their shape. Breaking lumps into 1/2in - 1.5cm - fragments will show whether their porosity, root patterns.

Shape of soil pieces It's obvious that you want to see the soil as it is present in the field, so parts that have been squashed by the spade and boots are not representative. Similarly when handling the need is to do it gently. Angular patterns, smooth surfaces rather than pitted indicate problems.

Plant roots in the block indicate the quality of the soil. Roots that are clustered, which turn at sharp angles, that are thick and short all indicate soil problems.

Soil colour is very important, as that which has been starved of air goes grey, and can smell of sulphur and quite frequently there are ferrous ions present as well. Colour varies with the mineral type.

Soil smell is another useful measure of structure. He described three different smells - like leaf mulch, a kind of woodland scent; like old compost which is perhaps slightly more acidic;

sulphurous with a hint of rotten eggs in there, and it is the last which indicates problems.

### Soil scoring

**Scoring the sample starts with the ease of block extraction, the aggregate shape, roots, colour and the ease of fragmentation. Soils have a wide variation of types and qualities, and there's no point in expecting yours to compare with the best - unless it is the best! All are susceptible to damage, and the damage will show itself in the same manner in each type of soil, which is why visual evaluation is viable.**

### Improving damaged soils, remedial methods

Bruce had less to say on the remedial work - but then his talk was on evaluation. Yet putting soils right was perhaps the reason for many of the audience being there.

Sward lifter warnings He had some words of warning about sward lifters - the Sumo is being well advertised and we featured a home designed one from Gwyn Scourfield, in Whitland. Good grass swards have prime roots which go down a long way. If a lifter is pulled through it the roots get cut and this obviously damages the plant and so reduces grass yield. Lifted swards are also more susceptible to poaching, as the soil can be quite aggressively moved upwards, leaving it less capable of carrying weight.

Aeration with a spiker Bruce explained the value of getting air and moisture into the soil. He said that aeration was valuable, and put up a

picture of the aerator your editor made in 1988! Spiking can't harm soil. Spiking is less drastic than subsoiling and sward lifting. If the soil is damp and smears, the slits are going to be less effective than if the soil breaks like scooping cold ice cream. But the soil which is dry takes a lot more weight to get the spikes in. We used the spiker once or twice a year over the whole farm, but were far too ignorant to understand the value of digging holes and looking at soil strata. I would probably have been horrified at what I was looking at. Aerating worked well absorbing rainwater after thick slurry spreading. Heavy rain all day was going to wash the slurry into the stream, which was monitored less than a mile away for pollution. The spiked holes absorbed had the rainwater and slurry - result: a saturated field which took 10 days to get dry enough to plough, but no officials called!

Getting the camera out Taking pictures over a period of years will show the changes that happen over time and Bruce says it can be a simple way to keep a check on progress.

### Broader issues

The trend has been for farmers to rely entirely on soil sampling and analysis, generally done free of charge by their fertiliser supplier. The pH, NPK and S results are a long way from what can be provided to guide the farmer to the most effective ways to manage their soil, not simply for the crop they are planting, but for crops in the future.

*This report first appeared in Practical Farm Ideas Vol 23-4 Winter 2014-15.*





# IS MAGNESIUM THE MISSING LINK?

Compelling reasons to take a good look at Mg levels in your soils and methods of raising them

*Written by Jon Williams from [thesoilexpert.co.uk](http://thesoilexpert.co.uk)*

The result of over 700 detailed soil samples in West Wales has consistently shown a shortage of magnesium with 70 per cent of the soils depleted on the clay colloid and 48 per cent showing a shortage in the available form, and unless we carry out a detailed soil analysis this major nutrient deficit cannot be corrected.

Here we consider some of the possible reasons how we have come to this situation in UK soils. For the last 70 years we have focused on PH, available P, K, Mg and the fertiliser industry placed great emphasis on the P and K without consideration for the Mg (Ref Kirkby and Mengel 1976). There is now increasing evidence of the occurrence of magnesium deficiency symptoms showing up in crops and plants which will affect crop yield and quality. [1]

## **Soluble Mg fertiliser is a recent discovery**

**One of the reasons for this was that there was no soluble magnesium fertiliser available in the UK until 30 years ago when bulk powdered Keiserite Mg So<sub>4</sub> arrived from a mined source of naturally occurring rock from Germany.**

However this was difficult to spread and sales of this soil amendment product did not take-off until a granular version arrived 20 years later, but still no manufactured compound fertilisers made in the UK contained Magnesium.

Today Keiserite, magnesium sulphate and Magnesia Kaniit 27%Na 11%K, 5% Mg, 12%S are available in the UK and both are approved for organic farms with derogation but there are still no compound fertilisers containing magnesium.

## **The role of Magnesium**

Magnesium has a key role in the formation of chlorophyll and acts as the anchor for Nitrogen in every cell of chloroplast both of which help to create the dark green colour we associate with a healthy plant.

However its major role is in enabling the phloem of the plant to easily transfer the products of photosynthesis, sugars down

into the roots. A magnesium deficiency results in a plant with excessive leaf growth in relation to root growth and the sugars stuck in the leaf which makes the plant very light sensitive and reduces the potential of the plant to transfer Co<sub>2</sub> via sugars to the roots and hence to the soil.

As a main component of Chlorophyll it has a key role in the production of ATP the energy storehouse of the plant and activates more enzymes in the plant than any other nutrient.

So magnesium is both a structural component of chlorophyll and needed for its bio-synthesis.

## **Soil analysis methodology**

To make an accurate assessment of soil levels of magnesium as well as the other major nutrient calcium a detailed soil analysis is of paramount importance for a healthy aerobic living soil and good major nutrient balance and the important ratio of Ca/Mg established by Dr William Albrecht

A healthy soil needs to have a total of 80 per cent of the clay colloid dominated by these two nutrients with the ratio being dependent on the soil texture for example a heavy clay soil having 68 per cent calcium and 12 per cent Magnesium. The detailed analysis will also provide the CEC (Cation Exchange Capacity), organic matter content and sulphate levels as well as the percentage sand, silt and clay content and so can be used as a management tool to bring balance and harmony to the living eco system which is the soil.

## **How to amend the soil levels?**

The soil amendments of these major nutrients are based on the liming agents either Calcium Carbonate or Dolomitic limestone depending on the results found on the clay colloid and what the soil texture is in any particular soil. Where the levels of calcium and magnesium are low Dr Albrecht stated that the liming agent needs to be applied in volume as with bulk lime. Raising the levels of these two major

nutrients will optimise soil microbial life.

However where levels are nearer to the optimum and for farmer convenience and easier spreading granular versions of these products are now available and so they can be used on an annual basis to keep soil levels at optimum for maximum yield continuously instead of letting levels drop and making amendments of these major nutrients every five years or so as was the practice in the past.

However the situation on many farms is that Calcium levels are good and Magnesium levels low or very low. The only option in these circumstances is to provide essential magnesium using Keiserite Mg So<sub>4</sub>. When the Calcium levels fall the soil will need both calcium and magnesium, at which point it will benefit from the Ca and the Mg in Dolomitic lime which comes with a ratio of 2 parts Ca to 1 Mg.

It must be noted that Keiserite supplies Magnesium in a soluble form and so will not build soil reserves on the clay colloid which is needed for optimum soil health.

## **Essential points to note**

Ensuring that magnesium is at the optimum level for your soil type will enhance the availability of phosphorus and in particular locked-up phosphorus. Over 90 per cent of soil tests show P at very high levels. The shortage of magnesium may well be what has brought this situation about in the soils of West Wales.

Releasing this phosphorus will increase the Brix index of the plant (sugar level) resulting in the plant having greater frost resistance and therefore a longer, more productive growth phase in every season.

A detailed soil sample which guides us to the correct levels of these major nutrients is essential for efficient nitrogen use. This results in a reduction of the environmental impact of applying synthetic nitrogen fertiliser resulting in lower costs for the farmer and an environmental benefit: a win-win situation.



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Magnesium has a key role in the enzyme activity in the plant affecting 800 enzymes and has a similar role in the human body affecting 300 different enzymes including enzymes that bring about the phosphate transfer into ATP production. It can be termed as the key that starts the whole engine!!

### It is all about balance

Excess Magnesium (Mg) will reduce the aerobic level of the soil and can lock-up Manganese (Mn) which can lead to Take-All in Wheat and too high a PH created by excessive levels of these two nutrients, Calcium and magnesium can reduce the availability of copper and zinc as well as manganese.

Magnesium is particularly important in the reproductive growth phase ensuring optimum fruiting of the plant. It particularly benefits the growth of legumes.

Magnesium uptake is usually between 10 and 25 Kgs per hectare per year, which is a similar amount to sulphur. Magnesium constitutes 50% of the plant's protein level as the result of holding the Nitrogen in the leaf.

Understanding the essential need for the adequate supply of magnesium in sucrose translocation is highly relevant for sugar beet and fodder beet production.

Magnesium uptake can be inhibited particularly in acid sandy soils with high aluminium levels as well as hydrogen and manganese ions.

High plant magnesium levels are needed in drought conditions or in soil with high potassium levels. The balance between potassium levels and magnesium levels is best in equilibrium in the soil.

With excessive use of nitrogen under stressed conditions a magnesium deficiency can occur and research still needs to be carried out to find out why.

A shortage of magnesium in the crop can be amended by a foliar feed after flowering to boost seed formation and fill but is best repeated every 5 weeks.

It is still not known to what extent magnesium status of crops must be raised to counter stress events which will undoubtedly increase with global warming. [2] as magnesium ensures a balanced plant with good root formation to support the above ground plant material.

**So magnesium can only be considered as being a major nutrient for optimum soil and crop performance and I suggest that we all take steps to monitor this nutrient for the more efficient use of nitrogen and to maximise carbon sequestration in the soil by carrying out a detailed soil sample using the Albrecht philosophy developed after 36 years of soil science research.**

The benefits for human health of adequate magnesium in the diet are such that we can boost our energy levels, have a clear mind, reduce stress, and with the stress related impact of the current health crisis yet to be assessed from the effects of lock-down and social isolation it is certainly highlighting the benefits of adequate magnesium in the diet.

Research is suggesting that half the UK population are deficient and so the overall benefits to the well-being of the health of the people is paramount and farmers have the responsibility to ensure soils have adequate magnesium if they are to be considered custodians of the soil, the environment and the people they serve producing quality food for the nation.

[1] Institute of Integrative and comparative biology at the University of Leeds

[2] Cakmak and Kirkby 2007

*This article includes information from a conference organised by the International Potash Institute and the International Fertilise Society and Sabanca University in Cambridge, UK on Dec 7, 2007*



# MODEL APPROACH TO IMPROVING SOIL HEALTH

*The challenge for UK agriculture is to build a sustainable and profitable future under a changing support structure, and restoring soil health to vast acreages of farmland will be key.*

That's certainly the view of Rob and Jo Hodgkins, who as educated self-starters in the farming industry have experienced first-hand the damage reeked over recent decades by modern large scale agricultural practices.

Both Nuffield Scholars and graduates of the Worshipful Company of Farmers' Advanced Business Management programme, the couple are committed to a farming methodology that has soil health at its core. Their approach includes the integration of livestock back onto arable farms, with cover crops included in a rotation that can see as many as six profit-generating crops grown in a four year period.



Field Options' Eco-Pasture legume and herb rich mix qualifies as a specialist GS4 mixture for Countryside Stewardship and delivers outstanding performance in terms of livestock output.

"We believe there is a sustainable business model that can work for a great number of arable farms, particularly where significant areas are compromised by poor soil health or by issues such as black-grass," says Rob. "However, it requires a real change of mindset and a fully committed approach to be successful.

"Through our own experiences, we've taken land with significant weed grass problems and poor soil structure – land that has been plundered for 20-25 years – and turned it around, making a decent return in the process."

Rob and Jo started with just 60 acres and 200 cull ewes back in 2013 and have now built their Kaiapoi farming enterprise that currently includes

1,600 arable acres and 1,000 acres of grassland in north Hertfordshire, all on Farm Business Tenancy agreements, and 2,500 New Zealand Romney ewes. They have developed a system with a four year arable rotation, alternating winter and spring crops to help combat the inherent black-grass infestations. Cover crops are grown in between winter and spring crops, providing over-winter grazing for ewes and finishing lambs.

"We tend to follow a winter cereal with a cover crop mixture of 100kg/ha of winter oats and 5kg/ha of berseem clover, direct drilled into the stubble straight after the combine," says Rob. "The earlier establishment makes all the difference and creates a forage crop that ewes and fattening lambs are turned onto from September."

Around 200ha of over-winter cover crop grazing is supplemented with an additional 80-90ha of stubble turnips grown on a neighbouring farm.

*"We like the stubble turnips for what they provide in terms of winter fodder but we're in an area that suffers badly with flea beetle so find them very difficult to grow," adds Rob. "Our neighbour grows a lot of winter barley, which allows earlier drilling of the stubble turnips and this seems to make all the difference in terms of establishment."*

The combination of cover crops and sheep make a valuable contribution to soil health and fertility, adding an estimated 35-50kgN/ha of available nitrogen for the following crop, in addition to building soil organic matter.



Cover crops such as winter oats and berseem clover are drilled directly into stubble straight after harvesting winter cereals.

"We don't aim to graze the cover crops to the ground as we prefer to leave some crop residue on the surface," says Rob. "Overall, the cover crops offer great flexibility and create options

"This year, for example, we've been able to establish winter wheat in January following the cover crop, effectively turning what would have been a spring crop into a winter crop. "That's potentially going to be really beneficial this year looking at the value of winter cereals."

## Sheep genetics

Key to the success of the system, according to Rob, is having the right sheep genetics. He's an advocate for the New Zealand Romney, a breed that he rates due to its low maintenance characteristics, resistance to foot rot and its ability to be lambed outdoors with minimal trouble, achieving 170-180% lambing percentage.

"Our system relies on a sheep breed that we can lamb outside, so we have little requirement for buildings, infrastructure and bought-in feed," says Rob. "We also don't need straw for bedding, and that's good because we aim for around 90% of it to be chopped and spread to go back into the soil as organic matter."

Rob describes his sheep as 'Arable Romneys', and that's because they fit around the arable system, with lambing taking place in the early part



of April when there's a window of opportunity between routine arable operations. Also, with cover crops that cost as little as £30-£35/ha to grow

*Rob and Jo Hodgkins have been honing the New Zealand Romney into the ideal 'arable sheep' requiring low levels of inputs and minimal infrastructure.*

providing ample winter feed, there's no compulsion to sell lambs off the farm early, so instead the strategy is to make the most of what are typically better prices for finished lambs in January and February.

### Quality grazing

Another key element of Rob and Jo's system are five-year herbal leys, grown as legume and herb rich pastures as part of a Countryside Stewardship Scheme. Within their 1,600 acre enterprise, around 300-400 acres will be down to herbal leys at any one time, these providing all the grazing from lambing time though to September when the sheep move onto the cover crops. Whilst there are some restrictions around what is grown and how the leys are managed, there are significant support payments – in excess of £300/ha – and additional grants available to fund infrastructure.

Specialist GS4 mixtures are supplied by Field Options and have been developed with maximum productivity as well as compliance as joint objectives. Testing is carried out at Field Options' trials site at Harper Adams University, where the best performing mixture, Eco-Pasture, produced 1.3 tonnes of dry matter per hectare more than Field Options' leading long term mixture. Put in terms of output potential, this equates to 1,300 extra grazing days or more than 300kg of additional

liveweight per hectare.

"With the leys unstocked over the winter, we are lambing on covers of

1,700 – 2,000kgDM/ha, which allows us to keep the ewes and lambs tightly stocked and this minimises the risk of separation. I'm sure this helps to boost lamb survival rates and – with the quality of grazing available – they do well.

"We split fields into four or five areas with electric fencing, to rotationally graze, which maximises utilisation whilst also allowing us to comply with the requirement for a five week environmental rest period."

### Adopting a model approach

With Rob and Jo's combined expertise, the Kaiapoi enterprise is developing into a sustainable and profitable business. It's an approach that they believe has merit in the wider arable farming industry and they



*A Vaderstad Rapid drill is used across the arable acreage and to establish cover crops in a variety of seedbeds.*

have demonstrated this through a comprehensively costed model.

Taking a 1,400 – 1,600 acre arable unit as an example, they have shown how putting the least productive 300-400 acres into a Countryside Stewardship Scheme – and integrating cover crops into the remaining arable rotation – can create the platform for a 1,000 ewe enterprise.

"We recognise the importance of expertise and have costed in a full-time shepherd and also allowed for capital expenditure on vital equipment such as a handling system," says Rob. "By taking advantage of Countryside Stewardship, and ensuring you have the right breed of sheep to complement the system, this can be a profitable way forward.

"I think there are a lot of farms where the worst performing 15-20% of the arable acreage is generating minimal profit, due to issues such as poor soil health or weed grass infestations. Integrating livestock into the system in the way we're outlining may well be the best way to go."

### Continuing innovation

With the commitment to building on their philosophy of six crops in four years, Rob and Jo are continuing to develop ideas and technologies to improve their system.

Working closely with Trimble and the company's RTK system, their latest innovation is a 12.5cm inter-row hoe that has the capability to take out weed infestations in a spring cereal and allow the establishment of clover in the crop.

"The aim is to sow just before the point of canopy closure, allowing time for the clover to establish," says Rob. "Once the spring cereal is harvested in August the clover will grow and provide a short term grazing crop for one or two months. It's then sprayed off and a winter cereal is direct drilled in good time.

"It's an idea we're looking at and is, as yet, early days, but we're hoping it'll be another way to accelerate the improvement of soil health and fertility whilst continuing to drive profitability."



# NEW US COVER CROP INFORMATION MAP CENTRALIZES RESEARCH AND FARM TRIAL DATA

As interest and integration of cover crops accelerate across the world, the industry has been challenged in its ability to provide easy to access, comprehensive information. Recently, a cover crop application company in the USA called GO SEED have developed the Cover Crop Information Map to provide a free, centralized platform for knowledge exchange.



Scan the QR code to access the site from your phone or device

"The Cover Crop Information Map is a free resource for agricultural producers, researchers and industry influencers wanting access to unfiltered, raw research data and methodology to help them translate and apply findings to their own trials and practices," says Jerry Hall, director of research for GO SEED.

Found on [gocovercrops.com](http://gocovercrops.com) and featuring an interactive map of the United States, users can narrow down available research and farm trial findings based on their geographical region and topic of interest. For example, clicking on the topic section 'Nutrient Management' drops pins on the map where research and trials pertain to this topic. Clicking on an individual pin will take users to a summary page highlighting what the study was about before taking them to the full literature.

"The Cover Crop Information Map currently has more than 200 pieces of research and trial summaries on 26 different topics such as compaction, forage for livestock and planting green. While the platform will be continued to be populated with previously published work, it also features the ability to add a pin, allowing individuals to add their own research and trial findings," says Hall.

For the last 10 years, Rick Clark of Clark Land and Cattle near Williamsport, Ind., has been integrating

cover crops into his 7,000-acre corn and soybean farm to reduce inputs. His continued learning and adaptation of practices has resulted in a zero-fertilizer input system and a nearly 50 percent decrease in farm diesel since 2011 without jeopardizing yield. An adamant proponent of planting green into living cover crops to maximize their nutrient contribution potential, Clark's data is featured on the Cover Crop Information Map.



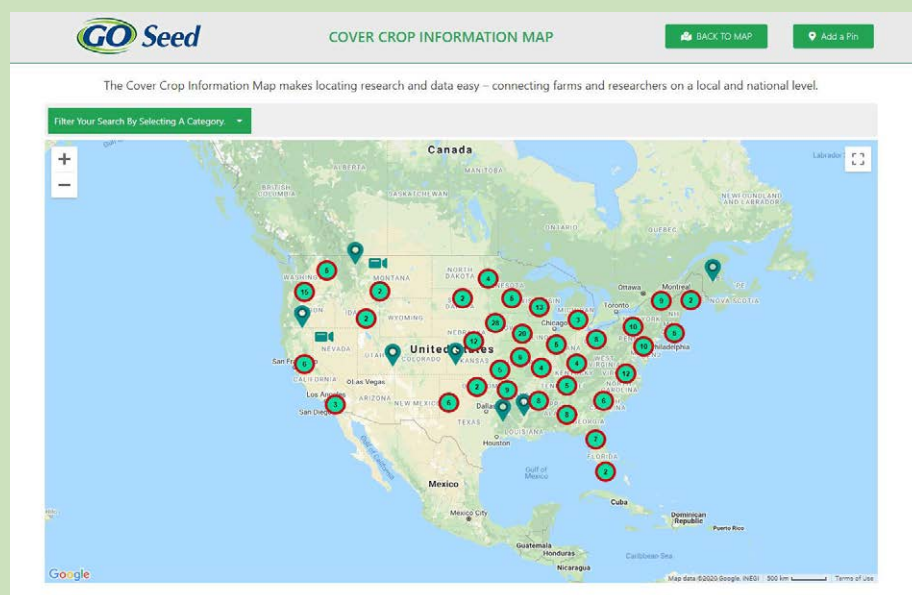
Scan the QR code to read Clark's data

"This platform is a great resource for producers wanting to get an idea of what is possible through the use of cover crops whether it be looking at published research or feature farm trials," explains Clark. "The raw data

provided will allow producers to adapt findings and management practices to suit their own unique geographical challenges and business needs to have greater success with their cover crops."

For Illinois corn and soybean farmer Andrew Reuschel of Reuschel Farms, the Cover Crop Information Map will be a useful tool to learn how other producers throughout the country are utilizing cover crops. A Soil Health Partnership Farmer, Reuschel and his father have been utilizing cover crops for nearly 20 years on their 1,200-acre farm near Golden.

"We started with a very conservative approach to cover crops by planting cereal rye before soybeans to help control erosion. For a long time, we were like a ship without a compass – it took us a while to figure things out. Fast forward to present day and we are planting our corn and soybeans green, inter-seeding into corn and utilizing mixes with up to



30 species. This has been a gradual process through speaking to other farmers about their experiences and then implementing multiple farm trials to find out what worked best for our system," says Reuschel. "I'm excited this resource has been developed to help educate people about what can be achieved with cover crops, and more importantly, linking them to on-farm implementation."

According to Rob Myers, Ph.D., a University of Missouri agronomist and regional director of extension programs for Sustainable Agriculture Research and Education (SARE), the Cover Crop Information Map provides a unique opportunity for users to identify research in their own area.

"The Cover Crop Information Map has very helpful links to some of the research projects conducted on cover crops across the U.S. This should be a good resource for anyone seeking information on cover crops for their particular region or who wants to look



at a sampling of cover crop projects from across the country," says Dr. Myers.

With a significant proportion of research being hosted behind paywalls, Hall says the Cover Crop Information Map will allow farmers to see what kind of research is being conducted outside their immediate area.

"It is our hope and desire that the

Cover Crop Information Map on [gocovercrops.com](http://gocovercrops.com) can bring more transparency and, as a result, will lead to even greater creativity in future research projects both at the university and on the farm. By sharing knowledge, we all can learn so much more," concludes Hall.



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# THE ANIMALS TO ARABLE CONFERENCE – THE KEY TAKE HOME MESSAGES

Despite a break in the weather making top dressing and spraying a possibility for some, over 100 farmers and industry members made the trip to Elveden Village hall (near Thetford) last Wednesday (4th March) to hear from a range of speakers about the possibilities and benefits of mixed farming.

Hosted by Tom Chapman, Head of Regenerative Farming at Innovation for Agriculture (IfA), an agricultural charity set up in 2013 to bridge the knowledge gap between research and on-farm practice, the event acted as a 'one stop shop' for those looking to solve problems such as blackgrass, poor soil structure, and tight rotations.

In terms of farming sector, the majority of attendees were from mixed farms but were still running livestock and arable as separate enterprises and therefore were looking for advice on how to integrate the two into one system. Other attendees included arable farmers who were considering making the switch, and livestock farmers looking for farming partnership opportunities.



## Stephen Briggs, IfA – Soils & Carbon

Kicking off the conference with a bacon roll, the first speaker was Stephen Briggs who is an organic farmer from Peterborough and also head of the soils department at IfA. Stephen started with a sobering statement that the UK agricultural industry currently faces an annual £1.44bn economic loss from soil degradation. With this in mind, Stephen then asked the attendees who would still be farming profitably without the support of farm subsidies; only 8 farmers raised their hands. Next Stephen asked who suffered from blackgrass on their farm. Over 70% of attendees said that they did. From this Stephen stressed that these farmers “do not have a blackgrass problem, they have a soil problem”. Stephen stated that soil is the most undervalued resource and reminded farmers that “soil is refillable; it's not too late”. His key message to improve the quality of soil was that enterprise change is necessary, and that livestock and grazing leys should be part of this

mix for arable rotations. By building this resilience into soils, Stephen believes that farmers will be better prepared to protect themselves against weather extremities which are becoming common place.

## Andrew Spinks, Brown & Co – How the numbers stack up

A vital aspect to consider – will it be profitable to farm with animals in the rotation? Andrew began by highlighting areas of change that are necessary within livestock only systems. The recent RBR farm business survey showed that all of the positive farm income on the majority of the UK beef and sheep enterprises was from Agri-environment schemes, BPS, and diversification. Andrew believed that to overcome this, livestock producers needed to adapt and modernise, and a way to do this could be through farming partnerships and grazing agreements. Andrew also highlighted that in 2018 only 57% of beef & sheep carcasses met specifications. So, it is clear that farmers must become more efficient and accurate when producing meat. Lower input systems, such as those seen in New Zealand should become more common place, and livestock and arable farmers can create a mutually beneficial arrangement by implementing this.

## Ian Wilkinson, Cotswold Seed – Forage choice, planting the right mixtures

As always, Ian delivered a passionate and informative presentation. He started with valuable advice; “Farmers should have a low cost of production, be a

seller not a buyer”. Ian pointed out that we need to consider the bigger picture when thinking about the benefits of grass leys. As nitrogen prices continue to rocket, Ian highlighted that 30-50% legume content in a grass ley can fix 200kg nitrogen per year. Anthelmintic mixes, such as chicory trefoil, can reduce worm burdens. Ian proved this by using a neighbouring farmer as an example, who hasn't wormed his lambs for two years by using one of these herbal leys. Ian stressed that using a vast range of plants in these mixes is vital, and if this and other management changes are implemented, there is no reason why animals shouldn't be kept outdoors all year round, whilst still maintaining welfare and achieving high protein levels. Ian's five top tips for successful cover crop establishment were “fine, firm, shallow, sow, roll”. Ian commented that, in his experience, cattle are best for building soil fertility.

## Tim May, Kingsclere Estate – Farmer Case Study

At an event such as the A2A conference, it is always good to provide farmers with information from their fellow peers. Tim is an outstanding example of the transition from a traditional arable farm to a fully integrated mixed farm. Using 'enterprise stacking' as the key to his farm profitability, Tim realised change was needed, having used no-till systems since 1997, yet still only achieving wheat yields of 7.5t/ha. Tim stressed that he believed 'no-till' was only a steppingstone. He began by integrating sheep into his rotation, and from here added store cattle (he now has over 500 on summer grazing) as well



as portable chicken houses, pigs and a mobile dairy. Tim has now incorporated over 500 hectares of herbal leys into his rotations. He believes that cattle are easier to incorporate than sheep due to their trainability in terms of fencing and movement, but acknowledges that TB restrictions may make sheep the better option in some areas.

### Alex Bragg, Savills – JVs, share farming and grazing agreements

Alex's key message was to collaborate to accumulate. He believes "that as an industry we are notorious for not sharing our problems or our successes." Reminding attendees that a typical 220ha farm would see their BPS reduce by £6,600 each year, until it disappears completely by 2028, he believes that now is a real opportunity for farmers to work together to become more efficient. He advises that farmers should think of their marketplace and work backwards to consider how they could club together to demand prices, processing hubs, share knowledge and work together to secure more funding.

### Mark Jagger BQP – The potential of pigs

The take up of bed and breakfast pig units has rapidly increased over the last 5 years. Mark pointed out that in terms of straw requirements, arable and pig enterprises are the perfect partnership. By farming pigs on a contract agreement, farmers can ensure that incomes are more stable and there is less risk. BQP offer 6yr contracts, which comprises 13 batches of pigs and which also includes vet care, carcase disposal, assurance, and feed.

### Rob Hodgkin's – The shepherds view

Providing another farm case study, Rob farms a mixed arable and sheep enterprise in Hertfordshire. His flock of Romney Marsh sheep, which Rob promotes as ideal for an extensive system, graze his, and many of his neighbours' fields, twice in a 4-year rotation on a spring/winter system. Rob advises that in this kind of system it is best to produce low cost, supermarket sheep, not pedigree



winners. He is averaging £92/lamb at 21kg carcass weights. He is getting a daily live weight gain of 365g/day from grazing oat and clover mixes. Rob agrees with the other speakers that from his experience, a rotational grazing system is key to success and stresses that to avoid poaching the sheep need to be moved regularly.

### Daffyd Jones, Precision Grazing – fencing and infrastructure

Daffyd is a consultant from Precision Grazing, an advisory team of 4 seeking to encourage more profitable farms through regenerative techniques. They run farm discussion groups, trials, fencing and rotational grazing advice. Daffyd quoted that "if you hear the church

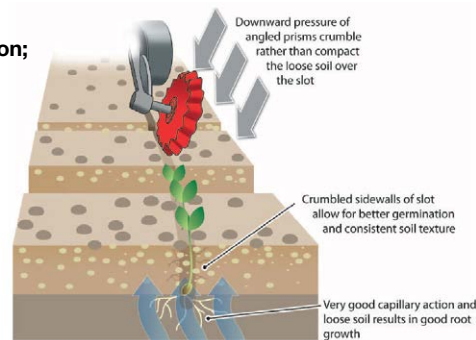
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bell ring twice, you're not rotational grazing". In terms of rotational grazing techniques, Daffyd advised that to avoid poaching, paddocks should be square. Creating long and thin paddocks means stock travel more, therefore increasing poaching. He also advised that rotational grazing on 12-24 hour shifts ensures the best gain of DM per hectare.

### Tim Leigh, AQM - Marketing your Livestock

For those who do not already have livestock on the farm, many wouldn't know where to send their finished product. Tim works for AQM, a farmer co-operative selecting the most suitable abattoirs for the breed and confirmation of the finished animal. Tim agreed with Andrew Spinks that targeting the

optimum grade is crucial when aiming for optimum efficiency. He recommends farm assurance for increased marketing opportunities and reminded farmers that cereal farm assurance is separate to beef and lamb. Tim advised farmers considering cattle in the rotation to be aware of the areas they are buying them from and to consider the high-risk TB areas.

### Richard Harding, ProCam - Integrating forage leys into arable

Describing himself as "an arable farmer, with all my livestock underground" Richard believes the key to conservation agriculture and sustainable intensification is a focus on soil and better utilising sunlight. He advised stripping out costs whilst maintaining productivity of cover crops by using them to 'farm' sunlight. He stated that this way a cover crop becomes a cash crop. Also promoting 1-day paddock grazing on cover crops, Richards key advice to farmers is to "Replace steel with roots, fertiliser with photosynthesis and Nitrogen with Nodules".

In summary, the key take home messages from the Innovation for Agriculture Animals to Arable Conference were

clear:

- Low production costs are key to profitability
- Rotational grazing will ensure maximum efficiency from grass leys, farmers should aim for a target of 12-24 hour rotations.
- The five rules of soil management are keep the soil surface covered, minimise soil disturbance, maximise plant diversity, keep living roots and shoots growing at all times and integrate livestock into your rotation
- Choose the stock based on your soil type and disease risk.
- Be open to farming partnerships. Farmers don't need to own livestock to incorporate them into their system.

Innovation for Agriculture would like to thank all of the speakers who gave up their time to share their valuable knowledge. Their presentations and recordings from the day will be uploaded to [www.i4agri.org](http://www.i4agri.org)



**INNOVATION for AGRICULTURE**

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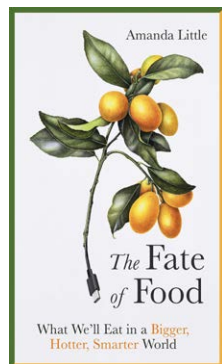
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# WHAT DO YOU READ?

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.

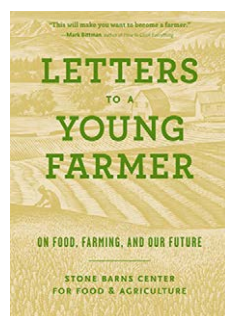


## **The Fate of Food: What We'll Eat in a Bigger, Hotter, Smarter World**

We need to produce more food. With water and food shortages already being felt in some parts of the world,

this might sound like an insurmountable challenge, but all is far from lost. You may not have heard about it, but the sustainable food revolution is already under way.

Amanda Little unveils startling innovations from the front lines around the world: farmscrapers, cloned cattle, meatless burgers, edible insects, super-bananas and microchipped cows. She meets the most creative and controversial minds changing the face of modern food production, and tackles fears over genetic modification with hard facts. *The Fate of Food* is a fascinating look at the threats and opportunities that lie ahead as we struggle to feed ever more people in a changing world.



## **Letters to a Young Farmer: On Food, Farming, and Our Future**

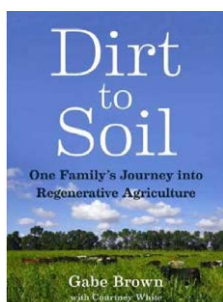
An agricultural revolution is sweeping the land. Appreciation for high-quality food,

often locally grown, an awareness of the fragility of our farmlands, and a new generation of young people interested in farming, animals, and respect for the earth have come together to create a new agrarian community. To this group of farmers, chefs, activists, and visionaries, *Letters to a Young Farmer*

is addressed. Three dozen esteemed leaders of the changes that made this revolution possible speak to the highs and lows of farming life in vivid and personal letters specially written for this collaboration.

Barbara Kingsolver speaks to the tribe of farmers—some born to it, many self-selected—with love, admiration, and regret. Dan Barber traces the rediscovery of lost grains and foodways. Michael Pollan bridges the chasm between agriculture and nature. Bill McKibben connects the early human quest for beer to the modern challenge of farming in a rapidly changing climate.

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



## **Dirt to Soil: One Family's Journey into Regenerative Agriculture**

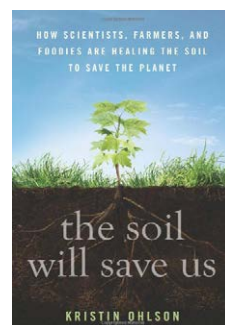
Gabe Brown didn't set out to change the world when he first started working alongside his father-in-law on the family farm in North Dakota. But as a series of weather-related crop disasters put Brown and his wife, Shelly, in desperate financial straits, they started making bold changes to their farm. Brown—in an effort to simply survive—began experimenting with new practices he'd learned about from reading and talking with innovative researchers and ranchers. As he and his family struggled to keep the farm viable, they found themselves on an amazing journey into a new type of farming: regenerative agriculture.

Brown dropped the use of most of the herbicides, insecticides, and synthetic fertilizers that are a standard part of conventional agriculture. He switched to no-till planting, started planting diverse cover crops mixes, and changed his grazing practices. In so doing Brown transformed a degraded farm ecosystem

into one full of life—starting with the soil and working his way up, one plant and one animal at a time.

In *Dirt to Soil* Gabe Brown tells the story of that amazing journey and offers a wealth of innovative solutions to our most pressing and complex contemporary agricultural challenge—restoring the soil. The Brown's Ranch model, developed over twenty years of experimentation and refinement, focuses on regenerating resources by continuously enhancing the living biology in the soil. Using regenerative agricultural principles, Brown's Ranch has grown several inches of new topsoil in only twenty years! The 5,000-acre ranch profitably produces a wide variety of cash crops and cover crops as well as grass-finished beef and lamb, pastured laying hens, broilers, and pastured pork, all marketed directly to consumers.

The key is how we think, Brown says. In the industrial agricultural model, all thoughts are focused on killing things. But that mindset was also killing diversity, soil, and profit, Brown realized. Now he channels his creative thinking toward how he can get more life on the land—more plants, animals, and beneficial insects. "The greatest roadblock to solving a problem," Brown says, "is the human mind."



## **The Soil Will Save Us: How Scientists, Farmers, and Foodies Are Healing the Soil to Save the Planet**

Journalist and bestselling author

Kristin Ohlson makes an elegantly argued, passionate case for "our great green hope"—a way in which we can not only heal the land but also turn atmospheric carbon into beneficial soil carbon—and potentially reverse global warming.

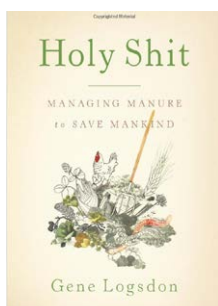
Thousands of years of poor farming



and ranching practices—and, especially, modern industrial agriculture—have led to the loss of up to 80 percent of carbon from the world's soils. That carbon is now floating in the atmosphere, and even if we stopped using fossil fuels today, it would continue warming the planet.

As the granddaughter of farmers and the daughter of avid gardeners, Ohlson has long had an appreciation for the soil. A chance conversation with a local chef led her to the crossroads of science, farming, food, and environmentalism and the discovery of the only significant way to remove carbon dioxide from the air—an ecological approach that tends not only to plants and animals but also to the vast population of underground microorganisms that fix carbon in the soil. Ohlson introduces the visionaries—scientists, farmers, ranchers, and landscapers—who are figuring out in the lab and on the ground how to build healthy soil, which solves myriad problems: drought, erosion, air and water pollution, and food quality, as well as climate change. Her discoveries and vivid

storytelling will revolutionize the way we think about our food, our landscapes, our plants, and our relationship to Earth.



### **Holy Shit: Managing Manure to Save Mankind**

In his insightful new book, *Holy Shit: Managing Manure to Save Mankind*, contrary farmer Gene

Logsdon provides the inside story of manure – our greatest, yet most misunderstood, natural resource. He begins by lamenting a modern society that not only throws away both animal and human manure – worth billions of dollars in fertilizer value – but that spends a staggering amount of money to do so. This wastefulness makes even less sense as the supply of mined or chemically synthesized fertilizers dwindles and their cost skyrockets. In fact, he argues, if we do not learn

how to turn our manures into fertilizer to keep food production in line with increasing population, our civilization, like so many that went before it, will inevitably decline. With his trademark humor, his years of experience writing about both farming and waste management, and his uncanny eye for the small but important details, Logsdon artfully describes how to manage farm manure, pet manure and human manure to make fertiliser and humus. He covers the field, so to speak, discussing topics like: How to select the right pitchfork for the job and use it correctly How to operate a small manure spreader How to build a barn manure pack with farm animal manure How to compost cat and dog waste How to recycle toilet water for irrigation purposes, and How to get rid ourselves of our irrational paranoia about faeces and urine. Gene Logsdon does not mince words. This fresh, fascinating and entertaining look at an earthy, but absolutely crucial subject, is a small gem and is destined to become a classic of our agricultural literature.

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