ISSUE 17 | APRIL 2022

DIRECT DRILLER MAGAZINE

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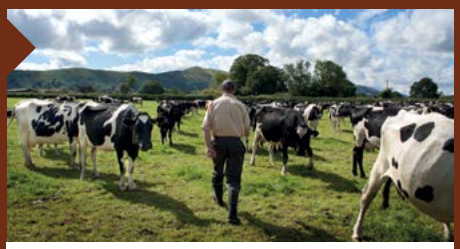

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DIRECT DRILLER MAGAZINE

Issue 17
April 2022

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THANK YOU

As executive editor of Direct Driller I would like to extend a warm welcome to our new sponsor Trinity AgTech and its founder and executive chairman Dr Hosein Khajeh-Hosseiny. At the same time, give most sincere thanks to ProCam for their support and inspiration from the magazine's first issue.

Procam have been great from the very start of the magazine, but there comes a time when that responsibility needs to be passed on. Their continued support of the magazine though COVID, when many were cutting their budgets was greatly appreciated. A new sponsor hadn't been considered until we met the man behind Trinity AgTech. Quite a few people from the trade I consider friends had already gone to work there. I had wondered why this was, I figured the pay was very good. Then I met Hosein. A man with a vision who wants change.

The difference with Hosein is that he believes farmers can lead the change, both for a better way of farming and to improve the environment. He talks of the "genius of the many" – the talent and innovation that lie collectively in those who care for our soils – and says he wants the software and services Trinity Natural Capital Group is bringing to market to help this along. The aim is to "democratise access" to the best science, to self-assessment and to new markets. This'll put farmers "in control", he says, and ultimately better off.

You don't get this a lot in farming. Individuals that want change don't "go far" we have been told. They are disrupters or dissenters, but we think farming needs change.

When I normally get asked to meet the owner of a company, I am expecting to be told off. If you follow Clive on Twitter (or me on LinkedIn) – you will know why! This was a very different meeting. My mind went back five years to a similar discussion with the Cherry family. We were thanked for what we had done to promote sustainable farming. I was probably quiet at the meeting. Well quiet for me. I was definitely surprised. I listened to a history, a success story and now they wanted to give farmers more options.

We know from TFF that if you are happy to embrace change, that you can build a business that supports multiple members of staff and helps farmers improve the way they farm and save money. It is not a zero-sum game. A month after the meeting, I offered Trinity AgTech the sponsorship of Direct Driller as an option for their marketing. They accepted.

However, you will see the Procam advert right opposite this article. We owe them thanks, they are a driving force in regen agriculture and I hope they will continue to be in the magazine for years to come. Many won't know the history behind Direct Driller Magazine. The idea came out of a need for more and better information about soil health. With the likes of John and Paul Cherry thinking about Groundswell we started Direct Driller.

Getting anything started from nothing is difficult. We knew that TCS in France and No-Till Farmer in the USA were both successful publications. There was no reason why a UK publication couldn't be just as successful. But making it a reality is a big step.

First, we asked farmers if they would like such a magazine. The answer was "yes". Over 800 of you subscribed to a magazine that didn't exist. Secondly, we found content for a magazine. The third part of producing a magazine is funding it. We never wanted to charge farmers, we wanted knowledge exchange to be free and open. Not only as an on-line publication, but as a hard copy magazine which includes the cost of postage. This is where is gets tricky. It's very hard to get advertisers to see the value in a new magazine.

Things changed when I met Richard Harding from Procam. Richard was sat in John Cherry's kitchen working out how we were going to get farmers and advertisers at Groundswell. Richard was a font of knowledge – inside I was thinking he would make a much better editor than me. Richard introduced me to Garth Bretherton, then Regional Director at Procam. Procam wanted to be seen as the forerunner of this regen ag space. I put a deal to Procam, where they could be the "sponsor" of the magazine. They accepted and with five other advertisers we had enough revenue to get the first issue printed and mailed. But more than this, Procam lent us some of Richard's time and expertise to help find content for the magazine. Richard is as much a part of the magazine as Clive or I am.

With free labour, from Richard, myself, Clive and a barter agreement with Mike Donovan who back in 1992 started and built up Practical Farm Ideas, we had the team to get the first issue put together. While many not quite of appreciated the contribution of Procam in those early days of the magazine, they were critical to it's launch.

Everyone involved with Direct Driller looks forward to an equally stimulating and useful relationship going forward, which comes at a propitious time in farming. There will be many changes and developments in farming over the next ten years and all will involve the need for both honest explanation and educated discussion. Our new sponsor takes us into an exciting time.

Chris Fellows,
Direct Driller magazine

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INTRODUCTION

MIKE DONOVAN, EDITOR

We don't know what the future holds, either for farming as an industry of for our individual farm business. Leading farming commentators describe the present situation as chaotic. They point out there's no way they can plan ahead with prices yo-yoing as they have.

As an agri economist I say farmers need to plan like never before. The huge price movements pose a danger similar to a storm at sea. These days we can use the wonders of the Excel spreadsheet and its ability to do multi-layered calculations in a few seconds. We can put in the known and unknown factors and calculate the results, hoping the unknown unknowns are of minimal importance. The spreadsheet is a tool which have become as important as the tractor.

Our concerns may well need to be further spread than farming. Ukraine could still be the tipping point for global economic crisis. Economics over the past few years have been extraordinary and destabilising, and the huge changes in commodity values should be of great concern to governments, and the question is whether the tail is wagging the dog - that commodity traders and speculators are causing price movements which exaggerate the relationship of willing buyer and seller. Has the supply of red diesel fluctuated so much that it was 60p/l less than a year ago, and recently peaked at 160p? How much of this variation is caused by traders across the globe dealing in paper rather than physical supply and demand of the commodity? Is it sensible for basic products to be subject to the short term trading which we see today? Will the era of 0% interest be followed by uncontrolled inflation? Will there be sufficient food to feed the world, and what are the consequences if there's a major shortage? All difficult questions which were theory just a few months ago.

There have always been two groups of farmers. The first sticks to a well-tried formula, reasoning if it works don't fix it. The second sees opportunities to do better and tests and trials to make improvements. Our publisher Clive Bailye is very much in the second category.

One of the benefits of Direct Driller magazine with its numerous farm focus articles is that it encourages experimentation and the reassessment of inputs as their prices change. Profitable farming needs a huge amount of knowledge and it is good to be part of a successful team disseminating it.

THE MEDIA WE CONSUME

CHRIS FELLOWS

We are becoming increasing divided by the type of media we consume. We see this on Twitter, The Farming Forum, LinkedIn and Facebook. Everyone tends to read sites and articles that reflect their own views. Reinforcing what they already think, the way they evaluate problems and how they react. This is often referred to as the farming echo chamber.

This means that often we have no idea what other people think and disregard them as outliers to the way we think. The internet has most certainly made this worse, Facebook encourage it.

We need to integrate and share knowledge more. Knowledge needs to be more democratic. It shouldn't matter where it comes from. Farmers need to be shown both sides to an argument and be allowed to choose the path that is then right for them. At the moment content is dictated by too few sources. There are around 800 websites around farming that have knowledge on them. How many do you read a week or even a year?

How do we change this?

No one wants to read they are wrong; no one wants to face their failings. It's tough to accept, but mistakes are a part of life. You should just be able to say, "that was a bit stupid" and apologise if necessary.

I have always said what I think. But then my career does not depend on being part of a structure. I can set my own structure. It is, however, important to know why you are taking a position and be able to back it up by facts. It should not just be based on the position of the institution you are part of. You and only you are responsible for what you believe and the arguments you choose to put forward.

You are free to change that opinion as more facts are presented. You should constantly be in a state of self-reflection. Objective truth exists, we should be questioning whether we are making a conscious choice to adhere only to information that does not challenge our position. Be aware of your own confirmation bias.

The easiest way to do this is to read more and from more sources. Expand your horizons, it may not change your view every time, but knowledge and understanding breeds sustainability in businesses. Get out there and read!

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FEATURED FARMER
PHILIP BRADSHAW

I farm in partnership with my wife Jayne, in the Cambridgeshire Fens near Peterborough. We started farming together in 1989 when I left the family farm having gained our first tenancy on an 33ha County Council Farm. It is staggering to think that we equipped the farm for less than £10000, including a 15-year-old combine for £1500, but with both of us also doing some off farm work we had a couple of happy years there.

Over the years we have moved farm twice to gain larger tenancies, inherited my father's share of the family farm, and bought a bit more land along the way. Our 2 sons have good careers outside of agriculture, but they will still occasionally roll their sleeves up and help at harvest. We now farm 220 ha of mainly skirt fen land in 3 blocks around Peterborough, 30% owned and 70% rented. Because of the distance between the blocks, the smaller two parcels to the north are ran with a collaborator/contractor doing much of the work, with some direct drilling, while our main farm at Whittlesey is worked by myself with a fleet of largely 'classic' machinery on a 'Conservation Ag' basis.

We share farmed extra land for a while, and grew potatoes and sugar beet for many years, but dropped potatoes around 10 years ago. At this point we largely stopped ploughing and started on a system of shallow tillage using a Vaderstad Carrier, with subsoiling as required. I didn't realise at the time, but this was a good way of preparing our soils for the move to no tillage. The system worked well, and we managed to keep blackgrass at a modest level on most of the land, while also growing consistently good yields of cereals and sugar beet.

We started investigating 'Direct Drilling' some years ago, visiting a few people already not tilling and we also tried a few drills. One of my collaborative colleagues bought a Weaving Big Disc drill, and from around 2014 we started establishing some crops with it, and our sugar beet and OSR using a Sly Strip Cat system.

Having gained confidence in the process, we decided to acquire our own no till drill, and considered the options of buying second hand or new. Unfortunately, with a modest acreage, and the shortage of second hand no till drills on the market it was a challenge to find such a machine.

Happily, help was at hand, and we were fortunate to gain funding from the Fens LEADER group project which was part of the Rural Development Programme (RDPE). LEADER had various aims and objectives, including modernising and improving sustainability, and encouraging strategies to protect soils, and reduce Greenhouse gas (GHG) emissions.

On this basis I decided to try an application for LEADER funding. The bureaucracy involved was daunting, but after a very comprehensive application procedure we were eventually awarded a grant of over £13500 which we used to acquire a new British built Weaving GD 3m disc coulter direct drill which arrived in July 2016.

I believe we were possibly the first LEADER funded drill in the country, and we had to sign up for some interesting projected outcomes including cost savings, fuel savings, reducing greenhouse gas (GHG) emissions and sharing knowledge.

The new drill arrived just in time for our annual farm open day in 2016, and the 50 or so visiting farmers here primarily to look at KWS wheat varieties could also look at the shiny new drill and discuss our planned strategy. This started the 'No-Till in the Fens' project of knowledge transfer that was a condition of our grant.

I knew then that I would have liked two drills, one tine, and one disc, but could only afford one, and plumped for disc. I believe the GD was a good choice but regret not going for a larger trailed one. We bought a second-hand front tyre press to go on the front linkage to consolidate our sometimes fluffy lighter soils, and also counter the weight of the mounted drill.

We had identified with our earlier no till experience, that the headlands and some sidelands of fields were slightly compacted due to turning of machinery, so we also bought a 40 year old Howard Paraplow for £600 to cheaply alleviate headland issues.

I set off drilling straight into stubbles, including fresh lifted beet land, and the GD was very impressive. We applied slug pellets with the drill after OSR and this proved to be very wise. We put some cover crops in and drilled straight into them in the spring.

Harvest 2017 was nervously anticipated, with 95% of our crops direct drilled, but except for some heavy land beans, yields were right up with our 5-year average, with considerably reduced costs. Our small area of heavy land we realised needed easing gradually into the no till system...

In autumn 2017 we had the dubious privilege of being selected for a post LEADER grant inspection by the RPA. This caused some fresh challenges; as part of the application claimed some positive outputs involving cost savings, fuel savings, reducing GHG emissions and sharing knowledge as mentioned earlier.

Analysis of accounts and other data allowed us to show we had surpassed the fuel and cost savings, and the success of our open days and other events had ticked the box for knowledge transfer, with 180 stakeholders engaged. The GHG emissions initially looked difficult, but the internet was my friend, and I found some conversion factors to show that the fuel saving alone also translated to a GHG saving that more than hit our target.

We have since gained the confidence to sell our plough and cultivation equipment, and pursue a strategy of no till establishment, with some occasional loosening of soil as deemed necessary. Interestingly, our yield maps showed that our paraplowed headlands now sometimes yielded slightly better than the field middles, which means we are not afraid of paraplowing a whole field should it be necessary, but we hope the need for this will diminish.

This system has worked well, with yields maintained, and over the years we started to learn more about a 'Conservation Ag' approach that went further than simply not tilling land. While we have found many sources of knowledge useful on our path, including this magazine, and the excellent organisation that is BASE, we have also been fortunate in gaining first-hand advice from other sources. Our agronomist Rob Wilkinson of Strutt and Parker, has been very supportive of the system, and also brought Ian Robertson of Sustainable Soil Management along to help refine our strategies on soil management, and the use of biologicals etc.

We are also fortunate to have regular visits from Philip Wright of Wright Resolutions, partly as a consultant to advise, and partly to conduct some joint on-farm trials including tyre pressure trials, soil loosening and biological soil management effects.

We now have refined our system and work on a few agreed principles. We have added a second-hand 2013 Weaving Sabretine drill to our modest fleet, and I overhauled and upgraded it last year. We also have still the GD which is now in it's 6th season and has recently had new closing wheels/tyres and some new bearings.

Both drills and our 5 leg paraplow have liquid fertiliser/amendment kits fitted using components sourced from SK Sprayers Ltd, and all are fed from a front tank that I made up using a second hand Knight front sprayer tank. An old, trailed press is used to consolidate paraplowed land, and a set of heavy rolls with hydraulic paddles are used post drilling if needed, and also as a 'Straw Rake' on occasion.

We sell most of our straw, but use some of the proceeds to buy and establish multi species cover crops. I prefer to keep growing roots in the soil when possible, but we do rotationally return some straw as well. The recent wet years have caused some issues with compaction from the weight of rain, and washing down of fine soil particles, so we actually paraplowed a lot of land in autumn 2021 to alleviate this.

We aim to use the Sabretine drill to establish cover crops, OSR and some beans, and the GD for everything else, but this strategy does vary. We have also attempted to establish a clover crop ahead of spring beans to hopefully keep as a living mulch, but it may not be quite good enough due to the lack of moisture at establishment.

Because I do some off farm work, and we manage some on farm trials here, we can justify some slight over capacity in machinery, and have our own combine, and also a 20 year old self propelled sprayer. Some collaborative/contractor work is done on some of our more distant land.

Our rotation is variable, but typically is wheat, second wheat or winter barley, OSR/oats, wheat, beans. With use of a good catch crop for a few weeks between the wheats, and some biological help for the soil and plants, we can now grow a second wheat that will yield virtually as much as a first wheat. Unfortunately, we have very little storage facilities on farm, so our cropping choice is sometimes affected by logistical issues, and we occasionally grow peas. (Sugar Beet was dropped a few years ago due to the low contract prices offered. It worked well with strip tilling).

We are looking to add biologicals with the drills rather than liquid fertiliser, but this is work in progress. We haven't really applied any P&K from a bag or lime for over 7 years now, and field indices and pH appear to be either stable or improving. I still wonder if we could be very slowly mining our soils of nutrients, but the strategy seems to be improving soils rather than depleting them, and we have at least 5 species of worms in increasing numbers. We cut back carefully on Nitrogen last year by about 25%, and hope to cut back more this year, while also maintaining crop output.

We don't currently have any above ground livestock on the farm, but this may change in the future, with maybe some managed strip grazing of cover crops with sheep. We do not currently have a controlled traffic system in place, but do take great care to avoid soil damage. Grain trailers are kept to the headlands at Whittlesey, and tyres are ran at low pressures when possible. Some trials work here has shown the importance of tyre pressures on the drill tractor, and we run Bridgestone VF tyres down to around 0.65 bar pressure.

All the farms are in an HLS/ELS agreement that we are currently rolling over on an annual basis. This takes out some of our poorer land, and a good mix of options has improved our environmental profile. We have some diversification with some storage under licence on one farm, and I also do some occasional consultancy work on Farm Management issues.

We are enjoying our journey into 'Conservation Ag' and learning a huge amount as we go along. The time saved in establishing crops has allowed us to improve our work/life balance further, and the change in approach is now showing us a sustainable way forward as we look to reduce further our reliance on artificial inputs as our soils and crops improve.

There are challenges ahead with recent substantial rent increases on the Whittlesey farm, storage issues, input costs rising and potential lack of availability. However, our crops and soils are looking well as we enter Spring, and we wouldn't farm if we were not optimists!

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PIONEERING DIRECT DRILLING - 1965 TO 1993

Written by Dave Ablett.

I started direct drilling in 1965, and for 21 years was at the front end of spreading the word. I started on machine design and manufacture and was responsible for the first commercially produced and sold seeding machines in the UK in 1967 and in Brazil in 1973. In those early days direct drilling was mainly promoted by the desire of chemical companies to promote sales of herbicides. I was employed by ICI (under its various names!) and all my design and development work was given to machinery manufacturers free of charge. In those early days considerable problems were encountered because of the lack of follow up herbicides. My main design and development work was done in co-operation with Howard Rotavator Company in the UK and their Brazilian associate company FNI. In those early days the size of a seeding machine was restricted due to the size and hydraulic capacity of tractors.

The first direct drill I was involved with was the "Fernhurst coulter system" on a Massey standard seed drill. It proved to be an efficient rake when working where there was surface trash.

Fernhurst coulter – small disc and coulter shoe

OK when no surface trash

As a result of these trash problems it was thought that a powered slot cutting system would cope better with any crop residues. The first "Rotaseeder" had normal rotavator blades and moved all the soil. In reality the seed only needed to be introduced into the soil with the least soil disturbance possible so the blades were cut down to provide a narrow slot. Moving from complete width rotavating to narrow slot cultivation with coulters placing seed into the slot was a major step forward in maintaining crop residues on the soil surface. The Rotaseeder was mainly intended for grassland renewal, kale seeding and cereals.

Full width cultivation dropping seed into moving soil

Seed placed in narrow slot

Development field work was carried out throughout Europe. A major demonstration tour through France, Germany, Spain, Holland and Denmark was done in 1966 to get farmer opinion on system.

Setting off across the water !

Press Day at Stock, Essex

The final design was launched to the press in 1967 on a farm in Essex. Because of my involvement in design and development Howard Rotavator Company asked me to operate the machine for the launch.

Rotaseeder. Wheat direct drilled into cereal stubble

Prototype

In 1967 the main problem faced by the Rotaseeder was that cutting blade wear was too severe when seeding

stony or sandy soils. Also rate of work was slow compared to conventional cultivation seeding machines. Not needing to plough or carry out further tillage operations were not taken in to account when farmers were under pressure to get the seed in the soil. The Fernhurst coulter and triple disc systems left open slots which were an ideal habitat for slugs. The Rotaseeder did not suffer slug problems to the same extent.

As a small side diversion I encouraged Howard Rotavator Company to build a trailed machine capable of putting fertiliser on with the seed. It had to be a trailed machine because tractor three point linkage was not strong enough too lift a double hopper machine. I did a little work with it but Howard's development engineers were too busy involved in big balers and rotary muck spreaders.

Rotaseeders were produced by both Howard Rotavator Company and WMF, their main use in later years was for grassland renewal. Indeed until a few years ago a machine was being used in Wales to stitch in grass seed after a silage cut. No herbicides needed!

Simple "kale coulter"

Kale growing in Rotaseeder slot

Kale was a popular crop with dairy farmers but they had serious poaching problems when grazing a conventionally seeded crop. I designed and developed a simple "kale coulter" to put seed into a simple slot with minimum soil disturbance thereby maintaining a firm surface when grazing. The slot producing coulter was a modified injection tine with a simple brush feed seed mechanism. I went on secondment to Brazil and my successors in the UK got Gibbs of Ripley to make a complete simple machine available.

A new team of engineers were taken on by the Machinery Section to work on direct drilling coulter systems and and I moved on to design and development of specialised spray attachments to apply Gramoxone for weed control along the row of plants in orchards and vineyards mainly in Eastern Europe..

In February 1972 I was seconded to Brazil, mainly to develop sprayers

for weed control in coffee and citrus. I was also heavily involved in the Direct Drilling campaign.

Mid August 1972 I was asked to visit a farmer in Parana State to advise on direct drilling soya beans. The farmer had visited me at ICI when he was on a visit to family in Germany. On his farm in Parana he had made a copy of the first prototype UK Rotaseeder. He was using full size rotavator blades cultivating the whole area.

Parana and the other two southern states of Brazil are hilly and all planting was done following contours. Double cropping of wheat followed by soya beans was the standard farming practice. Also heavy rains at soya planting time – late August onwards – gave serious problems of soil erosion. This washed the standard incorporated herbicide down hill and into the water systems and rivers. The terra roxa soil had no stones and made soil moving seeding machines less prone to wear.

My designed coulter system for soya bean direct drilling

I immediately went to FNI (Fabrica Nacional de Implementos) who were Howard Rotavator Company in Brazil and suggested we should make a mounted direct drill capable of seeding both soya beans and wheat for use on contour farming system areas of southern Brazil. ICI were in the process of setting up two development teams to promote direct drilling. One based in Parana and the other in Rio Grande do Sul with the principle aim of promoting herbicide sales. They had initially planned to use direct drills imported from the UK but my provision of locally made Rotacaster's solved their seeding problems. My design of a new coulter system was rapidly taken up by FNI. Because disturbed soil could dry out the coulter placed the seed at the bottom of the narrow slot and a following press wheel gave excellent seed to moist soil contact. Tractors were getting bigger but still good manoeuvrability in the contoured fields was imperative. This seed placement system consistently gave the best germination performance when compared with others including conventional methods. Direct drilling was called “Plantio Direto” in Brazil and I had helped the Parana development team make an audio visual of the system.

Lay out of coulter system. (right to left) front fertiliser tube, slot cutting blades, seed delivery, press wheel

The FNI Rotacaster was launched at the 1973 Sao Paulo state fair. I believe some 80 to 100 machines were made and sold during the few years it was in production. (Unfortunately FNI followed its parent Howard Rotavator Company into liquidation).

Accurate placement of soya beans in bottom of slot pressed into moist soil gave best germination results of any planting system

ICI UK had sent a triple disc coulter equipped machine to the team in Parana. It could not cope with soya bean seeds. The double discs both crushed and broke the seed skin and also gave erratic seeding depths. Often

Planting soya in Rio Grande do Sul

Soya seedling in wheat stubble

Display by FNI at Sao Paulo State Agricultural Fair in 1973

on the surface of the slot. I designed an improved “kale coulter” so that the team could use the seeder as a test unit for herbicide application systems. Also Jaime Ozi, president of FNI, had imported a Bettinson triple disc machine with a view to manufacture in Brazil. This had the same problems when seeding soya beans so I made a similar “kale coulter” design for him. My coulter design was to replace the triple disc. The depth wheel which was adjustable to control depth of slot also gave good seed to soil contact to optimise moisture availability.

Other planting machine

manufacturers were only half heartedly interested in direct drilling

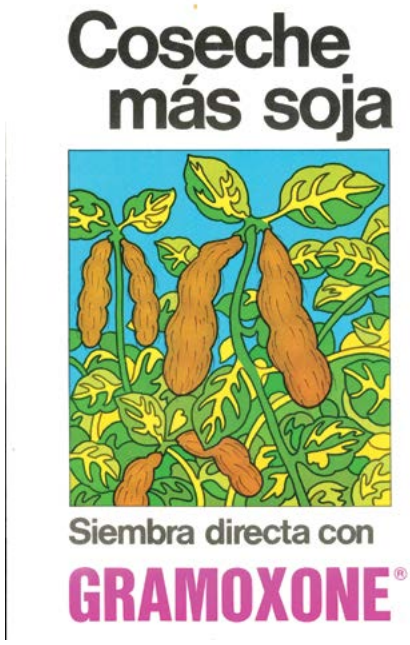
in the southern states because their machines were planters and not suitable for wheat seeding.

Main problem stopping uptake of direct drilling during the early/mid seventies was the lack of over the top herbicides to aid weed control during the growth of the soya before a canopy could be formed. If there was poor wheat stubble cover then a few weeks after seeding weeds could take over! I designed many tractor mounted machines with a view to applying herbicide along the row. None were produced because a fortunate development, coinciding with my return to UK, was the availability of selective herbicides.

Back in the UK with Alan Bloomfields team from 1976 – machinery technical service and visitors, and specialised Gramoxone application equipment including demonstrations of my citrus machine mounted on a Landrover in north Africa.

I was sent on secondment to Argentina in 1978 and moved from machinery design and development to herbicide systems management. Several suitable direct drilling planters were being made suitable for handling soya beans on the flat pampas. I set up a "specialist" team of distributor/ agronomists to promote "Siembra Direto" - local term for direct drilling. I also organised an Argentine conference on direct drilling held in Rosario and sponsored by Duperial the ICI local agents. I produced herbicide tank mix recommendations to improve weed control and an audio visual system for use by the distributors. I also gave a couple of thirty minute technical TV shows on Siembra Direto.

After Argentina I almost immediately went on secondment as Techno/ Commercial manager to Nigeria. Included electrodyn work in cowpeas



in cooperation with IITA plant breeders and also writing the users operating handbook/leaflet.

Back to **minimal cultivation** and maintaining surface crop residues I was sent to Canada in 1984 to put some sense in to chemical fallow. For years ICI had been promoting the use of a herbicide to control weeds during the fallow year of the Canadian prairie wheat producing system. It was clearly apparent that low wheat yields could not support high cost of herbicide so I finally killed the project. I did actively promote the system of minimal cultivations for winter wheat following the introduction of improved winter wheat varieties. This kept the stubble on top and prevented soil erosion by wind. In the prairies there are 400 kms of wind per day!

Following on from Canada in 1975 I was seconded to ICI Americas and based in the mid west -Kentucky. Not involved in machine design, as there were many no till planters available for direct drilling. ICI contact herbicide Gramoxone had been sold by Chevron in the USA and it was being taken back in house by ICI Americas.

My project was to develop the best tank mixes recommendations and train the ICI Americas local staff in how the herbicides and systems work. I had development sites from St Louis , Missouri across to Delaware and down to Tennessee. Some six sites in all.

In September 1986 I left ICI before completing the secondment and was headhunted to run the Cooper, Pegler sprayer company. In 1989 I took on a Hill farm in Wales and in the third year I was loosely involved in **direct drilling**! Having a suckler cow and sheep enterprise I was making silage. Perusing the local farming press I found a 4 metre Moore Uni drill for sale cheap. I bought it and a local engineer helped me cut it down to two and a half metre width which meant I could get down the narrow Welsh lanes and stitch grass seed into silage stubble for my neighbouring farmers. Stitching in and then applying slurry gave excellent establishment results.

Now retired and reminiscing I realise I was actively involved in Direct Drilling on and off

for over 30 years and still maintain an active interest in Direct Drilling and |No-Til worldwide.

NB at a machinery exhibition in Rio Grande do Sul in 2007 the FNI Rotacaster was exhibited at the entrance to the show as the "PIONEER" of direct drilling in Brazil..

Dave Ablett

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TOGETHER FOR A HEALTHY AGRICULTURE

HEALTHY SOIL – HEALTHY PLANTS

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Joe Wecker runs a 9,000-acres farm in Canada. He does not only work according to the principles of organic farming, but also uses companion crops and inter-crops and improves soil health by applying plant auxiliaries. He talked to terraHORSCH about his experiences.

Joe Wecker's focus is on soil health and on what you can do to improve it

Companion crops and inter-crops, auxiliaries, soil health and a varied rotation – these were the topics Joel Williams, an independent plant and soil health educator, wrote about in the last two issues of terraHORSCH. Joe Wecker, a farmer with German roots from Regina Plains in the south-east of the province Saskatchewan, Canada, uses these principles in practice. The family farm which he runs together with his father and two permanent employees is situated between Winnipeg and Calgary just over 100 km north of the US American border. The region is extremely flat, there are no windbreaks. The average annual rainfall amounts to 380 mm, though in the past four years there was significantly less rain – a total of 50 mm per year. However, this season it finally rained some more. Winters in Regina Plains are very cold, the summers are warm.

Wecker Farms are located on a main road. On the one side there are two residential buildings as well as the farm buildings including an impressive silo installation with drying and cleaning. More about why the latter is important later. Only some metres away on the other side of the road are further silos. The farm and the inventory are very well kept. Tractors and combines mainly are from John Deere. The farm uses a 9560 RT, a 8370 RT, a 6215 R as well as a Fendt 1050 Vario, two combines with 14m cutter bar and two swathers with 12 m working width. They sow with an 18m machine with liquid fertiliser system. Moreover, they use a fine cultivator for tillage in spring, harrows and hoes as well as a roller-type harrow. The harvest is transported from the combine with an auger wagon and from the field boundaries with three trailer trucks.

The region around Wecker Farms is extremely flat with low rainfall

They farm more than 3,500 ha, 2,500 organically, the remainder is in transition to organic farming. "But everything is farmed in a nutritional farming system", Joe Wecker says. This is why the farmer considers his machine park to be rather large. In his opinion, nutritional farming on the one hand means diversity of crops, cover crops, inter-crops and green manure. Moreover, he relies on the specific use of plant auxiliaries. He grows: durum, HRS wheat, oats, flax, alfalfa seed, khorasan wheat, spelt, emmer, peas, lentils and chickpeas.

He flexibly uses different companion crops depending on the rotation. For example: cereals/cereals-clover, cereals-alfalfa, chickpeas-flax, pea-mustard, pea-oats or barley, lentil-oats, lentil-brassica as well as brassica-pea-clover.

Less risk

But why does he do this? "Intercropping, i.e. the cultivation of companion crops and inter-crops, means more bio diversity", the farmer is convinced. "The result are very positive consequences for soil fertility, for beneficial insects, for the encouragement of mykorrhiza and for nutrient exchange – this is particularly apparent for peas as a companion crop, as well as for a synergistic growth. There is no competition, less fertility inputs are needed. There are higher residues for ground cover, less weeds and harvest residues decompose faster. And: risk reduction, especially in very dry years.

My experiences for example with oats in combination with peas were very good. Their root structure and its function, too, are completely different. There are different pH values in the different areas and nutrients, too, are released differently. If you dig up the plants, you can perfectly see the rhizobia that fix the nitrogen. Another example is the combination of brassica and maple peas. We grow them together because the peas often get lodged before the harvest. But the brassica supports them so there are hardly any problems when threshing. It works excellently. For maple peas really are rather difficult to grow. Thus, we get a high price for them, and brassica is a great help", the farmer explains.

You can clearly see how well the two crops are interwoven and how the mustard keeps the peas up.

For organic flax with chickpeas. "We cultivated these crops two years in a row", Joe Wecker says. "Normally chickpeas have to be treated with fungicides five to six times. But being a certified organic farm that's no option for us. With the combination we had the experience that we don't need any fungicides at all. There are some processes, probably in the soil, which make them unnecessary. You can clearly see it.

Another combination we like to use is organic Eurasian wheat with clover as an under sown crop. I attach major importance to one thing: For me, intercropping does not only mean to grow mixed crops where both partners are used. In my opinion, it also includes companion crops where only one crop from the combination is harvested. I like to use this for cereals, for example for oats and peas. This actually is one of my most favourite combinations. It is always striking how healthy the leaves are. Another example is oats with marrowfat peas. The latter poses quite some challenges for the farmer. In combination with oats it is much easier. Especially the weed pressure is lower."

Positive effects

Joe Wecker describes another possibility: HRS with alfalfa as an under sown crop. Especially when producing alfalfa seed there again and again are volunteer plants in the following years. Although, in this case, he specifically uses them as a companion crop, he has to see to it that the alfalfa share does not get too high. The cereals then have a better chance to pass the alfalfa. The positive effect Joe Wecker noticed are 1.5 to 2 % more protein in the wheat. And all that without any yield losses. Using an underseed with alfalfa, thus, is ideal if you want to achieve an increased protein content for wheat. According to his experience, brassica with maple peas also work very well together. Threshing can be carried out without any problems by simply changing a few settings at the machine.

Wheat has already been laid on the swath. Despite the low rainfall, alfalfa completely covers the soil, the field is green when winter starts.

According to Joe Wecker you immediately see the effects of intercropping. Right in the first year he did no longer have to use any fungicides for the combinations flax-chickpeas and flax lentils. With regard to soil health, it takes a little longer. Over a period of three years, step by step we reduced the fertilising

intensity and now the quantity is only half as high compared to the time he started. During this time the biological activity of the soil improved – with stable yields. The plants in total, benefit from not being filled up with nitrogen to such an extent. The pressure of fungi and animal pests decreases significantly.

Joe Wecker attaches great importance to soil and nutrient analysis. "I focus on the correlation of what is in the soil and what is in the plant", he says. "Or rather what is in the soil and what is not in the plant." For you cannot take it for granted that everything from the soil is available to the plant. You need an intact biological activity of the soil. This is why we do not only carry out soil analysis, but also tissue test of the plants. If we notice any peculiarities, we know that we have to do something for a good biological activity of the soil. In addition to our inter-crops and companion crops which also have a positive effect on it.

No matter if organic or conventional – we apply stimulants on all our fields to encourage the activity of the soil especially in the root area. It thus gets a boost so that the plant can dispose of some nutrients that so far have not been available."

Regular analysis

At Wecker Farms, the tissue tests are carried out at least once a year. Joe Wecker compares them to the soil analysis and if he notices that nutrients are not available to the plant he spreads them.

It usually is boron that is applied together with kelp and fulvic acid. It is not expensive. And it does not do any damage, Joe Wecker says. But he achieves this little boost for the soil activity.

But back to the soil and plant analysis. Joe Wecker describes the results of an analysis of the fields that are still farmed conventionally. "The crop is flax. I did not apply any phosphor. The analysis showed only half as much nitrogen as there actually should be. But I did not worry about that at all. And the population really develops excellently. Before our objective always was how to achieve the highest possible yield with a high effort. Today we do the opposite: we focus on how little effort is necessary to not lose yields.

During the vegetation period we always have the refractometer at hand. We, thus, can find out very quickly on site how healthy the plants are. By means of the sugar content we notice if there are any shortcomings. If so, we immediately carry out a laboratory test to get exact data. If for example we apply boron, we mix in fulvic acid, kelp and a little bit of sugar. Sugar is good for beneficial organisms."

You cannot take it for granted that everything from the soil is available to the plant. You need an intact biological activity of the soil.

Consequent action

The conversion of the farm to organic farming started five years ago. Asked about his reasons the farmer answers: "On the one hand, we ourselves have been eating organic food for quite some time. On the other hand, we noticed soil degradations on the farm. This is why we started to think about intercropping. We also questioned a lot and tried to detect correlations. You often do not notice small things until the problems get bigger. And then you start to think.

With regard to the yields, the losses are really minimal compared to my neighbours. However, it depends on the crop. For barley and flax for example it is hardly noticeable, for wheat we talk about 10 to 15 %. In this case it is very important which variety you chose: Modern wheat only achieves good yields if the nutrient supply is optimum. Therefore, we prefer older varieties which usually are still on the market. If not there often are some remaining stocks. Barley in turn is less sensitive according to our experience.

But yields are not everything. I often discuss with the mills I supply directly. This is the reason why the cereals are thoroughly cleaned and dried. My customers often tell me: We love your cereals. Our bread tastes a lot better with it. As I already said before: In the future, our customers will no longer only pay for the quantity, but also for other things. For example chickpeas grown with zero fungicides.

I wanted to farm in a regenerative-organic way for quite some time. My focus has always been on soil health and especially on what we can do to improve it. This is behind everything we do. For a healthy soil guarantees healthy plants. The same is true for insects. We attach major importance to that the fact that our fields provide a good living environment for bees and other beneficial organisms. In this respect, intercropping is ideal, for we automatically create areas where insects can thrive in an optimum way.

And it".last but not least, I am convinced that our customers expect more from us than just always going on like before. This will not only be an important reason for them to co-operate with us. They will also reward it".

The breeding facility for earthworms consists of ten containers

The resulting substrate is used to treat the seed. It encourages rhizobial nodulation for example for peas.

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FARMER FOCUS
ED REYNOLDS

At the beginning of February I was fortunate enough to attend the 2022 BASE-UK AGM. There were many excellent presentations, including the lecture from Dr Sam Cook on conservation biological control where she referred to the three P's - Predation, Parasitism and Pathogens. It got me thinking about the next level of IMP that we have the opportunity to follow. At the same time as using less insecticides and more funding for habitat under mid-tier and ELMS schemes, identifying beneficial species and making decisions made on insect numbers (trapping) and crop risk is surely the direction we should work towards.

The one presentation that stood out was Professor Richard Bardgett's session on soil fauna and its relationship with diversity of plant species. He talked about how 'diversity of plants cultivate the soil micro-biome' and the significance of this regarding complete functionality of the soil (including organic matter breakdown, physical structure and nutrient availability through the 'microbial loop').

Professor Bardgett suggested degraded arable soils can potentially be turned around in 2-3 years with this approach. Unfortunately, most of the cash crops we currently grow are monocultures, but there is great opportunity for plant diversity in catch and cover crops. A problem we have is a workload peak at harvest, at the time when cover crop establishment should ideally occur. Understanding that getting them in early is key, we are experimenting with a faster way to establish cover crops very soon after harvest. We have mounted a Techneat Avacast onto our Claydon straw harrow, with the hope to establish the cover crop and get the benefit of the straw harrow 'cultivation' effect on crop residue breakdown and slug egg destruction. The air seeder unit has several different metering cartridges to cope with the variation in seed shape, size and density. I see growing cover crops as an investment in our soils, and will endeavour to do this between every cash crop, if we have 6-8 week gap. A species mix with a diversity of physical root structure will be our aim.

Another winter project we have just embarked on involves taking soil organic carbon (SOC) measurements to get a handle on where we are, and to establish a baseline. I have been told, from people more knowledgeable than me, that this is a good idea for the future and allows you to track the effects of regenerative farming practices on your soil. We have started with one 24 ha field. We split the field into 5 zones according to soil texture and used two different sample depths. We have taken a GPS coordinate of each soil core, to allow repeatability every 5 - 10 years (with the help of CA Agricultural Services). We are using a measurement that includes organic and inorganic carbon, bulk density (to calculate quantity) and active carbon to see what is available to soil microbes. In the past, I have been sceptical of soil organic matter results (around 5.6%) on our high calcium soils, as artificially high. I hope these tests now available to the industry are more representative, and my method of sampling stands up to scrutiny over time.

As winter gives way to spring, the flying flock of sheep move on. They have been with us for the winter months, grazing our cover crops. This is the second year we have done this, and I would like to thank Ed Hartop (sheep grazier) for his diligence in moving them round according to our soil management plan. It struck me that the farm as a whole is better-off because of his presence with us, even though it is fleeting. Ed has a great knowledge of agriculture, which is different yet complementary to mine. We take a collaborative approach to problems and put plans into operation that are more likely to succeed. I hope to see more grazing animals on the farm by including 2 year species rich leys in the rotation and possibly grazing wheat in the future. This is just one example of more people being on our farm in general, since we followed a more regenerative ag path. I am all for that.

Ed Hartop

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[2] Case Puma 220 MC, 358 g/kWh Fuel + 28 g/kWh DEF, Profi Test Results, 09/2019, in similar test conditions.
[3] Fendt 724 Vario, 371 g/kWh Fuel + 15 g/kWh DEF, Profi Test Results, 11/2021, in similar test conditions.
[4] John Deere 6250R, 348 g/kWh Fuel + 16 g/kWh DEF, Profi Test Results, 06/2018, in similar test conditions.

PLANT SAP ANALYSIS: WHAT IT IS, HOW TO DO IT AND WHY

Maintaining plant health to reduce inputs is a key goal for many regenerative systems. In this series of articles Mike Abram explores how plant sap analysis could help deliver this

Much like with our own health a balanced diet is important for maintaining health and ultimately maximising yield and quality of crop plants.

Some of the macro- and micronutrients the plant takes up are used to power photosynthesis – energy production in the plant – while others facilitate the conversion of the sugars produced by photosynthesis into a whole range of other plant compounds.

These include defence materials, such as anti-feedants, cell strengtheners, physical barriers, and root exudates to recruit microbial communities to help protect plants from attack.

To build these defences nutrients are needed in various quantities ranging from kilograms of macronutrients such as nitrogen, phosphorus and potassium to grams of micronutrients like copper and zinc.

A deficiency or excess of any of these can limit photosynthesis and / or these other plant compounds, including both passive and active defences.

But understanding whether a plant is receiving a balanced diet of nutrition is no easy matter. Soil nutrient analysis gives a picture of what is present in the soil at that point, but not necessarily what is available to the plant to take up.

Plant tissue (dry matter) tests during the growing season are another potential source of information. These measure all the mineral nutrients stored in the sampled leaf, and are particularly helpful for understanding the success of nutrient applications at the end of the season.

But again, it doesn't just measure what is available to the plant at the testing point, as it also measures the nutrients stored in the leaf, which are much less available to be used for plant development.

Wanting to determine just the nutrient fraction that was available for plant development was the starting point for the development of plant sap analysis by Dutch company NovaCropControl back in 2009.

Its sap analysis service provides, what it says, is a more accurate way of measuring the nutrients available to the plant at the time of sampling.

The advantage of only measuring what's available to the plant is that it shows up potential deficiencies earlier – perhaps one to two weeks earlier – than tissue analysis, says Eric Hegger, a consultant with NovaCropControl.

"In a tissue test a big part of what is being measured are the stored nutrients in the leaf, which cannot be used any longer," he explains.

The test is crop agnostic. If the crop is green and growing, and the firm can extract sap, it's possible to do sap analysis, with over 200 crops covered.

"Most growers start with sap analysis because they want to know and manage their nutrient uptake from the soil to improve their fertiliser efficiency, and to avoid nutrient deficiencies or toxicities before they are visible in the plant," he says.

"Ultimately we want to save costs through optimum plant growth, health and quality."

Sap analysis tests for 16 different nutrients, including three ways of measuring of nitrogen, plus total sugars, the total dissolved salts (EC) and pH (see box).

What does NovaCropControl sap analysis test

- Total sugars
- EC
- pH
- Calcium
- Potassium
- Magnesium
- Sodium

- Nitrogen (nitrate, ammonium, total nitrogen)
- Chloride
- Sulphur
- Phosphorus
- Silicon
- Iron
- Manganese
- Zinc
- Boron
- Copper
- Molybdenum
- Aluminium

Sampling is important – there are some basic rules to get it right to deliver the best results. These include sampling before 9am in the morning for full leaf tension and ensure consistency of results. The leaves must be dry – or dried with a tissue before sending – and free from dirt and disease, with the petiole or stalk that attaches the leaf to the stem removed.

The analysis also compares young and old leaves, which must be sampled separately. If deficiency is showing sample these leaves separately from healthy ones. "That will give the best insight into what is the deficiency.

"If you do a foliar spray then either sample before to help understand what correction to do or at least one week after, as there will always be residue on the leaves and this will influence the results," adds Mr Hegger.

Samples should be sent in clean zip-lock bags, preferably using labels supplied by NovaCropControl. Around 85g is required for a wheat leaf sample.

Delays in getting the samples to the Netherlands was an issue for some growers last season with changes in Customs rules following Brexit. Help and instructions for sending samples from outside of the European Union can be found on the NovaCropControl website.

"The main issue with delays of more than three to four days is with the quality of the leaves. As soon as the leaves are picked they start to decompose, and the longer they are in transport the more that occurs. It mainly increases ammonium levels and also the pH of the crop – the rest won't really change.

"But the better the quality the leaves reach us, the better the results."

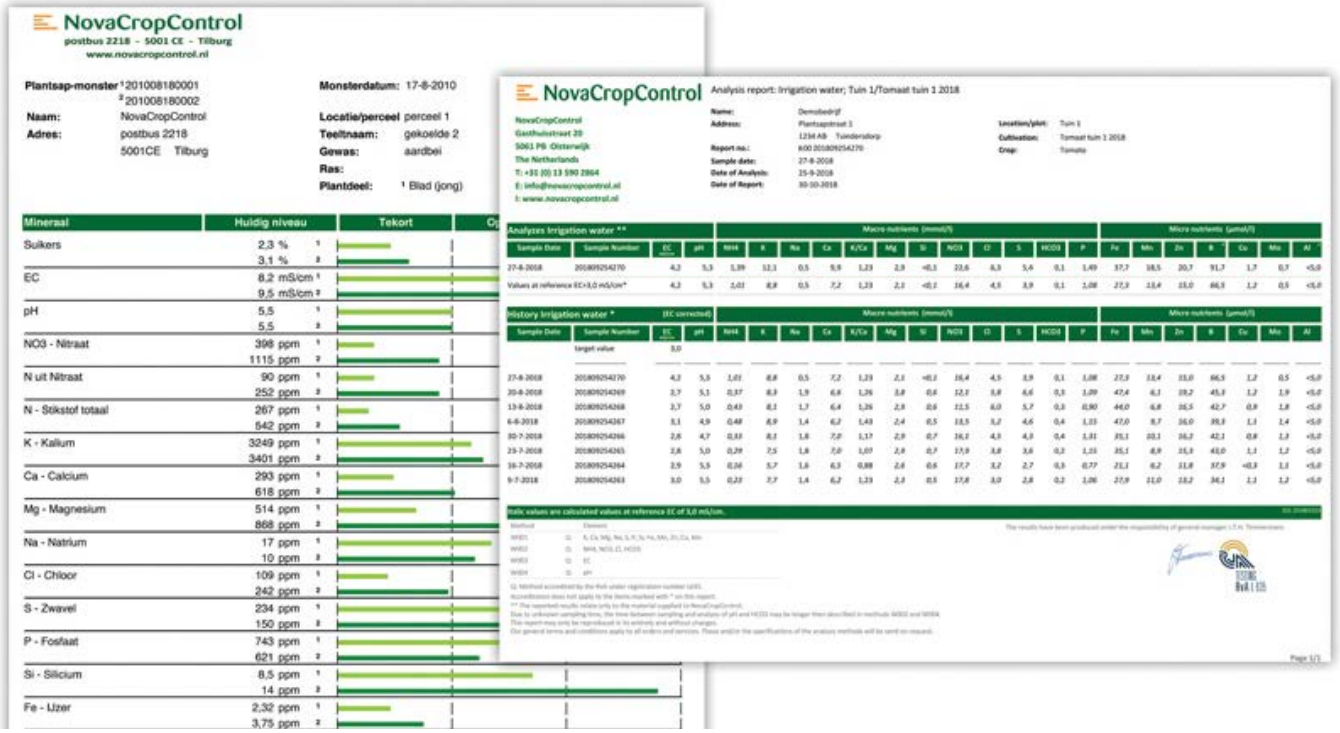
- In part 2 next issue, we look at the science behind plant sap analysis to understand nutrient use in plants

How and when to sample wheat leaves for sap analysis

- Sample oldest healthy leaf and youngest fully developed leaf, separately
- Leaves must be free from disease
- Sample before 9am for full leaf tension and consistency of results
- Sample only dry leaves or dry before sending with tissue
- Typically sample 2-4 times in season around GS30 (new leaves only), GS32, GS39 and GS65 for wheat
- Three-quarters fill supplied zip-lock sample bag and send to NovaCropControl in the Netherlands

Why use sap analysis?

- Understand nutrient availability in plant and uptake
- Improve fertiliser efficiency
- Avoid nutrient deficiencies or excesses before visible in plant
- Improve plant health & potentially reduce fungicide inputs
- Improve crop quality (especially horticultural crops)



MY NUFFIELD JOURNEY AND BEYOND

Nuffield Farming Scholar Andy Howard reflects on his Nuffield Scholarship and what it has enabled him to achieve since...

There were two key moments that got my Nuffield journey to the starting point. The first was sitting in a car with my friend and local farmer Tom Sewell, who was at that time in the midst of his Nuffield travels. Listening to him talk about his visits to foreign climes and inspirational farmers certainly got me interested in the idea of a Nuffield Scholarship. The second moment was going to a meeting and listening to this crazy French farmer, Frederic Thomas, talk about planting more than one crop species in a field at the same time, at that moment I knew I had a subject to study as well as the will.

Andy planting coffee

The next stage was applying and going for my interview. I admit I have a supportive family at home and at work, which really helped, but many people say to me "I'd love to do a scholarship but just don't have the time" or another excuse. My situation was that two days before my interview my second child was born and he ended up coming to the first Nuffield conference I went to at the age six weeks, so if I had enough time then most others will! The Nuffield staff are very helpful and flexible and will do their best to accommodate your situation.

After the conference, the next stage was to plan and organise my twelve weeks of travel. That involved a lot of Googling, map staring and logistics. I ended up visiting 82 farmers and researchers in 10 different countries.

This involved a maximum of four weeks away at one time, which was difficult with a young family but there really is not anything better than getting away completely from the farm and immersing yourself in a study tour. It opens your mind to what could be possible to achieve at home on our farm but just as importantly, you realise that wherever you are farming in the world there is no-one who has perfected their system. This was a very important realisation for me and took pressure off me mentally, as you can convince yourself that the people who author books on your subject know it all and have immaculate farms. This I can tell you is not the case!

Though the travelling and meeting of new farmers was an amazing experience, but it really is only the start. There are too many highlights to mention here, but you can visit my blog at the QR code below for more detail about my journey.

That section of my Nuffield Journey was only 18 months out of the total of a seven-year journey. More has changed in my life since I finished than did during my travels. You are told before you embark on a Nuffield Scholarship that it opens many doors, and this certainly has been true for me.

One of the immediate changes was the amount of public speaking I have done since. Before my scholarship I would struggle to speak for more than 20 minutes at a farmers meeting, they now have to kick me off after 90 minutes. In the last 5-6 years I have spoken to over 100 different groups in different countries around Europe, something that would have been unimaginable before.

On the farm there too have been many changes. I realised from visiting many inspiring farmers that many of the artificial inputs we use are unnecessary. This led me to reduce our inputs by 10% every year for the last five years. This has not only made the farm more profitable recently but also made farming more exciting. We have changed from a boring, predictable synthetic input system to a knowledge intensive, flexible system that is constantly changing and evolving. The scholarship inspired me to change my drill so that it can cope with intercropping and plant different plant species at the same time. I have also built, with my father, a bespoke intercrop separator from many second-hand components (Image 3), so we can now separate the intercrops we grow on the farm.

Even before my scholarship, I had started to do on-farm trials by myself to investigate whether new ideas would work on our farm. This has accelerated exponentially since finishing my scholarship. People have wanted to collaborate with me on trials on farm and this has added some professionality and scientific rigour to the process. We have worked with PGRO, Innovative Farmers, Diversify Project and Southern

Thomas Batley

Separator

Water, and the information coming from these trials has been invaluable to our business.

In the last couple of years this too has led to me being involved with an Innovate UK funded project called "N2 Vision" (N_2Vision – Automated Robotic Nitrogen Diagnosis of Arable Soil (wordpress.com)) The project is investigating how AI, Deep Learning and Robotics can apply nitrogen fertilisers extremely precisely to arable crops.

There are hopefully more projects in the pipeline that we are going to be involved in which all stems from being a Nuffield Scholar. It is an exciting time to be involved in the cutting edge of agriculture.

From becoming more well known since my scholarship and doing many public speaking events, my email inbox started to become regularly filled with requests for information and ideas. Firstly, this is very flattering that people think you are an "expert" in your field (most of the time I feel like a novice) but can also become time consuming. After a while I realised that this interest could be monetised and so I contacted a fellow Nuffield Scholar Stephen Briggs about joining Abacus Agriculture (Abacus Agriculture Consultants - abacusagri.com) and so started my career as a consultant, again something unimaginable before Nuffield.

The changes to the way we have farmed since 2015 have also changed the crops we grow and opened doors to different markets for what we grow on farm. We now grow crops for Hodmedods (Hodmedod's British Pulses and Grains [hodmedods.co.uk]), who are an amazing company that promote and sell British grains and believe in a fair share of the benefits to the whole supply chain. They have been a breath of fresh air to work with as they are not trying to grind you down to the minimum price or try to put as many quality claims onto the farmer that they think they can get away with. A real vision of how the food system should work!!

The biggest benefit from my scholarship has been the network of friends I have made around the world. If I have any issues on the farm, I know someone will be able to help. Also, the numbers of visitors to the farm (pre-covid) meant we had regular visitors from around the globe that always kept life interesting and continued the learning experience.

Peas oilseed rape intercrop

So, if the story above has not interested you in a Nuffield scholarship, then it may not for you. However, if your interest has been piqued, then go out and speak to scholars and just apply! What is the worst that could happen?

Applications for 2023 Nuffield Farming Scholarships are now open until 31 July 2022. To learn more and access the online application system, please visit **www.nuffieldscholar.org**.

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IN SEARCH OF THE **MISSING 30KG OF NITROGEN** PER HECTARE

Written by Richard Rawlings, Agronomist, Zantra Ltd and Robert Patten, PlantWorks Ltd

The application of nitrogen on-farm will be under pressure in spring 2022, due both to its price, at the time of writing hovering at £650.00 /t and its availability, so far government intervention has done little to ease either price or supply.

The reason for the price rise has been well reported as it directly links to the gas price. Natural gas is used in the production of anhydrous ammonia gas, which forms the base of most types of modern nitrogen fertilisers. Whereas in other industries the power source for manufacturing can be switched (oil to gas or gas to electricity), this is not the case here. Natural gas is essential to achieve not only the high temperatures to enable the process, but it is also a source of hydrogen required in the reaction. Thus, we are wed to its continued use.

A perfect storm has led to the gas price rise, including greater global demand due to colder weather in Asia, depletion of European stocks and of course politics and war. There is no solace in the fact, but we are not alone in experiencing higher than expected nitrogen prices as we share the pain with Europe and beyond with US fertiliser prices reaching record highs.

The reality is that 2022 will see the largest change to nitrogen regimes used on UK farms in two generations. Many farmers have already committed to winter wheat and in the coming months they will be considering the economics of growing the crop in 2022. Subject to farmers being able to afford the market prices, and indeed to source nitrogen, it is generally accepted that most farmers will need to modulate their nitrogen inputs by up to 30kg a hectare.

Not looking for false silver linings but this may create an opportunity to consider the rates we currently use on farm as norms. Work undertaken by the National Institute of Agricultural Botany (NIAB) in 2020 looking at nitrogen reduction rates in winter wheat showed little difference in yield between 100% application (250kg/h) and 70% rate, with any decline being offset by the costs of application.

Unfortunately, the wet winter of 2020/21 could have depleted much of the residual nitrogen from UK agricultural soils. This article comes a little late for promoting the use of legume-based cover crops, but spare a thought for this approach next year, equally a fundamental review of your rotations could be due in 2022 to include the use of known nitrogen fixers. Many agronomists out there can expect some challenging questions from clients as they seek to manage soil nitrogen in 2022 and beyond.

Efficiency will be critical to the economics for winter wheat in 2022. Many farmers will be considering the move to liquid nitrogen application for ease of use, storage, accuracy or to combine tank mixes and reduce fuel costs. The adoption of more precise agricultural techniques allows for a faster response to crop needs and protein management.

Another area of improved management is Nutrient Use Efficiency (NUE). One of the ways to use less fertiliser is to ensure that the majority of the applied Nitrogen, Phosphorus and Potassium (NPK) is taken up by the plant. Where previously we may have accepted nutrient losses to leaching, volatilisation or becoming chemically soil-bound we now know more about the plant, soil and nutrient interactions and we can manage these to improve the nutrient flow into the crop.

Many of the nutrients that are taken up by plants are first metabolised (digested) by microbes in the soil that strip away and re nature the chemistry to make it plant available. In many cases the interaction between plant and microbes goes further with,

for example, plants with a strong association of mycorrhizal fungi turning down their own mechanism for up-taking phosphorus in favour of taking it up more efficiently from the fungal network.

Ironically the use of sustained chemical inputs in farming reduces the functioning of the crop microbiome and decreases its value to the farming system. Biofertilisers can be used to redress this imbalance and used routinely to increase NUE. Commonly available biofertilisers include both mycorrhizal fungi and Plant Growth Promoting Bacteria (PGPR). The latter group are the most relevant to farmers that have planted winter wheat in 2021 as they are spray applied in the following spring. Trials in the UK under commercial nitrogen regimes have sown that nitrogen can be modulated downward post application of PGPR with these beneficial bacteria acting both to increase nitrogen uptake and to trap nitrogen offering an additional slow-release mechanism.

PRECISION MANAGEMENT

Reduce losses during application by considering different forms of N

RESIDUAL N PLANNING

Build soil nitrogen levels through rotation and cover management

NUTRIENT USE EFFICIENCY

Enhance soil microbial communities to increase NUE in spring 2022

There has rightly been an increasing focus on soil health over the last decade as farmers become more aware that they are managing soil as a key asset on farms. As we move focus from maximising crop yield to maximising profit, there are new methods of precision agriculture, smart rotations, and microbial technologies to adopt to address 'the missing 30Kg/h' on farm.

Replicated tram-line trials were carried out in 2021 harvest, by Dr Syed Shah Regional Agronomist (South) at NIAB

NIAB

SMART ROTATIONS
treating crops & soils

LEARNING FROM 10 YEARS OF COVER CROPPING IN KENT

Ten years ago Alan Clifton-Holt took the decision to use cover crops to address a multitude of issues across his Kent rotation. Today, with a decade's experience behind him, he shares what he has learned with the Direct Driller farming audience. As he says, he has a far better idea of what cover crops can do and how to make the most of them.

Alan Clifton-Holt says that the main value of cover crops on the Kentish land they farm is in developing a soil structure into which he can drill spring crops sensibly, and at the same time providing extra nutrients for the next crop. Parts of the land, especially on Romney Marsh, are under high pressure from blackgrass, and in the mid-2000s he can recall that some of the fields became almost unfarmable, with blackgrass reducing wheat yields to only 5 t/ha.

"We haven't completely conquered this challenge yet, but we are getting on top of it, having taken some big decisions, these includ reducing cultivation passes and depth, incorporating grass leys, spraying-off badly infested crops and spring cropping."

Blackgrass control and spring cropping

Spring cropping remains integral to current control tactics, with a double spring crop break within a six-year rotation that also includes two winter wheats, winter barley and oilseed rape.

Surprisingly perhaps, spring barley is not a favoured option. It was found wanting in the whole rotation system being developed. Spring oats and spring beans are now the mainstay spring sown crops, with chickpeas being trialled as an alternative, and cover crops grown ahead of all the plantings.

"With spring crops there are three over-wintering options," Mr Clifton Holt says. "The first is to leave the ground as a stubble, the second to cultivate it, and the third option is to plant something that can be drilled into. We took the view that the latter option had to be the best way, and it's working well for us."

Any cultivations the ground requires are carried out immediately after harvesting each autumn and the cover crop drilled as soon as possible after that. The aim is August, but it can be as late as late September, depending on weather and workloads, he admits.

Over the past three seasons the species mix and agronomy of the covers has been fine-tuned with the help of the latest research and on-farm trials overseen by Agrii agronomist Neil Harper. Drilling large 0.3ha plots of individual species and mixes have been very helpful in providing the best insights here.

Their current mix is based on rye, phacelia and linseed. He prefers rye to oats because it's more prostrate. "Oats can be a bit floppy and hold more water, making the field wetter when you come to drill it."

He says Phacelia is a great plant and that everyone should be growing it. Linseed is another plant that does a really good job of soil structuring and soil improvement if you handle it right.

Following recent trialling with Agrii, the base mix is being tweaked to include a vetch, and buckwheat is also being explored to see whether its phosphate mining ability will help – especially at current prices.

Alan says "I was initially reluctant to include vetch, but Neil showed me good evidence there wasn't any carryover from nematodes or pests that will affect our pulse crops. One of the reasons we took him on four years ago was to access to this sort of well-researched support. So, we've chosen to run with it."

Not convinced about sheep grazing in Jan-Feb

Overwinter management differs depending on the following spring crop. For the past two seasons, the cover crops ahead of spring oats have been grazed into January and February with a flying flock of sheep, before being sprayed off with glyphosate pre-drilling.

Mr Clifton-Holt is in two minds about the value of the sheep here. "The head is telling us it's the right thing to do, but we're not yet totally convinced," he admits. "We're seeing some surface compaction following the sheep grazing - it's not that they're being left on the ground too long, but more about soil type. A high silt content means it can cap badly if put under pressure when it's wet. In which case we've found spring cereal yields suffer where we direct drill rather than cultivating."

Some farmers, he thinks, might argue the capping is because of the cover crop, but he's convinced the crop is doing the right thing for their soils and is holding nutrients. They

try to be flexible with what they do to make the system work. As a result, a light spring tine cultivation now routinely precedes spring oat drilling with a Vaderstad Rapid to remove any shallow compaction. This has improved spring oat performance in the past two seasons.

He says "We don't charge a huge amount for the grazing and while we do get organic matter back through the sheep dung it comes with the headache of compaction, so we're still in two minds here."

Without the sheep grazing, covers before the spring beans are typically sprayed-off with glyphosate around Christmas to reduce the vegetation. With a surprising amount of re-growth in the base and blackgrass, they are usually sprayed again a week before direct drilling with the farm's Amazone Cayena.

Yields of the spring beans have definitely increased since using the cover crop, and in 2021 they did 5-5.5t/ha and they're certainly more stable. "We don't have the variability we used to have. I wouldn't grow beans without them now."

They have only ever grown spring oats after covers, so don't know how much they contribute to performance, but he is happy with the 7-7.5t/ha they deliver and, as they're on a contract at a decent price, the numbers add up.

Vetch cover crop trials show nitrogen-saving potential

Trialling three different varieties of vetch as a cover crop last season highlighted the potential for vetch to help reduce nitrogen requirements in the following spring oat crop. The 0.3ha plots trialled a Hungarian winter vetch and two spring varieties, Dieter and purple vetch, Bingo.

"In the following spring oat crop one block went flat first where the Bingo had been," reports Neil Harper. "Our testing showed there was around an extra 20kg N/ha in both the crop and soil here. So, we could have put 20kg/ha less on the crop – a very useful saving in the current climate.

"It needs a bit more work to establish the extent to which this vetch, in particular, can act as a consistently valuable nitrogen source as well as holding nutrients and improving the soil structure. This season too we are examining different seed rates to help determine the optimum for our conditions."

Alongside this, other trials are underway to establish the most effective cover crop plant populations and to use the thousand grain weights of different components to relate this to sowing rates.

Could chickpeas be an alternative spring crop?

Chickpeas are the latest crop to be trialled. Lucerne is promising but lacks a reliable local market. With chickpeas the aim is to develop a home-grown hummus market for human consumption, with home-grown livestock protein as an alternative albeit lower value option.

"This is the third year we've grown chickpeas in Kent," Mr Harper explains. "We started in year one with 0.2ha on a headland and they did OK. "Last year we put in 0.5ha, treated the same as peas, and got a 5t/ha crop out of them in places.

"This year we've grown fully 5ha. A little bit of botrytis got in, so we will need to how this has affected them. Drilled in May, we can normally harvest them in September. This season, though, that turned into October, which is also a concern. But they need hardly any inputs and the pigeons don't seem to like them either."

Growing the chickpeas on contract for Agrii, Mr Clifton-Holt's initial aim is to sensibly cover his costs while the right market is developed. "We're happy to get in first here," he says. "The moment we stand still and stop trying new things and learning about them we'll go backwards. This is something we cannot afford to do."

Networking for sustainability

AA Clifton is one of Agrii's new 12-strong network of Green Horizon farming businesses, sharing the latest ideas about and testing out a whole range of sustainability-improving opportunities and practices.

Alan Clifton-Holt and Neil Harper leapt at the chance to become involved in this initiative given its excellent fit with so much of the work they are already doing across the farm.

Towards the end of last November, for instance, they direct drilled 50ha of KWS Extase into a field of spring oat volunteers to test out ways of reducing inputs while bringing greater flexibility into their winter wheat establishment. Different parts of the field were treated with no fungicides, a low input programme and the full farm standard programme, and the experiment showed the opportunities available for reducing winter wheat growing costs quite significantly. Mr Clifton-Holt says "While, there was almost certainly some underlying Septoria that wasn't immediately obvious, I'm not sure it affected yield to the extent justified by the cost of our full fungicide programme."

"With our trialling we are also looking to finds ways of building more resilience into our cropping," adds Mr Harper. "We're growing five different companion crops – sunflowers, buckwheat, clovers, vetch, fenugreek – alongside a zero-companion control with oilseed rape this season in 0.4ha blocks. We are also actively testing out wheat varieties to find the most resilient ones for our particular conditions."

Innovative payment-by-results agronomy

Rather than paying for his agronomy on an area basis or within the cost of the products bought, Alan Clifton-Holt is working with Neil Harper in a payment-by-results Agrii partnership akin to some contract farming arrangements.

"When we took Neil on, we had a number of key goals," Mr Clifton-Holt explains. "The most important of which is growing good crops. A good part of this has nothing to do with the crop protection products we use, and it is becoming less about that and more about the whole system as time moves on.

"How can I criticise Neil, for instance, for not dealing effectively enough with blackgrass in a field when I've done all the cultivations wrong? Everything we do is a team effort from everyone involved. If we get one part of the equation wrong, it shows up all the way through.

"Another goal we had was to be ruthless with our costs – including agchems. "But as much as I am ruthless on price, I have no problem paying for the right advice and technical expertise."

This has led to a partnership arrangement whereby Neil Harper's agronomy is paid for on the basis of the gross margin performance of each crop. It means a greater reward if crops perform in the top 25% of Agrii's MAP field-based benchmarking programme and a lower one if they don't. This goes some way to sharing the annual risk and reward.

"The arrangement is working well," reports Mr Clifton-Holt. "It seems a much fairer way of doing business. I have even suggested we need to pay more. After all, if we are going to profit from the best available advice based on access to the country's most extensive distributor R&D programme – not to mention leading work on practical farming sustainability – we have to be prepared to pay properly for it."

While cover crops haven't answered every question, they certainly have a good place on this Kentish farm, which has benefitted from the early decision to incorporate them with their direct drilling establishment methods.

Alan Clifton-Holt, director, AA Clifton farms, a 1520 ha arable business spread over 50 miles from Canterbury to Romney Marsh.

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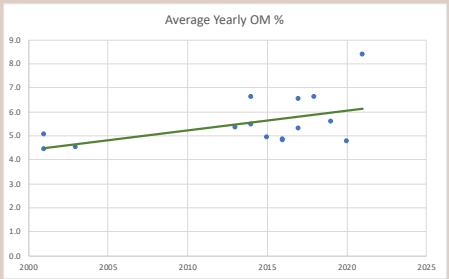
SIMON COWELL

Nitrogen Use Efficiency and Organic Matter

Having done 20 years of testing for organic matter in my soils I thought it would be a good idea to put all the results onto a spreadsheet and see what has happened over that time. I have a total of 63 tests, some fields have only been tested three or four times, others up to eight. The first thing that became obvious was the randomness of individual results in each field, organic matter percentages appear to fluctuate up and down over quite a wide range. This just shows the inaccuracies involved when sampling and testing in the lab. It is highly unlikely that a few grams of soil will ever be representative of the thousands of tonnes of soil in a whole field with variable soil type, however many sub samples are taken. By putting all the results onto one spreadsheet and then allowing the wonders of Excel Graphs to do its thing, the trend line is showing a definite increase over time. It would appear that on average over the last twenty years, my organic matter percentages have gone from 4.4 up to over 6. You can see on the graph that each dot represents an average of all the tests done in each respective year.



I have also taken quite a few samples in the last five years from different depths down to 45 cm. There is a gradual reduction of organic matter percentages as you go down, but even at the deepest depths, they are still around 4%. I didn't do these deeper tests twenty years ago for comparison, but I believe it is fair to assume that organic matter is forming throughout the soil profile, albeit at a slower rate than near the surface.

Having considered the weight of soil per hectare, soil bulk density and the fact that organic matter is fifty percent carbon, it appears that I am sequestering just over one tonne of carbon per hectare. The carbon to nitrogen ratio of organic matter is 10:1, which means that I am sequestering 100 kgs of nitrogen per hectare. This is nitrogen that would otherwise be available to our crops. Most nitrogen requirement calculations assume ten to twenty kilograms is available from soil mineralisation, but regenerative farmers who are increasing their organic matter are immobilising 100 kgs per hectare. The nitrogen entering the system from fertiliser and fixation from the air is effectively being used to grow two crops, the above ground cash crop and the below ground organic matter accumulation. If both these are taken into consideration, I wouldn't be surprised if my Nitrogen Use Efficiency is above 100%. In other words, fertiliser applications are not being lost to the atmosphere or leached into the drainage water but sequestered into soil organic matter along with the carbon.

My Wheat Blend

Blending cereal varieties is not a new idea, so after listening to talks by Prof Martin Wolfe and Prof Adrien Newton, in 2014 I decided to give it a try with some Hard Feed Wheats. With the help of my agronomist, four varieties that came from completely different breeding lines were used. This was surprisingly difficult because a high proportion of modern wheats are derived from Robigus. In my own trials Conqueror had always out yielded anything else. It is quite tall and has a slightly different growth habit to most varieties, and seems to particularly like my heavy land, no-till, low input system. The other three were JB Diego, Panorama and KWS Gator, and all four have maturity dates within three or four days.

The main reason for growing blends is disease prevention, blending slows down air borne diseases being passed from one plant to the next. There is plenty of trials work to prove this, but I have also seen evidence that even Septoria is reduced in a blend compared to a straight variety. It is very difficult to prove that my blend carried less disease, but from the beginning there didn't seem to be any yield loss so I thought that it was worth continuing with, saving and re-drilling seed every year. I did trials in 2017, 2018 and 2019 comparing up to ten varieties and every time the blend came out as the highest yielding; so it now seems that there is no reason to even look at new varieties on the Recommended Lists and I now just re-drill the blend over all my wheat acreage.

I have had several DNA tests done and the seed for sowing this year came back with very different variety ratios compared to the original 25% of each. There is now only 5% of KWS Gator in the mix, with Panorama 10%, JB Diego 22% and the Conqueror has gone up to 63%. This confirms what a great variety Conqueror is for me because it is out yielding the others every year and is gradually taking over the blend. I now have a dilemma, do I allow the Conqueror to continue its domination, increasing the yield potential each year; or do I add one or two new varieties to bring back the diversity that was originally intended?

I am often asked about how I pay royalties, originally, I just paid 25% of my wheat acreage for each one. After a few years the BSPB insisted that they do a DNA test to find out what I was actually growing. I was expecting that there would have been some natural crossing with different varieties living so close together and that they would no longer attract the royalties, but it turns out that all four have maintained their purity. This is quite interesting because it is generally assumed that farmers who home save need to regularly buy in new first-generation seed. Seed merchants have always claimed that by continuously re-seeding, varieties would somehow deteriorate, or lose purity. This is clearly not the case and farmers should never feel the need to renew a variety once they have bought their first batch.

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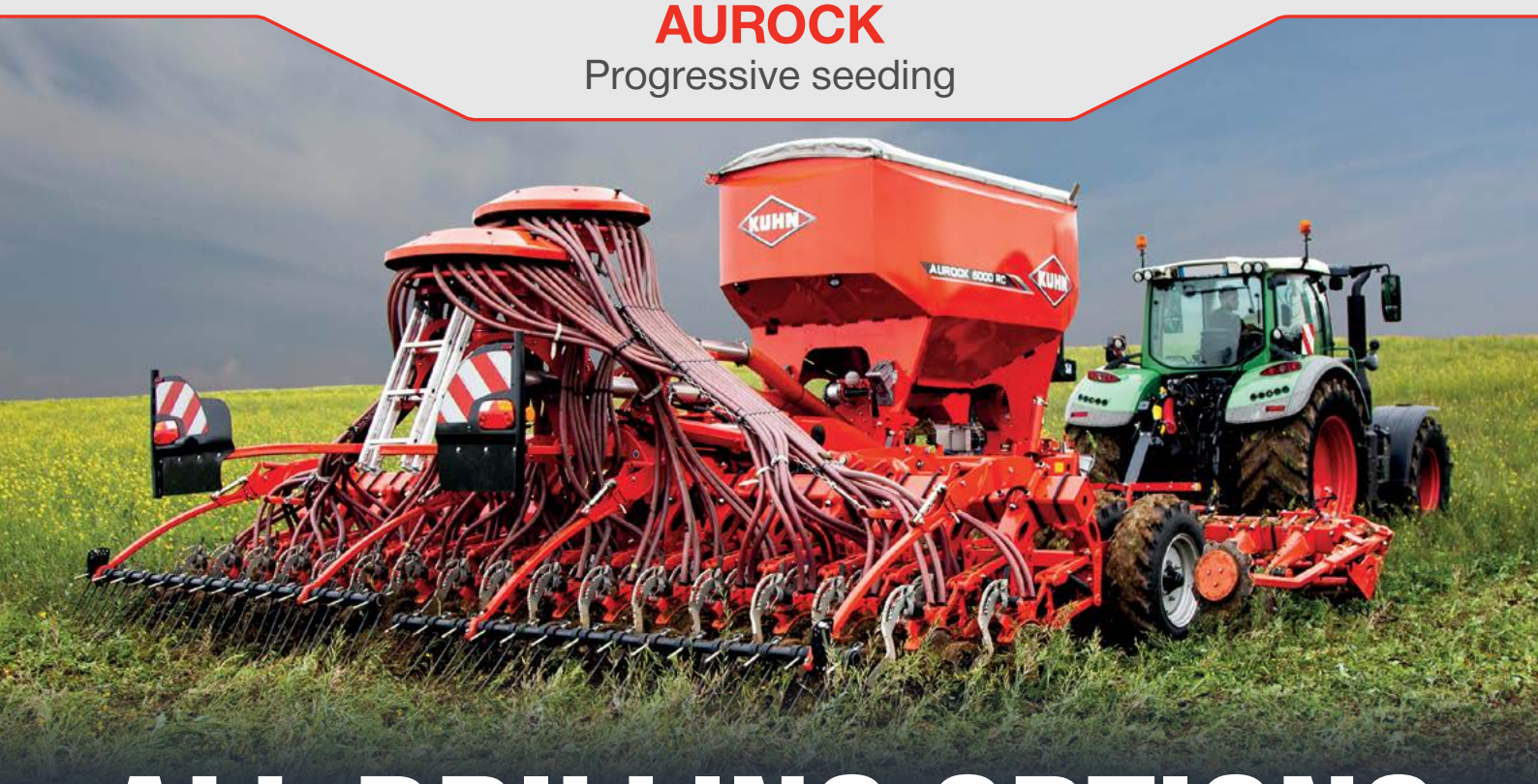

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LIVING MULCHES IN AN **ARABLE ROTATION**

Written by Ian Gould from Oakbank

Oakbank have been looking at ways to include a "Living Mulch" in an arable rotation for a number of years and we would like to thank Roger Davis and his team at Indigro for their collaboration with this work. Some of you may be familiar with this concept, but for clarity let me explain what we are talking about.

We consider a living mulch to be an understory that grows harmoniously with the main cash crop, providing some or all of the following benefits:

- Weed suppression
- Soil protection
- Increasing soil fertility
- Increasing biological diversity
- Potential for grazing
- Reduced synthetic inputs
- C02 sequestration
- Cleaner air and water

Having read a number of studies over the past few years, it has become clear that there are plenty of ways to make this not work well, generally caused by trying to be too greedy about the potential benefits and a slight lack of realism about what can be achieved. A good example of this would be to try and get a good grain yield and a good grazing crop is very hard, as it requires the understory to be too competitive with the cash crop in order to deliver good forage yields. Another example would be the initial establishment has to take the needs of both crops into account, which can mean the "nurse crop" is not as economically successful as it might have been. It is important to also appreciate that our intention is to keep the Living Mulch alive for 5+ seasons, so the benefits will accrue over that time and perhaps beyond.

Oakbank have been growing mixtures of species for a number of purposes over many years, so we used our experience to rule out overly complicated solutions in order to see if we could make this work with a simple combination. We settled on using small leaved white clover for the following reasons:

- Seed availability (still limited) and cost
- Low growth habit that creates relatively little crop competition
- Persistence of the White Clover and its ability to tolerate herbicide applications, including Glyphosate at rates that are lethal to many common weeds
- Nitrogen fixation ability
- Excellent root network

There are a small number of varieties that we consider suitable for this work, including Aberace, Galway and Rivendell (the latter is the one that we have most experience with), but there may be others coming through the pipeline. It is very important to use a small leaved variety in our opinion, as these give the biological and rooting benefits, with significantly less crop competition resulting in higher yields from the cash crop. They have the disadvantage that the grazing / forage yield is significantly lower, but there is often enough there to pass a flock of sheep over.

Establishment

Oakbank first used this technique with Oilseed Rape in 2017 at the Sky Agriculture trial site. In that situation we simply mixed 3kg of small leaved Clover with the Oilseed Rape seed and drilled it as a simple mix using the Sky Easy Drill. This worked very well and both crops grew perfectly together, although we did encounter some weed challenges. The great advantage of this method is that it allowed the clover to be established without any great effect on the OSR crop, apart from the choice of herbicide and that does needs to be carefully considered on a field by field basis.

Our work with Indigro has looked at using the Living Mulch in a cereal rotation on heavy land, where Blackgrass is a real problem! The establishment of the initial site

was done in spring of 2020 after a particularly wet winter and spring.

Roger Davis commented "We decided to sow the clover on its own as the sowing window for a successful spring cereal had passed on the heavy soils. After a light cultivation the clover was broadcast on the surface and rolled. We opted to use the small leaved white clover variety Rivendell at seed rate of 15kgs/ha which resulted in an extremely consistent establishment across the trial fields. Sheep were used to graze the crop in late summer 2020 which provided excellent forage. The sheep were removed to allow the weeds to establish before Glyphosate was applied. The glyphosate application knocks the clover, the stress then releases some of the fixed nitrogen providing a natural starter fertiliser to the establishing winter wheat which was sown in early October. Establishment was incredibly easy. The clover provided a 'green carpet' on which to travel, a disc drill was deployed and did an excellent job. The clover is stoloniferous and in our experience a tine drill has the potential to rip the above ground roots and encourage soil movement and therefore weed germination. The soil structure, its colour and smell changes very quickly once the clover is established and the worm counts go through the roof!! So, with the soils starting to come alive we can then look at the other advantages of having a living mulch.

Indigro have carried out numerous trials looking at reducing various inputs. Herbicide costs have dropped dramatically, and we are less reliant on large stacks of residuals for blackgrass control for example. Targeted rates and timings of glyphosate provide a robust and relatively cheap way to start the weed control program allowing the living mulch to compete against further flushes. We have trialled a range of herbicides, both pre and post emergence, contact and residual, most with good results. The idea is obviously to reduce the use of herbicides to a minimum, but it's useful to know what we have in the armoury if required.

Also, worth noting that on many farms utilising this practice we have eliminated the use of insecticides.

Another area requiring immediate attention is nitrogen. With the recent hike in fertiliser prices and the pressure on the industry to reduce its nitrous oxide emissions - permanent understory of white clover may provide some of the answers? Indigro have carried out trials looking at reducing nitrogen inputs and utilising the 'free' nutrient provided by the living mulch.

There are some exciting new products entering the market, such as the foliar poly N products which allow reduced N rates and provides an efficient method of getting nutrient into the plant. We are also looking at precision technology to enable more accurate decision support when reducing rates. The work is ongoing, and we have some interesting results as far as nitrogen use efficiency and yields, plus the positive impact on our carbon footprint.

There are many advantages of having a permanent living mulch from increased soil health, reduced soil and water movement, cleaner water, all year-round sequestration of CO2, reduced carbon footprint, grazing opportunities, increased soil biology, reduced pesticide and nutrient inputs all leading to increased gross margins and long-term sustainability. For those looking at transitioning into more regenerative practices this method is a great way to start the process."

There is no doubt at all that the addition of clover to this system has done wonders for the topsoil. The pictures don't really do justice as to how the colour has darkened, the structure and water infiltration have both significantly improved, plus there is far more life (particularly earthworms) in the soil. It is still a heavy clay soil but that has some great advantages too, provided it is functioning well!

It is early days and we have learned lessons for the future, but progress has been very encouraging. The work here is being replicated on other farms and we are working on how best to establish the clover under a successful spring cereal, without compromising the yield too much. Our combined work is ongoing and we are looking at various drills and row spacings, cereal and clover seed rates and varietal choice, direction of drilling ie west to east or north to south studying light interception, continued monitoring of soil health and nutrient levels and implications on yields, inputs and margins.

DRILL MANUFACTURERS IN FOCUS...

TIME TO CHECK YOUR SOILS TO SEE WHERE IMPROVEMENTS CAN BE MADE.

Jeff Claydon was out checking fields at the end of February to see where improvements can be made. This one got a 'thumbs up.'

Spring is the ideal time to take stock of your soils, test how good they are, look for signs of compaction and check that drainage is operating correctly, says Jeff Claydon. In this article the Suffolk farmer and inventor of the Opti-Till® direct strip seeding system shares what he has found on his own land.

26.02.2022

Despite challenging autumn weather, all our crops were established on time, according to plan and without issues. They looked exceptional going into winter and continue to do so but keeping them that way means focusing on the fundamentals and striving to improve every aspect of what we do.

The arrival of warmer weather will see crops really begin to really grow away, so now is the ideal time to examine areas where everything is going well and identify those that disappoint. The reasons for inferior crop performance could include drilling in the wrong conditions, slug damage, or as is often the case but frequently overlooked, poor drainage. The tell-tale signs of that include areas which struggle to grow away in spring, poorly-established patches within fields, where water 'ponds' or where it has eroded the soil and created small gullies.

Good drainage is fundamental to healthy soils and high yields, regardless of the establishment method which is used. To a certain extent, ploughing can mask drainage problems, but for direct drilling to yield its best results this is an area that must be spot on. The Claydon website (claydondrill.com) has videos on soil health and resilience, which make for interesting viewing.

Grants for land drainage ended in the 1970s and many existing schemes are now obsolete or ineffective, which is a major blow to the farming sector and its ability to produce food. Effective drainage helps soils to dry out and improves timeliness, makes them easier to manage, enables fertilisers and ag-chems to work most efficiently and minimises leaching. This can typically result in yield improvements of 25%-30%. New land drainage systems can therefore start to pay for themselves very quickly, but increasingly land is farmed on short term tenancies resulting in a reluctance for either tenants or owners to invest.

It is not difficult to identify areas where drainage is below par. If, after heavy rainfall, water flowing from field drains is dirty this indicates that it is full of sediment, so your most valuable asset is being washed away. Apart from increasing the risks of soil erosion and flooding this sediment will also block worm holes and capillaries, killing worms, starving the crop's roots of essential air and nutrients, reducing yield potential, and increasing the cost-per-tonne of production.

Identifying areas for improvement

I have been walking the farm this week to see where improvements can be made. Every farm has areas that are less than perfect and ours is no different, but we continually strive to improve the situation. Most of the Claydon farm is drained and less than 10 per cent has issues or needs additional drainage. After two decades of using Opti-Till® our soils are very well structured, allowing water to permeate freely.

This is not to say that everything is perfect, however. We have fields where the drainage schemes went in

A perfect crop of winter wheat growing in bands that have been hoed with the Claydon TerraBlade

This is another area that will need attention. The oilseed rape here is stunted due to waterlogging caused by ineffective drainage and the pigeons have taken full advantage.

during the 1960s, so they are well past their sell-by date and in need of replacement. On the 200 acres that we purchased in 2016 there are a couple of areas where old drains have failed, and some surface ponding is evident after heavy rain. There, we will need to install additional laterals and run moles into them, but like many who want to invest in drainage we are in a dilemma.

Defra would do well to reinstate drainage grants as well as funding attenuation ponds to catch sedimentation and control the release/flow of water. Will they see sense? I do hope so. A good friend, Harry Henderson (Knowledge Exchange Manager – Cereals & Oilseeds) at AHDB, says that he would prefer to see grants to the farming industry directed towards drainage rather than the purchase of no-till drills, and I fully support his view because well drained land is far less susceptible to erosion or weed infestations and much more productive.

Well drained land acts like a sponge, so water is gently filtered through the soil and released steadily, unlike waterlogged soil which washes off the top. Healthy soil copes better with weather extremes and our high organic scores on the farm have certainly proved their worth.

A straightforward way to deal with areas of poor drainage is to put them into an environmental scheme, which can work well in specific circumstances and be highly beneficial where there is no viable alternative. However, I believe that as a nation we need to remember that the primary aim of farming is to produce food. The current generation, in this country at least, has always been in the fortunate position of not needing to worry about having enough food, because there has always been a plentiful supply. But it is easy to forget that the combination of an increasing population and political unease around the world could bring serious problems, with little warning.

Just this morning as I write this, tensions between Russia and Ukraine have boiled over, resulting in military action, which just goes to show how easily the balance of normal life can change overnight. That can have serious knock-on effects, both for those directly affected, by supply shortages and on a global basis through higher prices. In my view there is no excuse for a nation not to prioritise its food supply and taking good agricultural land out of food production makes absolutely no sense.

Crops look good

Our crops are well placed to grow away quickly as warmer weather arrives, when we will also be able to see how well autumn-applied herbicides have performed. Their effectiveness varies from 80% to 40%, so it is impossible to achieve the 98 per cent level required to control grassweeds using agchems alone. Effective stubble management and good rotations are therefore essential to stay on top of grassweeds.

Many farms with grassweed issues try to get around them by ploughing, but that merely buries the seeds, which lie dormant and live to fight another day. Similarly, deep cultivations mix weed seeds throughout the soil profile, prolonging the pain of dealing with them. The

Very patchy no cultivation plot (left) at Agrii's Stow Longa trials site in Cambridgeshire last year yielded 2t/ha less than the full Claydon Opti-Till® plot (right) where the Straw Harrow, TerraStar and TerraBlade were deployed.

This field of oilseed rape gets the thumbs up from Jeff and will go on to produce a high yield.

best approach is to keep them in a tight layer near to the surface and use a combination of crop rotations, stubble management and chemical/mechanical methods.

On the Claydon farm we use Opti-Till® to establish combinable crops and sow in bands 300mm apart, so it is easy to spot any grassweeds growing between the rows. To enhance the control provided by chemicals, we use the Claydon TerraBlade inter-row hoe. Initially, we thought that it would only be deployed in areas with a specific grassweed issue but using it to control even low levels has brought huge benefits. Now, when a cereal crop gets to GS30 and the soil has dried to a level where it could be rolled, we use the TerraBlade to remove any weeds growing between the bands. This approach has been remarkably successful.

To develop and quantify the benefits of this combined approach we have been working with Agrii after early counts showed a 60 per cent reduction in viable blackgrass heads, equally as good as from some chemical controls.

At Agrii's Stow Longa trials site in Cambridgeshire the company's Trials Manager Steve Corbett is evaluating different establishment systems. Last year when I visited the trials, Steve emphasised the importance of operating a flexible farming system and resilient method of establishment. He also reminded me that drills are tools, not miracle workers and that the soil must be right to get the best from them. He also highlighted the critical role of soil health in achieving consistent crop performance.

Agrii evaluated a range of approaches, from no cultivations to the full Claydon Opti-Till® programme, including the use of the Claydon Straw Harrow, TerraStar light rotary cultivator and TerraBlade inter-row hoe in the spring to reduce blackgrass levels. The results were illuminating. Even though a full chemical control programme was used across all trials it was very apparent that the lower the level of stubble management, the higher the weed pressures were in the crop. Where no stubble management was done the yield was over 2t/ha less than where the full Claydon Opti-Till® System was used. At current wheat prices, around £220 per tonne that represents potential lost income of over £440/ha.

Agrii's work also proves that the TerraBlade is exceptionally effective in reducing the number and yield-sapping effect of weeds between the band-sown rows. Where used it produced an additional 1.4t/ha yield advantage (9.02 t/ha v 8.4 t/ha), worth around £310 based on current feed wheat price of £220/t for March 2022, as a result of enhanced grassweed control. That underlines the value of this remarkably effective, low-cost method of supporting existing ag-chem programmes.

In this corner of a field one of the decades-old main drains collapsed during the winter, resulting in the soil becoming waterlogged. The issue will be addressed after harvest, but this area will under-perform for the rest of this season.

The collapsed drain led to this hole appearing in the soil surface.

With fertiliser prices at extremely elevated levels and the cost of other inputs rising rapidly, it is more important than ever to make the most efficient use of everything that goes into producing crops. Effective drainage is a key element in achieving that, so I hope that you will join Harry and me in lobbying Defra to bring drainage grants forward so that we can all farm in the most environmentally friendly, cost-effective way.

CROP PROTECTION PRODUCTS ON **FARMDEALS**

In just its first year of building the UK's first digital buying group Farmdeals has secured many reputable suppliers in most areas of the UK for products such as fuel, fertilisers and feed. However, it has been disappointing that to date we have been unable to supply a full range of crop protection products. Despite every other buying group being able to offer product, we have struggled. For some reason the existing supply chain doesn't seem to like the idea of Farmdeals. While we see ourselves as just another buying group, the supply clearly does not.

Disruption to bring better price to farmers requires lateral thinking. Seeing how FBN in the USA have solved a similar issue has shown us there are other ways. An article by AgWeb in the USA about FBN shows how much things can change, it's an interesting read, scan the QR Code below to see it.

Speaking to and inspired by what FBN have achieved, we have secured our own direct supply. In 2023 we will have limited availability of most of the main generics used. It is out hope that this will come with game changing prices, with a target of 20% below the average market price. To achieve this though we need our members help, a chance for farmers to work together to change the market in their favour.

The best prices will come if we can commit to volume, to do this we need an idea of what FarmDeals members (and those of you still to join!) might need. Filling out our form and estimating what you think you might use in 2023 will help us get the best possible deal for you.

It doesn't need to be completely accurate, and we are not asking for any commitment. But those that fill out the form will have priority on the product volume we secure at the lowest possible price for 2023

Scan the QR Code with your smart phone or tablet to enter your requirements for 2023.

DE-RISKING **REGENERATIVE AGRICULTURE** DECISIONS

Dr Harry Langford, Dr Jemma Taylor


Dr Harry Langford, Dr Jemma Taylor

Helping farmers to de-risk the changes associated with adopting regenerative agriculture practices could play a vital role in ensuring a sustainable future for farming. To successfully achieve this, the industry needs to demonstrate tangible outcomes and associated impact, supported by quantifiable metrics, but how?

CHAP Innovation Network Lead, Dr Harry Langford and Research Associate, Dr Jemma Taylor, are part of a team that has developed a business case to explore just that.

Through CHAP's New Innovations Programme, which brings together skilled practitioners and technical specialists to define critical real-world challenges, potential ideas for overcoming areas of market failure are scoped. From this, business cases are formulated with a view to overcoming a shared sector challenge, in this case, de-risking regenerative agriculture decisions.

Reporting on the business case, Dr Langford and Dr Taylor provide sector insight, share the proposed solution and draw in knowledge from industry advocates of regenerative agriculture.

What and why

Regenerative agriculture (regen ag) is a series of methodologies, associated products and technologies, that seek to improve and build agricultural soils by creating a self-nourishing ecological system to benefit both food production and the environment. The most widely-supported definition of regen ag comes from 'The Carbon Underground ' - "farming and grazing practices that, amongst other benefits, reverse climate change by rebuilding soil organic matter and restoring degraded soil biodiversity – resulting in both carbon drawdown and water cycle improvements".

This is something to be taken seriously, as we consider the broader and future implications of current agricultural practises and what could take place to ensure a healthy and sustainable future food system.

For context, the modern intensification of agriculture began in the 1960s with the Green Revolution, and has since led to a number of ecological concerns including soil degradation, water pollution and high greenhouse gas (GHGs) emissions.

These are detailed as –

- Agricultural soils are degrading at an alarmingly fast rate. 33% of UK soils are thought to be degraded, with 6 million hectares at risk of compaction or erosion. Yet despite it costing an estimated £1.2 billion per year to the UK economy, translating soils research and unpicking the complexity of soil health to apply this knowledge on farm remains challenging.
- 35% of surface water bodies and 31% of groundwater bodies fail to meet 'good status' (ecological & quantitative) as legislated by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 . A quarter of this is correlated with agricultural activity, primarily through diffuse pollution and sediment deposition.
- UK agriculture is responsible for 10% of GHG emissions, with emissions of methane (56%) and nitrous oxide (31%) dominating. Through the NetZero policy, the UK government has committed to net zero GHG emissions for all sectors by 2050. This puts agriculture under pressure to reduce its emissions and remove, through sequestration, what it cannot reduce.

However, there is good news. Agriculture can be a 'carbon sink' due to the capture of carbon by plants and the sequestering of carbon into soil storage. This not only improves soil health and reduces water pollution, but is also a vital component of climate change mitigation.

Regen ag techniques enhance these natural processes by making them more effective. A key challenge is to better understand and measure these benefits, in order to accurately validate the sequestration. This will enhance the adoption of sustainable practice, as well as ultimately enabling revenue generation, either by public good delivery (via the upcoming Environmental Land Management Schemes) or through the carbon market. The latter could be an important emerging market to capture, as the price of carbon offsets in the EU Emissions Trading Scheme has doubled in the last year, from ~€28 to ~€56 per tonne.

We want to see what role CHAP could play in overcoming this challenge

Analysing the market

Many farmers already practice a range of regen farming techniques in the UK and across the world. The beauty of the system is that it is a process of continuous improvement, so there are always entry points and next steps for those who engage with it.

The greatest uptake country-wise so far has been in Australia, with Vietnam having the largest percentage change in land farmed regeneratively between 2017-2018 . The charity Regeneration International, which supports regen ag practice, currently has 391 partners, 13

of which are in the UK . There has also been an increase in academic research, with the number of papers mentioning the topic doubling between 2018 and 2019 .

Large companies such as PepsiCo, McCains and Danone are now pledging to support regen ag and encourage their supply farms to take up the practice. This not only benefits the environment, but could also potentially lead to a market advantage. The UK-led G7 Sustainable Supply Chain Initiative, including 22 leading food and agriculture companies such as Unilever and Sainsbury's, also launched on 16th December 2021 with a focus on building better agricultural systems. Netflix also premiered a film by Kiss the Ground , an American charity advocating regen ag, bringing it firmly into the public eye.

Supporting regen farming practices further are decision support systems (DSS) and tools. Popular examples include:

- Cool Farm Tool - Online GHG, water and biodiversity calculator for farmers
- Agrecalc - Carbon calculator tool to monitor and reduce a farm's carbon footprint
- RegenFARM Platform - Agri-tech platform enabling farmers to redesign food production by simulating regen ag interventions
- Farm Carbon Toolkit - Digital benchmarking tool for farmers to calculate carbon footprint for their farm.

Newly emerging tools extend this portfolio further and include AGREED, a platform to provide data-driven decision support around nature-friendly practices, and the Soilmentor Regen Platform, a benchmarking tool for farmers based upon 10 critical soil metrics.

Companies committed to breaking into the carbon offset market in the UK and EU are doing so by establishing trading platforms to ease the process of converting carbon capturing activities into sellable assets. Those in the UK are being supported in these ventures through the new UK Land Carbon Registry, but this sector is still in its infancy.

The case for change

"We wondered, 'if regenerative agriculture is so great, why aren't more farmers switching to it? what's holding them back?' When we dug a bit further, we realised it was the perceived risk of transition without clear tangible benefits that stayed most hands. That's actually good, because those barriers can be overcome with sound data and support."

Kelly Price, CEO AGREED

To meet the demands of an estimated global population of 9-10 billion by 2050, food production will need to increase by 70% on the same or less agricultural land area. The "Driving Productivity Growth Together" report, shows that increased, and more efficient productivity is a key strategic outcome for the UK. The AHDB believes farmers and growers have the biggest part to play in meeting the UK productivity challenge. This increasing pressure on farmers to increase productivity is against a backdrop of tightening regulations, withdrawal and restriction of crop protection tools, rising resistance to existing pesticides and increasing demand for reduced input and impact on the environment.

The case for change can be summarised in the following 'problem statement', that this business case is tasked with addressing.

Problem statement

"We need to measure, prove and demonstrate the tangible impacts of regenerative agriculture in order to de-risk change, drive adoption and create a new place for farming. There are not currently enough, sufficiently well-proven or locally-translatable, models for regenerative agriculture that truly balance yield, resilience, and carbon sequestration".

Regenerative agriculture – part of the solution

The use of regen ag leads to a number of benefits –

- Building soil organic matter to improve water holding capacity & crop resilience, and reduce runoff & erosion.
- Improving soil microbiome to enhance plant nutrient uptake & help prime/protect plants against pests & disease.
- Enhance the sequestration of carbon into soil storage; helping address climate change & achieve the net zero target.

Further exploration is required to establish how carbon sequestration could most effectively be achieved, and whether it could provide an income stream as an investible natural capital product. The value of this opportunity is significant, as most other industrial sectors cannot act as a carbon sink. More broadly, there is good correlation between regen ag and improving the 'ecosystem services' provided by the soil: e.g. purifying water, cycling nutrients, sequestering carbon, regulating flooding, and providing food, fibre and fuel.

The recent rise in precision agriculture and associated monitoring and measuring technology brings further opportunity for regen farmers. The improvement in data granularity, if effectively harnessed, will provide more information on crops, the environment, carbon and local ecosystem services with which to make decisions. If regen farming is to be rewarded through external factors (e.g. the market or ELMs), this data could also provide evidence to support.

Sensors can now measure key soil health indicators, from simple indicators, such as pH and organic carbon content, to more complex, such as microbial diversity or volatile organic compound (VOC) signatures. Aerial or satellite imagery can measure crop health and predict both yield and nutrition requirements, and sensing, sampling and laboratory analyses can determine biodiversity, community structure and plant micronutrition.

Despite these opportunities, there are still a number of barriers to the adoption and scale up of regen ag.

Barriers to overcome

During stakeholder workshops organised by CHAP as part of creating the business case, a number of barriers were outlined and confirmed:

- **Risk**

  Real and perceived **risk** from undertaking new practices with unknown and less predictable outcomes.
- **Evidence**

  Lack of r**obust data** and **evidence** in a complex system.
- **Diversity**

  Heterogeneity of soil systems & discrete farm management plans. Hard to make certain practices work at individual farm or field level.
- **Transition**

  How to implement a **successful transition period**. Regen practice seeks to improve the biological system, which takes time.
- **Reward**

  Lack of incentive, reward & recognition for regen produced food.
- **Confusion**

  How parameters for regen ag compare to conservation agriculture, integrated farm management (IFM), etc.
- **Mindset**

  Resistance to change must be overcome – mindset and risk appetite.
- **Integration**

  Practices often only bring benefits when part of a **full system.** Need to combine factors to make a difference.

Solution – The Field Profiler

CHAP proposes the development of a 'Field Profiler for Regenerative Agriculture', in the form of a profiling tool which exploits best-in-class approaches to measurement and clustering, to deliver accurate and resonant profiles to support regen ag decisions.

The primary purpose of this is to enable land managers to target multiple different objectives for their land, from yield improvement to carbon farming, by providing predictions of the likely outcomes of a management decision and insights into the possible pathways of delivering those outcomes.

Its secondary purpose is to support the development of common metrics with which to benchmark regen and net zero agriculture. This would be done through the integration and effective use of existing data, as well as generating new data through sensor and in-field measurement of the environment in and around the crop at a sub-field level, to create a series of profiles that represent the diversity of fields under-going regen ag.

Long-term, it is hoped that this data could be used to define a 'digital twin' of the field, for real-time analysis and predictive insight.

By focusing on improving measurement and insight, this solution provides a measurement protocol for, and benchmarks of, regenerative success, and provides the data to underpin improved scenario testing and simulation. It directly addresses the need to measure, prove and demonstrate the tangible impacts of regen ag to de-risk change and drive adoption. This is due to the profiles being scoped for individual fields rather than whole farms, allowing small-scale changes to be made with expected positive outcomes, so lowering entry barriers for uptake of regen ag practices.

The 'Field Profiler' was assessed as delivering the equal best economic return on public investment, despite being the highest cost. It substantially outperformed other assessed options for qualitative benefits (particularly in providing a clearer focus for research and practice).

It is recognised that it carries a moderate level of risk, but this can be managed and mitigated through good sector relationships. CHAP is confident that it can successfully deliver the 'Field Profiler' as a solution to the current challenge, as it strongly aligns to its purpose, vision and strategy within the UK agri-tech sector.

With special thanks to CHAP's partners and collaborators for enabling this report to be created.

www.chap-solutions.co.uk enquiries@chap-solutions.co.uk

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USING A DIVERSITY OF NITROGEN FORMS TO ENHANCE **FOLIAR EFFICIENCIES**

Joel Williams says this season presents some wonderful opportunities to test and trial some new approaches towards optimising N inputs – valuable lessons can be learnt for future seasons ahead.

With fertiliser prices the way they are, I'm sure everyone is already thinking it is going to be an eyebrow raising season ahead. This year will likely bring out some of the best and worst examples of a soils potential to function with reduced inputs. Reducing inputs is typically a long term game, best adopted slowly, in stages, and, by combining multiple strategies into an integrated approach. There sure is no silver bullet or one size fits all. Don't get me wrong, I know some have had great success with a cold turkey approach too, so it's not impossible, but certainly a tad riskier. On the other side of the coin, this season presents some wonderful opportunities to test and trial some new approaches towards optimising N inputs – valuable lessons can be learnt for future seasons ahead. If you haven't started thinking about a pathway toward N reductions, this year will be a great year to take your first steps.

By the time of print, this growing season will be very much upon us so for the purpose of this article, I just wanted to focus in on one of the key strategies that can be used in the more immediate short term – foliar N applications. It may be a shorter term measure, but foliar applications can be a valuable tool as part of a broader, longer term strategy to improve input efficiencies1,2 and transition from input dependency. There are many pieces of the puzzle that influence the success of a foliar N application (such as the formulation, application, crop and environmental conditions) but for this article I thought we could explore some of the nuance surrounding different forms of N.

I'm sure it will be no secret that my weapon of choice for foliar N is urea, but that said, I am not opposed to Urea-Ammonium-Sulphate (UAS), Ammonium sulphate (AS) or Urea-Ammonium-Nitrate (UAN) – in that order of preference. Urea should really be the centrepiece of a foliar N approach with the other N-based inputs rounding out the options to mix in as auxiliary sources. This is because urea has multiple benefits over the other sources of inorganic-N3,4 including:

- Higher analysis so saves on transport and application costs per unit of N.
- There is a C atom embedded within the urea molecule which can be used for photosynthesis.
- It has a neutral charge so it passes through the foliage faster than ammonium or nitrate.

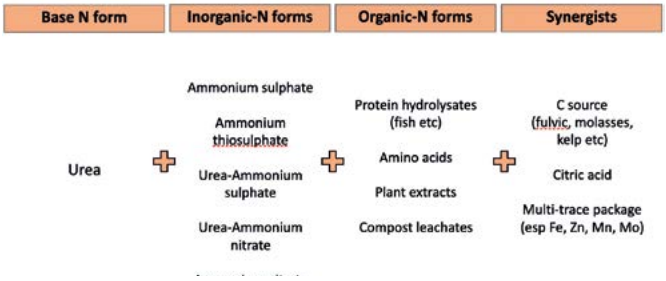
There are numerous studies that support the benefits of providing multiple sources of N for plant metabolism – it seems plants generally do better when supplied a mix of N sources5,6. The reason a diversity of N sources is desirable is that it has been shown to induce unique gene expression that ultimately leads to improved N metabolism overall3. Although nitrate is the least efficient form of N (as it drains the most metabolic energy to be converted into protein), I am not opposed to including small amounts with urea (for example, a Urea/UAN or Urea/AN combination). However, I would still lean more toward UAS or AS as auxiliary sources of N, as typically there is sufficient nitrate being cycled and supplied from soil organic matter (especially in more alkaline and higher organic matter soils) while the additional S from UAS/AS supports protein synthesis.

Similarly to this, it is additionally beneficial to include a mixture of organic and inorganic-N sources as well. Again, this relates to upregulating the genes that are involved with N metabolism and protein synthesis. A simple way to explain this would be that inorganic-N sources prime the genes involved in the early stages of N metabolism, while organic-N sources prime the genes involved in the latter stages. Therefore, by providing both N sources simultaneously, you are activating both the early and latter stage genes, which ultimately supports more efficient shuttling of inorganic-N sources along the full metabolic pathway into more complex proteins7–9. Organic-N options here include protein hydrolysates (such as fish or seed meal hydrolysates) as well as amino acid formulations. My preference leans toward the use of protein hydrolysates as these inputs contain a combination of different organic-N sources (amino acids, peptides and proteins) and again, this diversity of organic-N sources is more beneficial than pure amino acids – especially for encouraging more root development10. Beyond this, there is a handful of very interesting papers that have been published just recently all highlighting the importance of organic-N forms in the soil and calling for a greater research agenda to explore their role in soil carbon dynamics and plant nutrition7,9,11,12. Perhaps this is an article topic for another time, but the take home message would be that application of composts, manures and legume companions/residues – which all provide organic-N – should be encouraged as much as possible within our production systems.

Let's have a quick look at some practical examples of foliar recipes that could be used. I haven't discussed the specifics in this particular article but like always, I would be including a C source (such as fulvic acid, molasses etc) and acidifying the spray mix with citric acid.

Additionally, it's typically a good idea to include a small dose of a multi-trace element package, as many of the traces also support N metabolism and improve nitrogen use efficiencies. So starting with the base ingredient of urea (at around 10-20 kg/ha), I would consider the follow additional synergists:

In summary, the take home message is that nitrogen is not an island and does not operate in isolation. Multiple forms of N supplied simultaneously can bring benefits to overall N metabolism and protein synthesis. On top of this, other nutrients (such as S, Fe, Mo, Ni, Mn, Mg) are also important as well as general synergists for spray tank/foliar performance. We did not discuss the latter two considerations in this article but readers will find information on this online. Taken together, a multi-ingredient tank mix of these various N forms and N synergists can support N utilisation and improve nitrogen use efficiencies – this will be an important factor to optimise in a season when fertiliser prices are as high as they are.



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SOIL RESILIENCE STRATEGY LAUNCHED TO ANSWER KEY FARMING **SUSTAINABILITY IMPROVEMENT** QUESTIONS

How can I reduce tillage without adding to my risk? What are the best ways of cutting my vulnerability to the weather? How much carbon can I realistically capture? What do I need to do to achieve the most rewarding SFI soil standards? Where should I focus my improvement efforts for the greatest overall value?

These are just a few of the practical questions the Green Horizons Soil Resilience Strategy launched this spring by national agronomy leader, Agrii is designed to answer. And, in so doing, help East Anglian growers improve the resilience of their soils and sustainability of their systems.

Developed following studies with the UK Centre for Ecology & Hydrology (UKCEH) and others, the strategy pulls together the latest understanding of soil structure, chemistry and biology. It provides a carefully structured approach to improving soil resilience based on the best available science, a thorough understanding of soil management, and sound practical advice and action.

Flexible packages of laboratory and field-based assessments are designed to suit every soil condition, farming system and farm need, with an expanding team of soil management advisers providing specialist support.

Amy Watkins, Agrii sustainability manager

"Our strategy employs a range of modern lab tests and hands-on, in-field appraisals to identify the current health of farmed soils," explained Agrii sustainability manager, Amy Watkins at the Cambridgeshire launch.

"Together with a good understanding of each farm's particular objectives, needs and resources and practical soil management intelligence, these enable us to work with growers to develop the most appropriate plans of progressive improvement action.

"As well as concentrating the attention on some of the best areas for and ways of improving both immediate farm productivity and long-term sustainability, our strategy provides an ideal foundation for making the most of the evolving SFI soil standards payments."

Provided through both Agrii agronomists and Rhiza specialists, the Green Horizons Soil Resilience Strategy (SRS) starts with a thorough soil health assessment involving broad spectrum laboratory nutrient, pH and organic matter testing. To which can be added more detailed measurements of soil carbon at different depths.

Alongside this, it offers a suite of in-field soil biology, structure and water management assessments, employing standardised methodologies for worm activity monitoring, Visual Evaluation of Soil Structure (VESS), penetrometer, slake, aggregate stability and infiltration testing.

Carried out on a sample of fields representative of the farm as a whole or those posing particular management concerns – depending on individual preferences – the results of all these assessments are set out in easy-to-understand reports.

The Agrii team accepts that much remains to be fully understood about soil biology, the best ways of measuring it, and its complex interactions with soil structure and chemistry. So, their approach has been designed for the greatest flexibility in responding to future advances in the science as well as in meeting the individual needs of different growers and systems, not to mention changing legislation and agricultural support.

Appreciating there is no ideal soil biological community, it sets out to assess the most practical indicators of all-round soil health and productivity available as benchmarks for planning and monitoring improvements over time.

"Capturing the detail of all our assessments in the standard field reports we have developed to present the results in the clearest and most practical way provides the best basis for benchmarking and improvement planning," Amy Watkins said.

"Our reports give an objective and scientifically-valid record of soil status, allowing individual farm teams to set realistic objectives for improvement; monitor their success in meeting them; and (increasingly importantly for the future) demonstrate their progress to others – be they customers, carbon off-setters, agricultural support providers or the general public."

"To encourage the widest possible participation, we have kept SRS charges at standard consultancy and laboratory rates as reasonable as we can," she stressed. "The individual cost will, of course, depend on the specific assessments selected, the number of fields included and the frequency of re-testing."

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Scientific Understanding for Practical Action

Andrew Richards, senior Agrii agronomist

While its lab and field assessments produce a raft of benchmarking data, the real value of the Green Horizons Soil Resilience Strategy is in the practical action plans it develops from them rather than what they actually show, stressed senior Agrii agronomist, Andrew Richards at the launch.

Playing a leading role in developing the science behind the Strategy over the past five years, Mr Richards is adamant that only by combining a detailed understanding of each grower's resources and objectives with the best intelligence on all aspects of soil health and its management can any findings be translated into the most appropriate improvement action.

"More fundamental soil health constraints like pH, for instance, need to be addressed before it's worth you doing much else," he insisted. "Equally, moving to direct drilling without making sure your ground is ready for it could easily jeopardise performance. And it is essential to target levels of organic matter improvement that are realistic for both your soils and farming system.

"While no single metric can capture the sheer complexity of soil health, the best science suggests soil carbon offers an essential, simple way to assess it. But this has to be done with an understanding of how soil structure affects its carbon-carrying content.

"Our work with UKCEH has assessed the detailed organic content at DNA level of soils from almost 400 main southern England fields under a wide variety of management regimes. Amongst other things, this has shown that the clay:carbon ratio of soils is a much more useful measure of their resilience than organic matter alone. Because clay particles bind organic matter, the greater the clay content of a soil the more organic carbon it can store, but the higher the level it will require to be resilient and the slower it will be to build.

"So, we have made this metric central to our approach. Only by establishing exactly where soils sit on the clay:carbon resilience scale developed from Rothamsted work with the national soil survey, can we provide the most practical recommendations for both soil health and soil carbon storage improvements. (Figure 1).

Although the clay:carbon ratio is considered to provide one of the best available baseline measures of soil resilience status, soil organic matter changes only very slowly. So, Andrew Richards points out that merely monitoring changes in this parameter is not going to be enough to indicate progress – or lack of it – in improving soil functioning.

"Which is why our drive to improve soil resilience also involves a range of other soil physical, chemical and biological assessments," he said. "In our Visual Evaluations of Soil Structure (VESS) we record primary and extended root penetration depths and arbuscular mychorrhiza as well as soil plasticity, mottling and aggregation. We take penetrometer readings throughout the profile; carry out highly visual infiltration tests; and assess the type and activity as well as number of earthworms. Active carbon measurements are another useful tool alongside other laboratory tests.

"Taken together, these assessments enable us to establish exactly how resilient particular soils are and suggest the most profitable avenues for their improvement. This and a detailed understanding of each farm's particular needs and constraints go into our action plans, the success of which we then monitored by careful re-assessment to the same protocols.

Key Soil Resilience Assessment Considerations

Extensive Agrii trialling and on-farm testing over several years have identified a host of critical considerations in both assessing soil resilience and using these assessments to improve it. Most importantly:

- Selecting fields carefully on the basis of individual grower needs;
- Taking samples that are as representative as possible of field status;
- Making biological assessments at the best time, preferably in the spring;
- Recording the weather at the time of each assessment;
- Basing all organic matter testing on the same proven process (preferably DUMAS);
- Adjusting for bulk density, chalk and stone content for accurate carbon accounting;
- Following up in-depth initial assessments with seasonal snapshots;
- Re-testing every 3-5 years – ideally with active carbon monitoring in between;
- Making future assessments at the same time of the year and under similar conditions;
- Knowing the cultivation and cropping history of the fields assessed; and,
- Understanding the particular objectives and constraints of the farm.

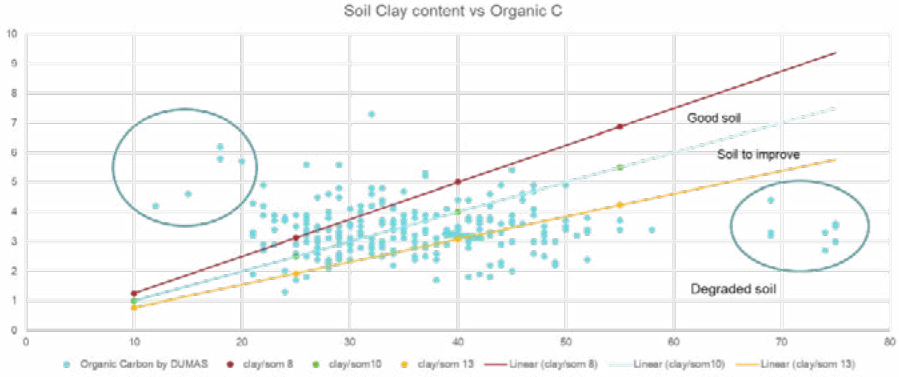

Figure 1: Agrii/UKCEH Soil Samples Set with Rothamsted National Soil Survey Parameters

Managing the Soil Microbiome

Detailed UK Centre for Ecology & Hydrology UKCEH genetic barcoding work with the heavy land soil at Agrii's Stow Longa technology centre has shown the encouraging extent to which its microbial communities have been influenced by different cultivation and cover cropping regimes run side-by-side under carefully controlled conditions over just three years.

Altogether, the microbiologists identified an impressive 62,000 different bacteria,

2000 different fungi and 4000 different eukaryotes in the Stow Longa microbiome.

Irrespective of the marker genes they used, they recorded large differences in the communities of all three types of microbe between the cultivation and cover cropping treatments. These were clearly associated with changes in organic matter level.

The degree of cultivation also appeared to be a factor, with the communities under a straw raking regime being similar to those under the various cover crops and distinctly different from those under either shallow or deep tillage.

The studies showed noticeable improvements in organic matter with both reduced cultivations and cover cropping. Even more interestingly, perhaps, increases in organic matter and decreases in soil disturbance were found to be associated with higher populations of potentially beneficial micro-organism indicators and lower populations of those considered to be harmful (Figure 2).

		Reduced Tillage – no cover crop				Cover crop & min tillage				
		Karat (shallow)	Karat (deep)	Straw rake & natural fallow	No cover crop/plough	Phacelia	OR	White mustard	Black oat & radish	Effect on crop
Soil organic matter		↓	↑	↑↑	↓	↑	↑	↑	↑↑	
Possible beneficial microorganisms	Bradyrhizobium	↑	↑↑	↑	↓	↑	↑	↑	↑	N fixing
	Verrucomicrobia	↑	↑	↑	↓	↑↑	↑↑	↑	↑	N fixing
	Metarhizium	↓	↑	↑	↓	↑↑	↑	↑	↑↑	Takeall decline
Potential pathogens	Phytomyxea	↓	↔	↓	↑	↓↓	↓	↓	↓	Club root
	Plasmodiophora	↓	↓	↓	↑	↓	↓	↓	↓	Cabbage club root
	Pythium A & B & C	↑	↑	↑↑	↑↑	↓	↓	↓	↓	Root rot – beneficial subspecies?
?	Pythium D	↔	↔	↑	↓	↑	↑↑	↑↑	↑↑	

Figure 2: Changes in Microbial Populations under Different Regimes at Stow Longa

FARMER FOCUS
CLIVE BAILYE

Risky business

The financial results are in, and they are good, in fact some of the best of my farming career to date. It would be wonderful now go on to describe how that is all down to the huge savings in fixed and variable costs made through our transition to a zero tillage, regenerative farming system, although that certainly contributes to the results it would only really be telling a part of a far simpler story.

The truth is the financial performance was really because of just 2 key decisions, buying inputs (particularly nitrogen fertiliser) and selling outputs at the right time. So, did I make money farming or trading? And which is higher risk? Farming or trading? How we look at and deal with risk is something that is a key driver to many of the decisions we make within our farming business and something I think everyone should explore their attitude towards.

As farmers we grew the crops, we took the risk with weather, put in the hours and were rewarded with a decent harvest, no record breaker but certainly on par and budget for our soil type. As farmers I'm not sure we always realise it but there is great risk in what we do, my father has said in the past "there will always be a harvest" and this is certainly true in the UK but many who farm under climates more extreme than our own will understand this is not always the case. As a result, farmers in such countries seem much more aware of the risk of planting a seed with nothing more than hope of harvest and adjust their investment accordingly to mitigate this.

Weather related risk, be it drought or flood is something that British farmers have enjoyed lower exposure to, unlike many others. In the UK a drought is usually measured in weeks, maybe months, in places like Australia however it's a question of years. The British are world renowned for obsessing and talking about our weather but in truth its nothing that extreme, making our exposure to weather risk some of the lowest in the world.

Yet most people I speak to seem to agree that our weather patterns do seem to be changing, climate change is becoming very real and whilst politicians and scientists talk about it, farmers are on the front line of that change. I'm not convinced the numbers tell the real story, looking at statistics for average rainfall and temperature in my area it seems little of significance has really changed, so why does it feel like windows to establish, harvest and spray are shorter than ever despite us having better technology and capacity than we did in the past?

The numbers don't reflect the patterns, the weather seems to get stuck in cycles of wet or dry. The autumn and winter of 2019 were the wettest I can recall farming through, establishing crops was extremely difficult and impossible for many the wet pattern lasted months and then as to add insult to injury was followed by a very dry spring / early summer during which we went 90 days without rainfall, a perfect storm of events which resulted in a lower yielding poor harvest 2020.

We can't control the weather, but I do believe we can mitigate the risk. Our move from a 6m drill to a 12m version for instance almost doubled our establishment capacity, reducing the length of window required for establishment, a move from 24m to 36m tramlines also had similar effect upon application timeliness and were both achieved whilst reducing costs and only really possible as a result of the lower horsepower requirements that no tillage bought to our farm. Regenerative farming systems typically are far more diverse in their cropping and rotation meaning all the eggs are never in one basket whilst spreading establishment, application and harvest timings.

Most importantly of all, however, is that building soil biology then changes soil structure and its ability to manage water. There is no doubt in my mind we suffer less from drought on our lighter soils that we used to, better structure and microbiological activity not only is more efficient and able to supply plants with the nutrition they need it is also important to the supply of water directly to where it's needed. The image below shows 2 images taken the same day in July 2017 from a drone following several weeks without rain, the first is looking over our wheat, the second after turning the drone 180 degrees looks over neighbouring wheat, I think it is clear which crop is better supplied with water despite similar soil types, the only major difference being over a decade of no tillage vs a more conventional plough based system.

Lack of water isn't always the problem, too much when you want to establish a crop can be equally disastrous. Again, no till certainly seems to reduce this risk and open larger windows

for activity with cover crops providing a green bridge to drill upon isolating wheels and coulters from wet soil beneath and improved structure that builds over years on no cultivation rewards with huge networks of vertical worm galleries helping move excess water to drains and subsoils more efficiently.

Agronomically, I have no doubt that our no tillage, regenerative agriculture system has reduced our risk but that's only really part of the story here.

Recent, tragic events in the Ukraine have caused chaos in commodities markets, the effect on oil and gas prices has seen red diesel rise to circa £1.25/L at time of writing. A big horsepower tractor working hard on cultivation can get though as much as 1600L of fuel a day, that's enough fuel to establish about 1000ac without cultivation! Looking back at records from when we did cultivate every acre, we used 32L/ha of fuel to establish crops, today that number is closer to 4L/ha. The increase in fuel cost has increased the capital required to plant a crop, the stakes are higher no matter what your farming system is but the rise is far more significant if cultivating that if you are not, I honestly do not know how farmers stuck in the high horse power cultivation treadmill are going to justify burning through so much fuel this coming autumn, where will that extra margin required come from?

Fuel is just a sideshow however compared to the rises in synthetic fertiliser costs, nitrogen is now almost £1000/t, a 4-fold increase upon last year's price yet with new crop wheat prices just 70% up. These are game changing numbers and although some are keen to point out that margin over input costs still makes application viable margins have been eroded, capital requirement increased and importantly risk yet again has grown. I have little doubt this will result in much lower planting of nitrogen using crops like wheat, barley and Oilseed rape this autumn. These are the high output crops that support high input farming system with high fixed cost burdens, take away the output and you are heading for financial trouble fast unless you can make rapid adjustments to your fixed cost structure.

Anything that can help reduce dependence upon synthetic fertilisers is now essential. Cover crops that can fix nitrogen are suddenly of greater value and interest to man. Diversity of rotation to include more pulses will look more attractive potentially causing oversupply in those markets, nutrient loss via offtake of crop residues and importing FYM and composts will become of greater focus. Of course there will be no shortage of products that claim to replace the need for synthetics, which some may well do but also many mostly probably will need time to provide proof via trials. For some on more marginal land fallow may become a better option than cropping, an option without output that really is only viable or something that a low fixed cost business can entertain. I don't think the Ukraine situation is something that will see rapid resolution so just maybe the certainty of entering environmental schemes could suddenly look a lot safer bet.

The farmers that have already moved to lower fixed cost, lower inputs systems are by far the best placed to deal with these extremely uncertain times, they have already built more resilient farm businesses both agronomically and financially. I could make a good argument that now is the time to reap the rewards of change but in such a volatile market the truth is profit or loss is far more likely to being down to those 2 same thing that have yielded me such a good year, buying and selling at the right time. In summary, manage and minimise risk it's what good business is all about, but more importantly be a trader, it's likely to make more difference than pretty much anything else you do today.

DRILL MANUFACTURERS IN FOCUS...

Triton seed drills are a British seed drill company that arrived on the market just 4 years ago and are now the fastest growing seed drill company in the UK with 120 seed drills now on the ground. Simon Chaplin who heads up Triton talks us through the background and development of the Triton Seed drill.

Farming in seven locations from Kelso to Cambridge over different soils in different climates gave us a broad idea of what most farmers in the UK require from a seed drill.

To use a rugby analogy, i see the seed drill as the fly half of the farm yard..ie the make of harvester or sprayer that a farmer uses does not have much influence overall but a versatile seed drill dictates the game, ie the cropping options, the preparation and timing, and profitability of the business.

Back in 2017 we were running several types of seed drills none of which were giving us satisfactory control of our farming system.

We have an uncompromising cropping system based on highest potential profit with highest potential wildlife habitat. These two goals are rarely seen to go hand in hand, but in my view they are natural partners.

The highest quality habitats can run alongside a highly profitable crop, there is no need to turn a farm over to loss leading spring crops and scrappy expensive temporary cover crops to help nature, infact far from it.

Temporary cover crops attract nature only to be destroyed. For example the roller crimper cover crop destruction technique does horrifying damage to nature.

Instead we have permanent cover strips round our fields made up of the Kings 'Poacher Leave it' perennial plants and the Bumble bee and bird mixes. These perennial plant wildlife strips are not cut back and they provide excellent dense nesting cover in the spring and winter cover for all types of nature.

Our cropping is based on maximum financial output, minimum establishment costs, and minimal input costs and we don't get taken-in by marketing.

For example if farmers used all yield the enhancement products advertised in a farming magazine then they would only need a few acres.. every seed treatment or fungicide or controlled release fertilizer will supposedly give a yield increase of 0.5t/ha, that could get up to 30t/ha if you used them all, so we don't use any of them.

We do use next generation biostimulants but only in recent years purely because our own weighbridge trials with AminoA flo gave good results.

We farm in a way which is kind to the soils and kind to nature, in a simple, straight forward fashion, the same could be said of our drills, designed to make crop establishment quick and easy, keeping cost of establishment low, the results speak for themselves, as does our customer feedback.

Triton Drills have come a long way since 2017. We will shortly be delivering our 100th drill and we look forward to being part of the future of farming in an ever-changing landscape.

"My grandfather first tried direct drilling with a disc drill in the 1970's with varying success. My father then tried in the early 1990's with another disc drill, again with mixed results. Over the last 15 years I have tried a more tine approach but again results have been inconsistent. Closing the slot with either a disc or a tine direct drill of any make is the issue on clay soils with high magnesium levels. Open slots either fill with water drowning the seed, or dry out depending on weather after drilling. They also exacerbate slug issues. The Triton direct drill is the only drill I have used that closes the seeding tine slot. For me the closing blade on the Triton is the best on the market and has now given us the option of direct drilling high magnesium clay soils, when appropriate. It's a true all rounder direct drill on both cultivated and none cultivated soils."

M G Sutton

What if you could simply create the perfect seed bed?

At Dale Drills we're as passionate about your soil as you are. As farmers we know just how vital good soil structure is to the health of your crop – locking in vital nutrients to create optimum conditions for sowing and growing.

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DALE DRILLS

THE FUTURE OF EFFICIENT CROP ESTABLISHMENT

DON'T WE LIVE IN A **CRAZY WORLD**

Written by Robert Plumb, Soil Fertility Services Ltd

Robert Plumb, Soil Fertility Services Ltd

Energy prices through the roof; inputs of fertilisers and chemicals at crazy prices; energy companies making seriously record making profits; Liz Truss - our own local MP, flying around the world with a big fat expense account and an expensive entourage to negotiate trade deals, at the expense of UK agriculture and now a War with Russia and consequences for Ukraine! Bear in mind when this was written - 1st week March 2022.

What is going to happen to your farming enterprises? The UK government would be happy for you to plant Trees or rewild - What a joke, maybe this European war will wake up our Government to back UK farmers to grow the food we need - as you are quite capable of doing.

For the past 70 years or so we have been hell bent on using chemicals and like any drug, we have become hooked on them. For a long time, 34% Ammonium Nitrate tracked the value of grain - roughly £20 tonne. In the last 10 years or so, it has drifted further apart due largely to increased demand from developing countries and increased application rates, as farmers chased yield. All good things come to an end.

Apart from the damage to the environment, what about the damage to your soil and your pocket? Oh yes, we have seen increases in yield, but that is mostly due to plant breeding - the same with other crops. Yes, we are growing higher yields pretty much across the board, but not without cost and in many cases, nutritional content is lower.

With what is going on in Europe, there is not much hope for fertiliser and other chemicals to reduce in cost, rather you can expect to have problems getting product at any price. NOW then is the time to learn how to use the alternatives. So what is the alternative? Is organic not a valid choice? Not for everyone, but it is possible to grow good crops without using chemicals.

Recently we have seen a move to another 'alternative' and that is the BIOLOGICAL OPTION. Soil Fertility Services have been promoting these concepts for 25 years and more; bear in mind we were the first people to have a soil profile pit at the Cereals Event as long ago as 1996.

SOIL is not DIRT. The difference is, there is LIFE in your soil - all sorts of life including a lot that you don't want, but why don't you want them? They are only a problem when they become dominant and then turn on your crops to live. Do bear in mind the years of poisons you have chucked on your soil and maybe, it is no wonder it is sick. Poisons can include N, P, K, and ALL other 'fertilisers' when they are applied in excess or out of balance with all other minerals. Even then they may be poisons to your 'life in the soil'.

100 ha of Nitrogen

The first thing you need to do, is to learn how to talk to your soil; to read a comprehensive soil fertility audit and check compaction layer - what does it smell like, what is the earthworm count? Then you need to learn how to feed your soil and how your soil will feed your crop.

For some 20 years we have been using Beneficial micro-organisms and we now have a stock of 25 different varieties that we can blend for specific purposes, including disease prevention and nutrition enhancement. These are Plant and Soil feeders and include specific products that can release so called "locked-up" minerals including Phosphate, Sulphate and Ammonium Nitrogen.

One of the keys to the success of this BIOLOGICAL PROGRAMME, is the food source that we produce to feed these micro-organisms. We call it V8; it is a mix produced from an organic equine Vermicompost that we use to extract all the minerals into a turbo charged biological stimulant. Because this is a natural product it is a complete food source with all essential trace elements with high levels of Humic and Fulvic compounds. On its own it is a low cost plant growth stimulant, when applied with a specific plant mineral required it can be highly effective.

We do often get tarred with the label 'snake oil', well, it's understandable, as we surely are 'out of the box' but science is always behind the innovators as many of you leading soil improvers and direct drillers will know. We work with specialist suppliers around the world and all our products are produced to the highest standards and used in human and animal health as probiotics; that is what they are – soil and plant probiotics.

If we supply your soil with the correct blend of beneficial micro-organisms, we can out-compete the pathogens. These microbes tend to be the aerobic varieties; hence we need soils with good earthworm numbers. When you think the air that we breathe is 75% Nitrogen, if you have aerobic soil, you could have 240kg/ha of potentially available Nitrogen, right there in your plant rooting zone. But how to make it available to your crops?

We have a consortium of specific bacterium and fungi that can do that; they convert the elemental Nitrogen into an ammonium form that the plant can then convert to Nitrate.

There are two issues we have to be aware of: Firstly these microbes do not like the cold, hence they will not work early in the Spring when you actually would like them to - the soil temperature is too cold; secondly, these microbes have to join up with your plant when they will 'feed' your plant, but only if it needs feeding then. This means you cannot get excess Nitrogen in your crop; however, because we are using a consortium of micro-organisms, there are many other plant health benefits such as improved root structure – hence more uptake of other nutrients including Sulphate and Potassium! 'Snake oil? No, just 'out of the box', the best thing you can do is to give us a call and have a chat.

NUTRITIONAL BENEFITS OF REGENERATIVELY GROWN CROPS

A new American study shows how regenerative farming practices — soil-building techniques that minimise ploughing, the use of cover crops, plant diverse rotations etc — affect the nutritional content of the food

Everyone knows fruit and vegetable are good for your health says the University of Washington News, but which of the dizzying array of options - organic, conventional, CSAs, local agriculture - are best for your health? The university has done a preliminary study, under the leadership of David Montgomery, a UW Professor of Earth and Space Sciences, which shows that the crops from farms which have adopted soil-friendly practices for at least five years had a healthier nutritional profile than the same crops grown on neighbouring, conventional farms. Results showed a significant boost in certain minerals, vitamins and phytochemicals that benefit human health.

Soil from a regenerative farm (blacker soil on the left) for comparison with soil from neighbouring conventional farm (right). Pic: David Montgomery/University of Washington

The experiment is described as preliminary because it has only included 10 farms across the U.S. Given the remarkable results there will be further research work carried out.

Crops from regenerative agriculture farms had 34% more vitamin K, 15% more vitamin E, 14% more vitamin B1 and 17% more vitamin B2 compared to the conventionally grown ones. The regenerative agriculture crops also had 11% more calcium, 16% more phosphorus and 27% more copper. (Jan. 27 2022 in PeerJ)

"We couldn't find studies that related directly to how the health of the soil affects what gets into crops," said David Montgomery, "So we did the experiment that we wished was out there."

Montgomery designed the study during research for his upcoming book, "What Your Food Ate," due out in June. His spouse, Anne Biklé, is a biologist and co-author of the study and the upcoming book.

The authors collaborated with farmers using regenerative farming practices to conduct an experiment. All the participating farms, mostly in the Midwest and in the Eastern U.S., agreed to grow one acre of a test crop — peas, sorghum, corn or soybeans — for comparison with the same crop grown on a neighbouring farm using conventional agriculture. Co-author Ray Archuleta, a retired soil conservation scientist with the U.S. Department of Agriculture, visited all the farms and sampled their soil in summer 2019. Farmers then sent samples of their crops in for analysis.

The study looked at farms across the U.S. doing regenerative agriculture, which uses soil-boosting practices. In eight of the farms (farms 2-9) the farmers planted the same crop as their neighbour to allow a direct comparison of the soil and resulting food.

"The goal was to try to get some

direct comparisons, where you controlled for key variables: The crop is the same, the climate is the same, the weather is the same because they're right next to each other, the soil is the same in terms of soil type, but it's been farmed quite differently for at least five years," Montgomery said.

The study sites included the farm and ranch of co-author Paul Brown. Brown had met the UW researcher during Montgomery's work for the 2017 book, "Growing a Revolution," which toured regenerative farms in the U.S. and overseas, including Brown's Ranch in North Dakota.

Results of the new study showed that the farms practicing regenerative agriculture had healthier soils, as measured by their organic matter, or carbon, content and by a standard test.

"What we're seeing is that the regeneratively farmed soils had twice as much carbon in their topsoil and a threefold increase in their soil health score," Montgomery said.

Crop samples were analysed at lab facilities at the UW, Oregon State University and Iowa State University.

The food grown under regenerative practices contained, on average, more magnesium, calcium, potassium and zinc; more vitamins, including B1, B12, C, E and K; and more phytochemicals, compounds not typically tracked for food but that have been shown to reduce inflammation and boost human health. Crops grown in the regenerative farms were also lower in elements broadly detrimental to human health, including sodium, cadmium and nickel, compared with their conventionally grown neighbours.

"Across the board we found these regenerative practices imbue our crops with more anti-inflammatory compounds and antioxidants," Montgomery said.

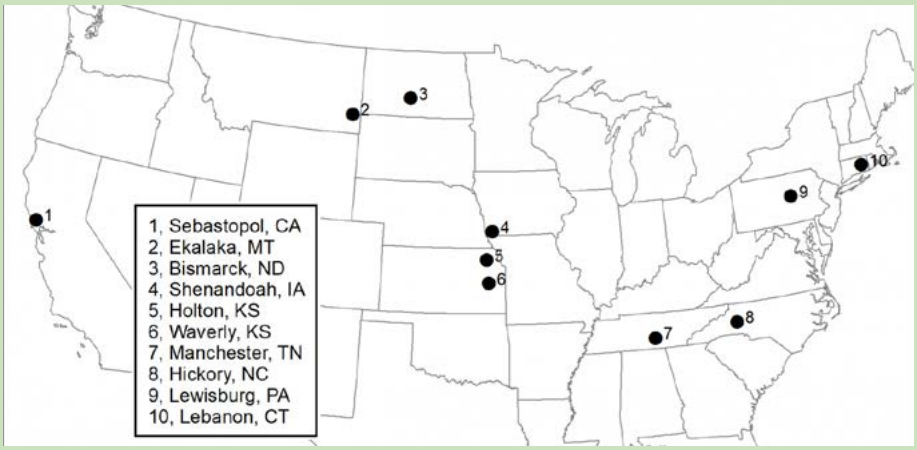
Organic farms avoid chemical pesticides but they can vary in their other farming practices, such as whether they have a diversity of crops or till the soil to control weeds. Results from a previous review study, published by Montgomery and Biklé in the fall, show organic crops also generally have higher levels of beneficial phytochemicals than crops grown on conventional farms.

The researchers believe the key lies in the biology of the soil – the microbes and fungi that are part of the soil ecosystem – as these organisms directly

and indirectly help boost beneficial compounds in crops.

"The biology of the soil was really the part that got overlooked in moving to chemistry-intensive farming," Montgomery said. "It may be that one of our biggest levers for trying to combat the modern public health epidemic of chronic diseases is to rethink our diet, and not just what we eat, but how we grow it."

The study also included cabbage grown on a no-till farm in California and a single wheat farm in northern Oregon that was comparing its own conventional and regenerative farming practices and provided both samples. The study included meat from a single producer, Brown's Ranch; the beef and pork raised on regenerative agriculture feed was higher in omega-3 fatty acids than meat from a conventional feedlot.



The small sample of farms came from across the USA

"The biggest criticism I would have of this study is small sample size – that's why the paper's title includes the word 'preliminary,'" Montgomery said. "I'd like to see a lot more studies start quantifying: How do differences in soil health affect the quality of crops that come from that land?"

The other co-author is Jazmin Jordan of Brown's Ranch. The study was funded by the Dillon Family Foundation.

For more information, contact Montgomery at **bigdirt@uw.edu**

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REGEN INTELLIGENCE

DRILL MANUFACTURERS IN FOCUS...

WEAVING TO EXPAND MANUFACTURING FACILITIES AND LOW DISTURBANCE PRODUCT OFFERING

At Weaving Machinery, we believe in offering effective and user-friendly low disturbance machinery at an affordable price, all designed according to the real needs and requests of farmers.

Yield is always a massive consideration on farms, and this is true now more than ever – as Clarkson's Farm highlighted, profit margins are tight – therefore current high input prices require high output for the balance sheet to wash its face. To that end, the last couple of years have seen more and more businesses recognise the benefits low disturbance machinery can bring to production and sustainability. For example, all our machines are built to use as little fuel as possible, a strength more prudent than ever with fuel prices at an all-time high. So, the combination of efficient fuel consumption and less time on the land makes direct drilling an increasingly attractive opportunity.

As a result, we've had a strong volume of orders and are now taking extra steps to not only meet that demand but also create new machinery that reflect the needs of our customers, immediately and for years to come.

This year, we launched our new Dual Disc, designed to run in front of seed drills to cut through cover crops and trash, even at high residue levels, in a low disturbance farming system. The Dual Disc works perfectly with both our GD and Sabre Tine drills which therefore benefits the two general routes we are seeing farmers opt for; many are looking to use a GD to drill into cover crops with a disc while others choose to transition into direct drilling at a more incremental pace with a Sabre Tine. We want to make each route viable and accessible for everyone.

Dual Disc

Speaking of the Sabre Tine, we're delighted to announce that a new model is coming this year. Our new 8 metre mounted Sabre Tine, ideal for larger farms, will launch in the autumn, following lots of demand over the last couple of years.

Sabre 6000M Drill

As well as extending our main product offering, we have also taken on some bespoke product development over the last few months, which has included a few "mini" GDs for drilling cover crops in towns and cities as well as for drilling vineyards. Another way Weaving Machinery demonstrates its commitment to prioritising the needs of our customers even where the requirement is not an 'off the shelf' product.

We've noticed more farmers opting for a low disturbance top-soiler to relieve surface compaction and get air in their soil. Our LD Top-Soiler effectively lifts the ground like a carpet and lets air in, before gently setting it down. This reduces compaction, improves drainage, and helps worm population levels all without mixing the soil profile. Demonstrations of our LD will be available by arrangement throughout the spring and summer drilling seasons.

Internally, we've also taken the step of investing in a new production hall at our home base in Evesham. The time was right to ramp up our capabilities and achieve a higher throughput, and we're doing so without halting or delaying ongoing production. The revamped production hall will include new welders, holding bays, spray paint cupboards, and an automated shot blaster – one of the largest in the UK, in fact. Steel will come in one door and go out the other as premium low disturbance machinery.

In addition to the physical enhancements, we have also invested in human resource, with a new Production Supervisor, Purchaser and Warehouse Manager joining

LD top-Soiler

the team over the last six months, each bringing more knowledge and experience to the team as well as a new Service Technician dedicated exclusively to the eastern counties.

Why does this matter? Because we aren't just passionate about manufacturing best in class and affordable equipment, but also making our own internal processes slicker and smoother. Our intention is to double production, and the improved facilities and broader skill set will help us get there.

As always, our actions are determined by our customers. We pride ourselves on listening to what our farmers need from us. That's how we can keep delivering the exceptional service and personal support that our customers expect and deserve. The next year will see us taking that mission towards new and exciting developments in low disturbance machinery, including wider drills and more.

Despite the challenges and uncertainty, 2022 is an exciting time for British farming. We at Weaving Machinery are working hard to ensure we – and our customers – are always moving forward and achieving more in low disturbance farming.

To see our machines in action, be sure to join us at LAMMA in May and Groundswell in June. We hope to see you there.

Mounted GD Drill

FARMER FOCUS
ADAM DRIVER

Last night we hopefully had the last frost of the year as the OSR is just starting to flower. I think we can finally relax with pigeon patrol. This has been relentless and my Father has spent a huge amount of time chasing them over the last few months. It seems to have paid off as the crop does look excellent whereas many have in the area have been eaten by pigeon. It is probably not a very "regen" thing to say but it does feel like the main way to getting some reasonably OSR is to drill it early, give it loads of early N, and keep the pigeons off. Last year where we didn't do these three things well enough we had some poor crops. Lessons learnt. OSR is a real difficult one as to whether to keep growing it. It can be very profitable but is hit and miss. Brings early drilling and early harvest but I have to stay our slug pressure is concerning post OSR. I keep being told the beetles will eat the slugs but their obviously is not enough of them despite not using any insecticides for years. We will carry on growing it as I believe the benefits out weigh the weaknesses of the crop at the moment.

OSR has had its total spring N (140kgs)and a foliar of the usual magnesium and molasses etc. That may well be door closed until harvest unless conditions are good for a foliar flowering N and other goodies. Another question is how and if we desiccate it? It could cost over £40/ha just to spray the stuff off. We actually have more combining capacity these days so direct cutting is an option being discussed and could well be the way forward.

Malting barley, as usual went luminous for a week or two. It now looks normal again. It also has had its total N (100kg/ha)and a tonic of the usual stuff that appears to be needed on this soil. There is not much to report about winter barley apart from one failure on my part. One field had very poor straw chop due to a damp and brackled crop that needed shaving. It has resulted in some gappy areas where germination was poor and slugs attacked. That is a lesson learnt if it really is chopping badly. It will certainly knock yield a bit and is unsightly, MUST DO BETTER.

We do have some Blackgrass in wheat this year, mostly second wheat and some after OSR. These areas we will inter row hoe with the Claydon Terrablade and see how we get on. Maybe they will need doing twice. We are not in yield affecting levels of Blackgrass by any means, but I would like to take out as much as we can on these areas. I imagine we will run the hoe through about 15% of our wheat area and 5% barley (brome). We have had the hoe for a year now but did not really get the chance to do much with it last year. If it works well then perhaps a bigger, better penetrating camera guided hoe will be on the cards. Our aim is to keep Blackgrass at an economic level.

Spring drilling will be starting imminently. We have about 1500 acres to get through which will probably mostly be done with our tined sprinter. I really worry with the disc drill in the spring as we have seen time and time again the slot can just open up and dry out very quickly. This is regardless of whether it's been drilled into dead cover, green cover, stubble, rolled, unrolled etc

FARMERS-FIRST: GENTLE FARMING WITH **AGREENA**

This is the most exciting time to be a farmer!

I am Thomas Gent, 24 years old, and I live on my family arable farm on the Lincolnshire-Cambridgeshire border. My grandad Tony Gent and my dad Edward Gent made the transition to using more regenerative farming techniques around 14 years ago.

During the first COVID lockdown, I started to look into the opportunities to differentiate and diversify my farm and the food we produce. After researching different opportunities and areas for innovation, I became aware of soil carbon and the amazing ability of the dirt under our feet to draw down carbon from the atmosphere.

So I set myself an exciting challenge: to monetise the carbon impact of my farm. Little did I know, this challenge would lead me to speaking at FTSE 100 board meetings, working with academics, advising investors and featuring on prime time TV.

Combating climate change is the greatest challenge of our generation. As caretakers of the land, we as farmers have such a unique opportunity to become climate heroes, showcasing to the world the importance of healthy, local food sources.

I founded a brand called Gentle Farming to explore these opportunities. After working for over six months

Thomas Gent

on different ideas and solutions to monetise my farm's carbon negative position, a number of factors became evident. I'd need to achieve high quality, internationally recognised verification and certification if I wanted

Julie Koch Fahler and Ida Boesen, Founders of Agreena, alongside Simon Haldrup, CEO of Agreena

to appeal to larger corporate buyers. At the same time, I'd need a system that was simple and easy to use in our day to day workings. Most importantly, it would have to put the farmer first. I wanted full control of my impact and the farming practices implemented.

There was no doubt that I'd set myself a difficult task, but after a significant amount of trialling, testing and researching multiple carbon certificate systems, things started to look up when I came across Agreena.

I connected with Ida Boesen, one of the founders of Agreena, in February 2021. Ida and her team were developing and launching their carbon system and looking for farms across Europe to pilot the programme. From our first few conversations, it was clear that we had a shared ethos and joint mission; to drive financial and environmental sustainability in agriculture.

Fast forward a year, and together we've built AgreenaCarbon - a programme that mints, verifies and issues carbon certificates annually to farmers who transition to regenerative farming practices. The farmer, the owner of the certificates, can then decide whether to sell or keep the certificates.

Our home farm was the first UK farm to use the system. I used the brand name of Gentle Farming to facilitate other UK farmers joining the AgreenaCarbon program.

It quickly became clear that Agreena wanted my help much more broadly than working in the UK. They offered me a full time role with the company to bring my "on the ground" regenerative farming knowledge to potential buyers of carbon certificates, who wanted to learn more about our form of farming.

From the start of 2022, Agreena replaced Gentle Farming as the brand name for the carbon program in the UK.

The AgreenaCarbon programme is now in its second year of operation, and consists of over 50 passionate people with expertise in agriculture, soil science, carbon markets, technology and finance.

I'm proud to say that working with Agreena, I feel we've been able to create a programme that meets the high-standards I set at the beginning of my journey.

The Gent farm has been using regenerative farming practices for 14 years

AgreenaCarbon is an internationally accredited soil carbon programme that works with leading technology and external verification partners. There is no doubt for corporate buyers and farmers that our programme delivers high quality carbon certificates.

The programme is accessible for farms of all sizes and types and makes a transition to regenerative farming practices financially viable. Even farmers who are at the start of their regenerative journey can enter. If you meet our minimum requirements on the fields you enter (no conventional ploughing and no stubble burning) you have the potential to earn carbon certificates.

Just like a normal harvest, carbon certificates are issued annually, giving farmers an additional annual income. With rising fuel and fertiliser costs, additional financial support will only become more critical for farmers.

What I'm most excited about is the amount of control we give to the farmer. Once the farmer has been issued their carbon certificates, they decide what to do with them. Agreena can support the farmer to sell their certificates to approved buyers, or alternatively, the farmer can sell certificates to their own buyers or alongside their grain. It's also possible for the farmer to keep certificates to offset their own unavoidable emissions. Whatever the farmer decides is the best option for their farm, Agreena will support it.

If I could give one piece of advice to farmers looking to join a carbon certification programme, it would be to ensure you find a programme with flexibility to meet your needs - now and in the future.

If you'd like to find out more about our AgreenaCarbon programme, visit www.agreena.com or scan the QR code at the top of this article.

I see carbon farming as the first of many shifts in farming that we must be prepared for. UK agriculture is set for the largest change for over 50 years. We are losing government funding, being asked to deliver more environmental targets, produce food for a growing population, and

Members of the Agreena team visit the Gent farm

somewhere amidst all of that, still run a business and make a profit.

To me, all of this is an extraordinary opportunity and an exciting challenge.

I believe as farmers we should be looking at something we have traditionally not been great at - marketing. The public now wants to know about farming and food production, and they are willing to spend to get that value.

Branding, marketing and storytelling about our farms is going to be a significant part of the future of UK agriculture going forward. I personally plan in the future to use Gentle Farming as a brand name to achieve this communication with my customer and capture more of the value that is traditionally lost through the supply chain.

Collaboration in this new age of agriculture is the way forward. Working with like-minded and entrepreneurial individuals is what makes these challenges exciting. I am always looking to connect with and learn from people who share my values and are passionate about the future of farming.

In conclusion, going forward Agreena will replace Gentle Farming as the brand name of the carbon program in the UK. But do not be surprised if you see Gentle Farming appear again in the near future with another solution to reward and recognise farmers who are using regenerative farming techniques to combat climate change and care for the soil that feeds the world.

DRILL MANUFACTURERS IN FOCUS...

REDUCED TILLAGE DRILL CAN OVERCOME WET SOILS

KUHN Farm Machinery has developed a significant presence in the tillage sector over the last decade, introducing a range of cultivation equipment and drills with the versatility to work in varying conditions. Specifically, the Espro and the more recently launched Aurock drills have been designed to operate effectively in the unploughed seedbed, including an ability to cope with trashy conditions.

Originally launched in 2015, the Espro range has become a firm favourite with medium to large-scale arable farmers and contractors thanks to the low power requirement and high output capacity of the various models. The Espro is available with single metering in 3.0, 4.0, 6.0 and 8.0 metre formats and with dual metering in 4.0 and 6.0 metre formats.

The CROSSFLEX coulter bar is the key to the Espro range's high working speeds, enabling seed to be placed accurately at up to 17kph. Each coulter is mounted on polyurethane blocks which allow the individual coulters to closely follow terrain contours. Ground pressure and seeding depth adjustment are controlled hydraulically. This ensures a consistent seeding depth across the machine's full working width and enables accurate seeding to be carried out at high forward speeds.

The challenge of drilling in wet conditions is becoming ever more common and it is widely appreciated that this can have a significant effect on min till and direct drills. The Espro has large diameter, narrow, offset press wheels which help to allow trash flow through the machine by preventing a build-up in front of the wheels. The Espro is better suited to wetter conditions because the wheels are mounted on their own axle so they can turn independently of each other, which ensures they keep turning. For particularly sticky conditions wheel scrapers are also available.

This also has an impact on power output and fuel economy needed to operate the drill efficiently. This means the Espro can be operated by tractors with as little as 160 horsepower, even in wetter than average conditions. The 900mm diameter of the packer wheels reduces rolling resistance and therefore the power required to pull the machine compared to smaller wheels. The wheels are also narrower than some drills at just 210mm, leaving an 85mm gap to improve soil and residue

flow. The narrow width means a larger infiltration zone in-between the wheels which helps to reduce erosion.

The packer wheels are offset 200mm front to rear, which prevents the sometimes-experienced bulldozing effect and makes the drill easier to pull. The reduced accumulation in front of the wheels also prevents the drill from bouncing, which improves the uniformity of seed delivery and placement.

This coupled with the larger 350mm diameter, bevelled edged seeding discs enables the Espro to cut through residue to ensure a consistent seeding depth. The offset discs also help to prevent hair pinning. To better deal with trash, further attention to detail has been given to the disc bearings which are moulded within the disc to create more space between the rows which allows trash to flow out more easily. The hydraulic adjustment of the working discs also helps in trashy conditions by allowing the operator to adjust the position on the move.

RC models of the Espro feature a double hopper to further increase efficiencies by choosing to apply fertiliser or a second crop in conjunction with the primary crop. The seeds pass through both metering units and are brought together in the main distribution head and subsequently sent to the coulter bar.

By choosing to apply fertiliser at the same time as the crop, the Espro is able to place fertiliser under the roots between two seed rows. This configuration is of real value for applying elements such as phosphorus. The adjustable fertiliser depth also prevents seedlings from burning. However, should the farming system benefit from cover crops, these can be doubled up and seeded together. The entire hopper can also be used for two varieties of the same seed species. This allows for separate metering but joint seeding for precision drilling of a main crop.

With windows for drilling decreasing in many areas, and the desire to move to a reduced tillage method increasing, the Espro is a valuable machine. The combination of speed, accuracy, and the ability to deal with tricky soil, even in the wet, will make it more attractive should climate change continue to disrupt conventional drilling periods.

BASE UK

BASE-UK is a nationwide, knowledge exchange organisation led by farmers for farmers and individuals passionate about the regenerative agricultural system increasing the sustainability and health of our soil, crops, livestock and therefore our industry.

In February we held our 2-day AGM Conference, which despite the threat of cancellation due to Covid-19, went ahead and was hugely successful. Next year will see the Organisation celebrate its 10th Anniversary and we are looking forward to holding this in Nottingham again with the theme "Growing Confidence!".

Growing confidence was the concept behind the creation of BASE-UK originally – to help likeminded people get together, to share experience and knowledge, and enable them to continue their journey with confidence. We are looking forward to growing in strength and confidence as a group to inspire each other.

We strongly believe we still endeavour to do this by bringing members together – lately via Zoom, but in the future with a resumption of member farm walks, visits, and meetings.

We will be attending Cereals and Groundswell in June and look forward to seeing you there.

If you would like to know more about how to join BASE-UK, please visit our website: www.base-uk.co.uk or email Rebecca@base-uk.co.uk

BASE
Biodiversity, Agriculture, Soil & Environment

www.base-uk.co.uk

HUTCHINSONS DIRECT DRILL DEMONSTRATION

Written by Mark Hatton

East Yorkshire is a part of the world I've always enjoyed spending time in, I wasn't expecting a North sea breeze to be quite as cold as it was when I visited the Hutchinsons Direct Drill demonstration at the beginning of March.

Mark Hatton

The event was put on by Hutchinsons North team with the kind permission of M.Meadley and Sons, Grange Farm, Driffield.

To be honest, I wasn't really sure what to expect from the day, with a lineup of speakers discussing everything from soil health to the transition from BPS to environmental schemes and everything in between.

With well over 100 visitors throughout the day, the group was split into two for the opening presentation.

Dick Neale (Hutchinsons Technical Manager) took the audience through a very interesting discussion on Healthy Soils, soil structure and the benefits of cover crops.

The switch from conventional plough based or minimum till systems over to Direct Drill is not overnight, the most successful transitions seem to be 3-5 years, with current input costs now becoming a much bigger consideration the temptation to go 'cold turkey' and put the whole farm under direct drill, would need some very careful consideration.

Cover crop selection is also a topic that also requires careful consideration, farmers that have tried cover cropping with little success and dismissed it as not worthwhile, have possibly chosen the wrong mix for their soil type. Oats for example, often used as being a cheap cover, lock in moisture near the surface, as seen on site at the demo.

Soil structure assessment pit

Brassica and Legume choices should be matched with soil types to help improve soil structure. A soil structure assessment pit had been dug along with trial boxes of the same soil with different seed mixes to demonstrate the effects of correct mix choice.

As well we know, worms are critical to soil health and soil structure, trials have shown that worms take material from the surface, even distribution of chopped straw is critical, with straw rakes becoming much more widely used to ensure much better coverage.

One of the biggest questions was

the choice of drill. With a selection of machines in the field, spanning both tine and disc, there is no simple answer. The die hard direct drillers will advocate discs, purely down to less disturbance, however many would argue the case for tines, both have their benefits, both will depend on soil types.

Before we got to see the drills in action, the Hutchinson team presented the benefits of the Omnia Precision mapping services and Terramap.

Omnia Precision is an unrivalled precision agronomy system that analyses information from a variety of sources, to enable intelligent and informed decision making for the full range of variable applications. It enables grower and agronomist to work at sub-field level.

It highlighted the savings on farm inputs in today's uncharted world of costs at an all time high. Directly linking the ability of many of todays drills to place both seed, fertiliser and companion crops accurately.

TerraMap produces the highest resolution soil mapping layers in the world at over 800 data reference points per hectare.

The in-field process of collecting the data is carried out in two very simple steps; scanning and collecting reference soil samples. The raw scan, soil data and soil samples are then combined and processed to produce up to 28 high-definition soil property layers.

With representation from eight drill manufacturers, a mixture of tine and disc systems, there was plenty of variation of drill designs to compare.

Given the amount of rain prior to the event, the conditions were surprisingly good. Drilling into a variety of sprayed off cover crops, both types of drill worked surprisingly well.

In my opinion the disc drills had the advantage over the tine based machines, the amount of moisture seemed to ball the soil up leaving more seed visible than the disc drills.

The disc drills appeared to leave a much more even, consistent seed placement, less smearing of the surface and better seed coverage as the pictures below show.

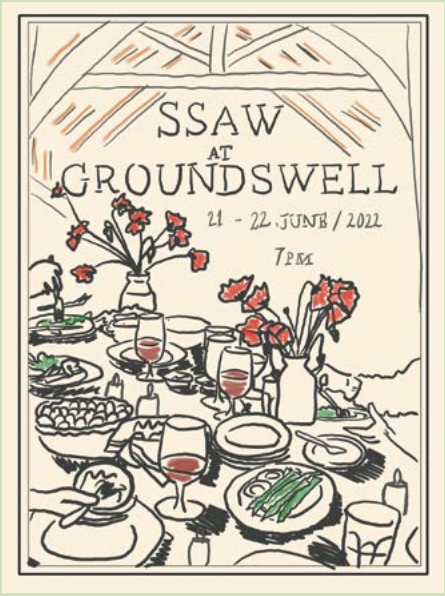
After what seemed like a long winter it was good to be back out seeing live demonstrations.

The biggest take away from the event for me, was the amount of interest in changing how we farm, not just today but in a constantly changing world of ever increasing costs.

GROUNDSWELL **2022**

There are probably as many different ways of farming as there are farmers. This certainly applies to farmers who are trying to work out how to farm in a regenerative manner. I'm sure that you are all familiar with the five principles of regenerative agriculture which give us a direction to work with nature rather than against her. Our cousins in America have added a sixth principle, context, to these five which helps us focus on the particular factors that affect our own farm whatever they may be, like family set-up, local markets for produce, soil types, local weather patterns and the myriad peculiarities that affect our decision making.

This year's Groundswell Show, which we are currently organising, will, we hope, feed delegates with ideas to implement techniques that enable us all to find ways of growing abundant crops with minimal inputs, within our contexts. We have been overwhelmed with suggestions for talks from a large array of different quarters, most of which sound fascinating. Unfortunately we haven't got space or time to fit them all in, but we hope that the ones that we let through will resonate and stimulate. More details on these will become available nearer the time.



Meanwhile we have some keynote speakers flying in from abroad, after a couple of years of no-one flying anywhere. I'm particularly excited to welcome Dwayne Beck back to the UK. I've been asking him to come every year that we've put a show on, but he's always been too busy with his own annual event at Dakota Lakes Research Farm in South Dakota. Dakota Lakes is a farmer owned operation which studies ways of making farming more resilient economically and ecologically and, in the many years with Dwayne at the helm, both he and the farm have become leading lights in the no-till world. You might think that there is not much we can learn from someone and somewhere so different to the UK, but if you thought that: you'd be wrong!

Jill Clapperton came to the first Groundswell Show we put on and we're thrilled to have her back this year. Like Dwayne, she's a titan of the world of soil and she explains what's going on under our feet beautifully clearly. We have also lined up various speakers who can explode the myths that suggest grazing animals are inevitably disastrous for global warming, like Diana Rodgers and Seth Itzkhan.

Greg Judy is back to tell us how he manages his grazing animals, he will also be joining us for the traditional moving the mob event and providing us with on hand advice. I'm afraid, yet again, it is going to be really hard to choose which talks to go to and which to watch on the computer later, but just tell yourself it's character building.

Meanwhile we have the direct drilling demos in a slightly rejigged demo field, with machines from thirteen drill-makers all drilling into an established cover crop/weed mixture. There is also going to be an inter-row hoe or two demoing in a crop of wheat. We have lined up various different composting techniques in the compost zone, which could easily engross me all day. There'll also be another dung-beetle safari, as last year's one was ridiculously popular.

There are lots of interesting exhibitors taking stands, many of them will be giving their own talks and demos, there won't be any dull moments. The main attraction is, of course, all you lot, some of the country's most innovative and delightful farmers all gathered in one place for a couple of days...it's incredibly reassuring being surrounded by such a peer group, old and new friends chatting away and egging each other on. There's nothing quite like hearing other people's stories to convince yourself that the future need not be quite as dark as the present seems to be.

Groundswell

The Sixth Annual Regenerative Agriculture Show and Conference

Wednesday 22nd and Thursday 23rd June

PRACTICAL AND INSPIRING IDEAS ON HOW TO FARM IN THE NEW ENVIRONMENTAL AND POLITICAL CLIMATE THROUGH REGENERATING YOUR CORE ASSET - THE SOIL.

Over 100 Sessions including:

Regen Ag First Principles • Rainfall Simulator • Policy Hour • ELMS and SFIs • Reintroducing Livestock • Composting • Carbon common standard • Biodiversity Net Gain • Benchmarking • Regen Ag Education • Vertical Supply Chains • Fungi • Livestock speed dating • Herbal Leys • Access to Land • Meet the Farmer • Agroforestry • Soil Farmer of the Year • Making the most of a carcass • Regenerative Viticulture • How to tell a story • Dung Beetles • Learning from Mistakes • Fibershed • Rebirding • Intercropping • Regenerative Dairy • Using your own Woodchip

Over 100 Speakers including International international appearances from Greg Judy, Jill Clapperton, Dwayne Beck, Alfred Grande, Jussi Knappi, Diana Rodgers

In-field demonstrations taking place each day of Groundswell:

Amazone • Dale • Claydon • Garford • Horizon • Horsch • Kverneland • Novag • Ryetec • Sam Agri • Sky • P Tuckwell • Primewest • Weaving

AMAZONE · CLAYDON · WEAVING THE GROWING BUSINESS · DALE DRILLS · HORIZON AGRICULTURE

HORSCH · JOHN DEERE · Novag Next Generation Farming · RYETEC · Kverneland

Samagri Ltd · OPICO · Primewest Limited Agricultural Contractors & No-Tillage Specialists

NEW FOR 2022 - THE BREAKOUT TENT FOR INFORMAL ROUND TABLE DISCUSSIONS AND Q&A

The Earthworm Arms Bar is back bigger than ever with over 15 different independent food traders offering delights throughout the day and night ranging from Pasture-Fed burgers to vegan pulp patties. All attendees are welcome to stay for the evenings of the 21st, 22nd and 23rd and the bar(s) are open late.

Catch up on sessions from last year on the Groundswell YouTube channel which is free to view for all: **www.youtube.com/groundswellagriculture**

The Groundswell festival is a catalyst for change in the farming community and we are proud to be a part of the 2022 programme. Returning for the second year, we'll be taking over a beautiful 19th Century timber barn on site to offer communal dinners, creating an installation with our flowers and providing a dinner that's not just about bringing people together at a long table but honours the relationship between farmer and chef, flowers and food, using some of the best locally sourced produce.

Expect dishes that are simple and elegant: a focus on letting the ingredients speak for themselves, seasonal and consciously sourced. Dinner will be served on sharing platters to encourage guests to meet and connect, share ideas and inspire others to continue pushing for positive change in our respective communities and industries.

Food & flowers for people & planet.

Book your place through the SSAW website. **www.ssawcollective.com**

PRODUCTS IN FOCUS...

Techneat engineering ltd ONE APPLICATOR FOUR USES... SO FAR

Microcast 200 applicator reduces crop passes, saves fuel and helps a Northamptonshire farm reduce its carbon footprint

Replacing a troublesome liquid fertiliser spreader on his John Deere 750A drill with a Microcast 200, an applicator designed for precision placement of seeds and granular products, has enabled arable farmer Andrew Pitts to improve the accuracy of previous broadcasting systems and widen the use of the new applicator via different metering cartridges available through Microcast manufacturer, Techneat Engineering.

Andrew, who farms 800ha of combinable crops alongside brother William on primarily heavy chalky boulder clay soils near Mears Ashby in Northants, originally changed his method of establishment from minimum tillage to direct drilling in 2016. After trialing six direct drills between 2016 and 2018, he eventually settled on the JD 750A as he found it moved the least amount of surface soil, critical to the ongoing success of the farm's blackgrass strategy built around minimal soil disturbance.

Eighteen months on from the investment in the Microcast 200 and, amidst the farms move towards a new 6-year crop rotation, the change to a new applicator has also revealed some additional agronomic and economic benefits.

"As a business we have always been very market driven. Everything we grow is based on a forward contract, and this enables us to track our fixed costs against predicted returns with a reasonably good degree of accuracy. With machines our policy is performance, accuracy and reliability so, when the liquid fertiliser spreader's distribution heads started to continually block up, we made a quick decision to switch to a granular application system using the Microcast 200 from Techneat.

"We've known Techneat for 30 years, since purchasing their Autocast V2 for rape establishment back in 1992. They build simple, well-engineered, reliable machines and, when required, can also innovate with a hands-on engineering approach if we're looking to achieve something that may fall outside the standard specifications. The Microcast has a quick set up, is easy to calibrate and delivers granular fertiliser, or seed, into the furrows accurately via a flexible number of individual outlets spaced evenly across the full width of the drill.

"Although the primary reason for investing in the Microcast was to replace the liquid fertiliser system with a granular fertiliser applicator we were also aware that the machine can double as a seeder unit with minimal modifications. Fast forward eighteen months and we have now successfully widened the use of the Microcast 200 to include applying cover crops, companion crop planting and slug pellets through use of different metering cartridges that can be changed quickly and easily.

"The economic savings from reduced fuel use and agronomic benefits of protecting our soil through reduced passes are important, enabling us to reduce the farms carbon footprint. However, when further examining savings on fertiliser inputs in greater detail, the overall benefits of the Microcast investment look even more impressive.

"In early August 2020 we used the new applicator to apply a mix of starter fertiliser and stubble turnips. Soil mineral nitrogen tests conducted in March 2021 indicated that, before being grazed by sheep, that mix had captured 85-90kg of nitrogen/ha, equating to 100% of available nitrogen. So, on the Spring barley crop that followed, we were able to reduce the applied nitrogen by 150kg/ha because we already had that amount of nitrogen being used in the soil operating at 60-70% efficiency. Given the current high cost of fertiliser, that equates to a considerable cost saving made by planting a companion crop, not to mention the creation of an extra use for the field itself in that we're effectively growing 3 crops over 2 years at minimal cost.

"The adaptability of the Microcast 200 applicator helped facilitate the addition of the companion crop so it must take a fair amount of the overall credit for the cost savings" concludes Andrew.

Take ownership of your carbon potential

With Agreena, **you** decide how to use your carbon certificates.

- Keep to offset your own practices
- Sell alongside your crops
- Sell to approved buyers, with our support

If it works for you, we'll make it happen.

Talk to our UK team


Thomas Gent


Oliver Clarke


Edward Reynolds

Visit **www.agreena.com** and learn more

ARE WE CLOSER TO SEEING **ROBOTS ON FARMS**?

Progression as a company over the last year.

In the last few years there has been a clear focus on deploying and demonstrating ROBOTTI around Europe. This is the best way to prove the robustness, reliability and the commercial value. In the last two years Covid-19 had a big impact on the company and its activities, limiting the possibilities of moving around. The reliability of ROBOTTI is already getting proven by the number of approaches from the third parties – there are many companies and people believing in the technology that we have developed.

AGROINTELLI has been progressing significantly over the last year. Our capital structure has been strengthened. The "capital equity injections" from our two main investors – Nordic Alpha Partners and Vækstfonden have enabled us to scale up, both commercially and in terms of operations and production.

We have aligned our organization so we have been focusing our sales activities towards distributors to establish a very tight distributors network all over Europe. We have started onboarding quite a lot of distributors, e.g. UK, Germany, Hungary, Poland, Italy, but we also saw an interest in Australia and overseas.

We have been also focusing much on end-customer and not so much on universities and research institutes. We have focused on quality insurance on our production and procurement and we are continuously working on our risk assessment on ROBOTTI to ensure that we have one of the safest robots in the world. We have technologies to support the safety of ROBOTTI with 10 different systems related to safety.

The new model of the robot - ROBOTTI LR

We have established a relationship to a number of implement manufactures both traditional and intelligent implements. They were interested to change the design to fit even better to ROBOTTI. Examples of traditional implements: Schmotzer weeder, Danfoil sprayer and other are in progress. We are also working with manufacturers of intelligent implements, where we combine different types of autonomous technologies with our robot, e.g. in harvesting.

Last summer we expanded our activities in Germany with establishment of an office and demonstration field in southwest part of the country, in Baden-Württemberg state. It is placed in a strategic position, making it much easier to support ROBOTTI's distributors and activities around Europe.

In December we have won Agritechnica's Silver Innovation Award for RoboVeg ROBOTTI, fully autonomous broccoli harvester. The same month we have introduced the new model – ROBOTTI LR, which is built upon the experiences of ROBOTTI 150D. The main difference is that ROBOTTI LR is designed for non-PTO operations, has one motor, and is able to drive up to 60 hours before the next refueling.

How do you see the market going forward and future plans?

There is a clear trend in the market towards more and more automation. We expect the market to increase continuously. There is a need of automatization of operations as it is considerably difficult to get labor.

"AGROINTELLI will keep developing its technology to be able to offer autonomous solutions to the market, so the existing workforce can do other tasks, that are creating more value." – says Jakob Bebe, AGROINTELLI's CCO.

Agriculture is a special industry and it is a task to convince such conservative

ROBOTTI weeding leeks in the UK

customers as farmers to robots. They have to believe in it so we have to change their mindset to embrace this technology. Since ROBOTTI can take over the repetitive work, the farmers can save the lacking workforce and this is one of most convincing arguments. On our side it is a matter of showing that ROBOTTI can handle capacity and it is reliable. We are going to do that this year by operating on fields from 20 to 200 ha.

Where farmers can see the robots.

An option available at all times is our "ROBOTTI" YouTube channel. Another source is our website, there is an option "book a demo". You are always welcome to call us to hear more. In there you can also see where the nearest distributors are located. All AGROINTELLI's distributors, without an exception, have a demo robot, which is meant to be shown to the potential customers and those that are interested in this technology. Customers can also see it in Denmark at our production facilities and the headquarter. We are planning to make various demonstrations in the countries in which we don't have currently distributors.

ROBOTTI demonstration and media coverage in Australia

We, or our distributors, are going to present the robot at the agricultural fairs. DLG Feldtage, SIMA, FIRA – are only some of them.

A new activity that we have already started are field trips to the existing customers so farmers can talk to farmers about the experiences with ROBOTTI.

DRILL MANUFACTURERS IN FOCUS...

HORSCH PUSHES DIFFERENT ASPECTS OF AUTONOMOUS DRIVING SYSTEMS

In five short statements Michael and Philipp Horsch describe what they understand by autonomous driving systems, which technical requirements are necessary, how the topic developed in the HORSCH company and what will be required in the future.

Gather experiences in the field – the robot with a mounted Maestro 24 SV.

1 **Michael Horsch:** Our first steps towards an autonomous driving system must have taken place in the early 2000s when we bought the first AutoFarm GPS steering system for HNG. At that time, it was the first RTK system from the US which allowed for driving within the range of a centimetre. When it worked, we thought: If something like this works, we should be able to drive autonomously. But at that time the project came to nothing. When we bought our test farm AgroVation in the Czech Republic, we had the chance to focus on CTF and track planning. We originally started with an agronomic point of view, but we soon realised that CTF first and foremost is about planning. This was another step towards autonomous driving systems.

2 Philipp Horsch: I would rather call many things which today are associated with the term autonomous automation. Let's take the example of a tractor that drives with GPS and can reverse on its own – for a start this only is an automation step, there is still somebody sitting on the machine who controls it. Autonomous means that there really is no driver. And we are talking about different vehicles, i. e. without a cabin on it. And what is extremely important: Automation comes before autonomous driving. It definitely is the first step. As automation has been an important topic for years, we have been making good progress. However, there still are quite some hurdles to clear until we reach complete autonomy.

3 Philipp Horsch: To be able to work in a partially autonomous way today, three things are required: First of all, the track planning system. Then you need geofencing, i.e. a digital fence. And the third point is the safety topic. Today we solve it by placing a "driver" with a

The HORSCH Robot

remote control in the field whose task it is to monitor everything and to intervene in case of emergency. The remote control is authorised for a range of 500 m. These three aspects are important to make sure that we soon can work in the field in a partially autonomous way and be safe. The next step logically is the sensor system so that the machine can be monitored, e.g. a clogging detection etc. From a technical point of view, we are working on different concepts, for at the moment we still do not know what will stand the test and in which conditions. What we know is that we have to take the different concepts into the field, exercise respectively, learn and develop further. In any case, our approach is free from any bias.

4 Michael Horsch: The current legal situation is another important issue. At the moment, from a legal point of view, the legislator does not separate between road and field, but treats them as equal. But on the road, you drive significantly faster and there is opposing traffic. The need for a re-definition and the public pressure to finally create appropriate framework conditions is enormous. If we separated road and field, we could get started in the field much faster. Another point is the possibility of the homologation of the safety concept, i.e. camera systems, radar and lidar systems. We hope that in the next few years the safety systems will have developed in such a way that they can be homologised, for from a technical point of view we are ready. All this is perfectly sufficient for a test farm, for this is where we want to gather experiences, test machines and integrate them into the farm processes.

5 Michael Horsch: The time of the generation - that by the way I also belong to – that is into fully air-conditioned cabins and a showy bonnet is coming to an end. The next generation is already waiting in the wings, is 14 to 18 years old and digitally native. The ability to deal with touchscreens, smartphones and tablets is almost innate. These young people control everything that moves completely intuitively and without ever having read a user manual. The users are already there. We have to meet the requirements.

Michael and Philipp Horsch talk about autonomous driving systems.

PRODUCTS IN FOCUS...

BTTUK - ONE YEAR ON!

Starting a new venture at anytime can be challenging, add that to being in the middle of a global pandemic and some people would say that we needed our heads looking at!

However, we had a number of key, unique and innovative elements in our business plan that helped us to swing the decision into the starting up of BTT UK Limited a subsidiary of Bourgault Tillage Tools in Canada.

Bourgault Tillage Tools (BTT) had been active in the UK for many years through an importer, but it had by no means reached full potential and something had to be done to realise this.

Bourgault Tillage Tools based in Saskatchewan, Canada identified UK Agriculture as a changing market with changes in climate and farming practices like the move towards very low disturbance and soil moisture conservation. Issues that have been around for many years in Canada and Australia

Stuart Aldworth (Technical Manager) explains that BTT have been developing and manufacturing a vast range of quality, proven and innovative wearing part products for many years supplying a global market and therefore have a proven track record in solutions to deal with these changes. This along with a significant investment commitment by BTT Canada to UK agriculture in a significant stock holding in our base near Peterborough, all combined with an unrivalled breadth of product and system knowledge from the UK based team have certainly given BTT UK Ltd the best possible foundations to work from.

One year on and BTT UK has had a steady and solid start. The increased stock holding over the year has led to all customers receiving exactly what they required quickly and efficiently. 93% of all parcels sent out are arriving with customers the next day and 100% of pallet orders have been received within 3 days, many within 2 days. For the very occasional emergency order taken on the phone at 2pm on a show stand in Norfolk we managed to get to the warehouse in Peterborough and then onto farm in Winchester by 8pm that night enabling drilling to continue through the night. Ian Clayton-Bailey (Managing Director) explains that the can-do / will-do philosophy of BTT UK is one of the key elements to success. Service is everything in agriculture, farmers do not stop at 4.30pm on a Friday to till 8.30am on a Monday so why should we. Companies that are not prepared to offer this level of service to our industry are on borrowed time.

What our customers are saying about us

I have been successfully using Bourgault VOS openers on my 6m Horsch Sprinter for 5 years. The technical support and backup has always been good for that period but now BTT have started trading in its own right in the UK it has gone to a new level, a very positive move as it has brought a dedicated manufacturing company its support and product stocking along with the continuation of key people direct to farmer users in the UK.

Tim Hayward - South Fawley Farm

"I've used BTTUK since they set up. The level of stock, speed of dispatch and competitive price is second to none. All backed up by the knowledgeable & enthusiastic team of Stuart & Ian, it's always a pleasure to deal & meet with them"

Farmer – Geoff Simms, St Albans

VOS (Versatile Opener System) - THE NEXT 12 MONTHS

The success of the Bourgault VOS (Versatile Opener System)

mainly associated with the Horsch Sprinters and CO's has led to many conversations over the past year about can the VOS seeding coulters be used on other drills? The simple answer is yes, with an adapter or in some cases a complete new leg. Also, more farmers seem to be now doing what Clive Bailye did some years ago with his 'Pimp MY Drill' project and developing their own seeding drill to meet their own requirement. BTT can help this process by supplying the complete leg and seeding coulter system to be bolted onto an existing frame and hopper unit.

Clive Bailye TWB Farms

" We were looking for a cost effective backup drill to our main drill, which allowed us to establish our crops quickly and cheaply, our Horsch CO6 has been heavily modified since we bought it in 2016. Having tried various different coulters in that time, we switched to the Bourgault Paired row opener 688-HLD-2080 holders with 610-TIP-0802 tips in 2019. We have been extremely happy with how they have out-performed all of the previous openers on their wear rate alone.
Ian and Stuart are incredibly knowledgeable and offer unbiased advice on the best options for your machinery, looking forward to our next workshop project already!"

SPEED-LOC – Jack be nimble jack be quick!

Weather patterns and conditions seem to be changing more rapidly as time goes on. The Bourgault Speed-Loc System is a proven system of quality quick change cultivation and seeding wearing parts. This means that users can react quickly and easily to any conditions that are thrown at them in short notice ensuring that the tractors keep rolling as long as possible. A-shares / sweeps, knifes, spikes and spoons are all available in the UK at Peterborough.

As with the Versatile Opener System (VOS) we are seeing not only interest from the OEM market but also from some farmers that want to make more use of existing solid equipment. One example of this is a farmer that had a SIMBA Culti-press and wanted to make use of the existing solid, well built frame. By changing the legs to create a lower leg angle and the addition of a Speed-Loc adapter and a 16 inch A-Share the unit now offers a high speed cultivator that works the top 30mm of soil, levelling and controlling new weed growth

For further information please contact Ian or Stuart at BTT UK Ltd **01733 971971 help@bttuk.com www.bttuk.com**

FARMER FOCUS
ANTONY PEARCE

How I decided to join a carbon payment scheme

Not a week goes by without another discussion about getting paid for carbon. I know that many farmers are taking a "wait and see" approach and I respect that. Above all, I understand that making a decision to enter this new market feels big and it feels complex. Without good advice on it, or how, to proceed, the natural choice is to do nothing.

I was in no better position than anyone else six months ago, and I could see that many professional advisors were equally out of their depth, being honest. Nevertheless, I try to do all I can to learn about new opportunities directly myself and so I embarked on a process of systematically engaging the main providers.

In the end, I have signed up with Soil Capital and I have tried to document my key learnings to get to that point in a series of videos on my YouTube channel so that others can benefit from what I discovered. Here are some of the most important takeaways that helped me make a decision!

Carbon payments are based on annual improvements

Lots of influential bodies and voices seem to be warning farmers against "selling all your carbon now". This seems to be based on an important misunderstanding about how carbon payment schemes work – at least in annual arable systems.

When you engage in such a scheme, nobody is coming along, measuring the total carbon stock in your soil that you've built up over the past and offering you a contract based on you keeping that stock of carbon where it is today for the next 20, 50 or 100 years. That may be how it works in forestry, but not in soil carbon.

Instead, these schemes are offering to generate payments for the new carbon you add to your soil on a year-by-year basis. Contract terms vary, but fundamentally, transactions are organised around this annual flow of new carbon into the soil, not by forward-selling rights to the entire stock of carbon you've historically stored in your soil.

As it happens, Soil Capital is able to reward both new farming practices and the maintenance of existing ones that achieve these additional flows of carbon into the soil, but the core point is the same – it is annual improvements generating the payments. The decision is not as big as "all your carbon".

There are options beyond carbon credits for offsetting

Discussions on this topic always seem to refer only to "carbon offsetting". This makes us all think of oil and gas companies, or other heavy emitters, happily polluting the atmosphere and using their profits to clean their conscience and their carbon balance sheet. They formally "offset" their emissions with carbon credits purchased from farmers but they have no relationship with the farmer.

This is understandably not such an attractive proposition for many farmers. But it is wrong to think that this is the only way for companies to reward farmers for improving their climate impacts.

The companies that buy farmers' crops now have to consider the carbon emissions from their supply chains – including those at farm-level – as part of their own carbon

balance sheet. Schemes that enable such companies to incentivise farmers in their own supply chain to improve their carbon performance exist, and Soil Capital is one. In this case, the offsetting dynamic that puts so many off is not there. This is simply companies within our supply chain working to reduce their own footprint.

Getting to net zero first isn't a hard requirement

Surely, if we as farmers are more often than not "part of the climate change problem" we should have to get to net zero ourselves before we can get paid for carbon?

I hear this a lot and it is a perfectly reasonable point of view. But we all need to understand that this is a moral position, not a requirement of the market we could be selling in to.

For decades, carbon markets have existed to enable the world to find the most economically efficient way to reduce greenhouse gas emissions. Reducing emissions has always been in their scope and that has often meant paying people to make changes that reduce their emissions, but see them continuing to generate emissions overall. The discussion about going further and taking carbon out of the atmosphere – including via so-called "nature based solutions" – is much more recent.

Carbon payment schemes for farmers tend to reflect this market reality – rewarding farmers both for reducing emissions and for increasing our storage of carbon in our soils. The market is comfortable with us getting paid to progress to (and then past) net zero, even if some of us are not there yet.

You don't have to tie your hands

No farmer, especially at such a time of change, wants to enter an agreement that binds them in for the long-term and limits their flexibility to adapt their farming system. This is an area where due diligence matters and two topics stand out: prescribed practices and exiting an agreement.

On prescribed practices, I learned that different schemes take different approaches. Some will set as a rule that you cannot cultivate deeper than 10cm. Others will require you to select practices that you will implement from a set menu. I prefer the flexibility to do what I judge is most appropriate for my farm, with visibility of any consequences in advance. This is what I get with Soil Capital.

On exiting an agreement, the key thing is to understand the terms for exiting, because these do vary. Some schemes may ask you to pay back portions of the carbon revenue you have previously earned. I looked for straightforward terms that allowed you to exit easily and with no such clawbacks.

Prices may rise, but moving early isn't necessarily a disadvantage

All the signs are indeed that the value of carbon should indeed rise, it's just a question of by how much and when.

What I learned was that, for a farmer already practising carbon friendly systems, delay can be costly because the carbon markets cannot continue to reward carbon improvements in farming indefinitely. Typically, after 20 years or so of consistent good practices, the understanding is that soil carbon levels reach a new equilibrium and so those new flows of carbon into the soil that the market is looking to reward tail off.

With that in mind, the question becomes how a scheme commits to sharing the benefits of rising carbon prices with farmers that get involved now. Is the price fixed for a number of years, meaning past a certain point, the scheme operator benefits at the expense of the farmer? Are details even specified?

Soil Capital was running its scheme in continental Europe before bringing it to the UK. This experience informs their commitment to farmers that the farmer will always earn 70% of the final sales price of their carbon, however high the price rises. I like how this aligns the interests of the farmer with the platform operator.

I hope my experience helps you understand this opportunity. As I say, there is plenty more on my channel. Whether from the supply chain, the government or just wider society, it is clear that becoming part of the "climate solution" is a challenge we all must face. For me, the right carbon payment scheme can offer transitional payments to help us put carbon friendly practices in place. Along the way, getting proper carbon footprint assessments done and practice improvements certified can only put us in a stronger position for the changing world of CSS, ELMS, SFI and carbon trading.

REGENERATIVE LIVESTOCK FARMING EVENT LAUNCHED TO HELP FARMERS OVERCOME INDUSTRY CHALLENGES

This summer, a brand-new event is being launched to help livestock farmers get to grips with regenerative farming and see it in action on a commercial farm.

Down to Earth, taking place on 15 June in Shropshire, is tailored for beef, sheep and dairy farmers. It offers an arena where the whole industry can come together and address the opportunities, facts, and the science surrounding its principles and see them in action.

At its core, regenerative agriculture looks at improving soil health or restoring highly degraded soil. This unique event will offer farmers the practical advice they need to start applying its principles back on their farms.

The event, organised by the RABDF and sponsored by Barclays, Mole Valley Farmers, Promar, Kite Consulting and AHDB, is hosted by organic dairy farmer Tim Downes. He has been using regenerative farming principles for many years and is now reaping the rewards. He is achieving grass yields upwards of 11t of DM a ha without any bought-in inputs, with 4,500L of milk from forage.

As well as seeing the regenerative farming principles in action through farm tours throughout the day, Down to Earth will also host top industry speakers, drop-in workshops, practical demonstrations and a range of exhibitors.

Commenting on the event, RABDF Managing Director Matt Knight said: "As pressure mounts for all livestock farming systems to become more sustainable, the RABDF has launched Down to Earth to offer practical face-to-face help to farmers. Regenerative farming can help build a food system that meets the consumer's needs, the animals and the environment.

"Livestock farmers face unprecedented changes with

diminishing farm payments, increasing pressures to farm in an environmentally sensitive way, and looming emissions targets. It's inevitable, as a result of these mounting pressures, all farmers will have to make some changes to say in business.

"In addition, food security is also becoming a cause for concern with the pandemic and the Ukrainian war thrusting it into the spotlight. The UK has some fantastic agricultural land and can utilise the uplands effectively with native breeds. So, finding ways to produce world-class food efficiently and in an environmentally sensitive way is a must!

This year the event will focus on seven key areas of regenerative farming. They are:

1. Soil Health/Management

Soil health is central to regenerative farming and can directly influence the palatability of the grass, grass quality and yield.

Farmers can learn about the basics of soil health, how to test soil, what they should be looking for and top tips on improving soil biology for optimum yields.

2. Grassland Management

Multi-species swards can produce high yields of quality forage when managed correctly with potential for excellent animal performance. While many features of managing multi-species swards are the same as conventional swards, there are some key differences. Farmers can hear about establishing multi-species swards, the benefits they offer and how they should be managed.

3. Agroforestry

Trees can offer many benefits in livestock systems, including improved stock health, added nutrient value and environmental benefits. Experts will discuss how trees can be used and established and the grants available to help farmers achieve this.

4. Water management

Research suggests dairy farms pay between £31 and £100 a cow a year on water. However, there are many ways farmers can reduce costs by using water more efficiently and investing in equipment to help harvest rainwater.

However, knowing the most cost-effective system, the rules and regulations around using harvested rainwater and working out the potential to collect rainwater based on roofing materials and geography can be mind-blowing.

Hear about the different types of rainwater harvesting systems available, the cost- benefits, keys considerations, and the latest updates on grants.

5. Nutrient management – recycling slurry/manure into the system. Cover on the slurry store

Pressure from the government's Clean Air Strategy to cut ammonia emissions means farms must look carefully at slurry and manure management.

This means farmers may be required to cover slurry stores, apply slurry using low emission spreading equipment and bring in tighter housing designs.

Experts will talk about preparing for new rulings coming from the Clean Air Strategy, including identifying the grants available.

6. Bokashi bugs – improving soils

The Japanese process 'bokashi' can turn manure into a valuable soil improver whilst reducing carbon and nitrogen emissions.

The technique involves ensiling farmyard manure, inoculated with a mix of microbes to create an optimal soil conditioner used to promote soil microbiology, while significantly reducing carbon and nitrogen losses.

It is believed every 1t of bokashi applied can save 40-50kg of bagged fertiliser.

At Down to Earth, visitors can find out how to get started with Bokashi, the costs and paybacks, and see the finished result of the process.

7. Carbon workshops

Conducting a carbon audit is something most farmers will have to do as the net-zero deadline nears.

Farmers can learn how to get started with carbon auditing, what's involved, the costs and tips on getting started on the journey to net-zero.

Experts will also delve into the science behind carbon sequestration and outline why farmers are part of the solution to climate change.

Attending Down to Earth

Down to Earth is taking place at The Farm, Shropshire SY5 7PT on Wednesday 15th June 2022. The event is £15 to attend, visitors must register for their free ticket at www.projectdowntoearth.co.uk where they can also find out more information about the event.

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DRILL MANUFACTURERS IN FOCUS...

MZURI PRO-TIL PRODUCES CONSISTENT CROPS FOR USER CHRIS HEATH

Fourth generation farmer, Chris Heath and his family have been farming Warwickshire countryside along the historic Fosse Way since the 1940's and now farm 3300 acres. With a broad portfolio of soil types ranging from sand to heavy clay, the family's enterprise is diverse and in addition to their arable enterprise, they also run an agricultural manufacturing business – Heath Engineering. Manufacturing a range of tele-handler implements including the Heath Super Chaser, the company also makes 16t grain and silage trailers and 32' flatbed trailers. Alongside this Chris and his family also operate the diversification, Newbridge Straw Products and produce straw bedding products for the Equine and Poultry markets, largely using raw materials produced on their own farm.

Up until more recently, the arable enterprise has largely been plough based but in response to the rising cost of fuel and increasing grain price volatility, Chris and his family have started to move away from heavy cultivations. The farm went down the min-till route with a popular tine drill which proved beneficial but after poorly performing headlands – and a lot of them, the decision was taken to purchase a Mzuri Pro-Til 4T to increase crop consistency whilst still keeping fuel usage down and minimising machinery and labour costs.

Described as a 'leap of faith' Chris took delivery of the four metre Pro-Til and after less than 6 months of ownership, defined the Mzuri as a 'god send'.

Chris suggests that one of the most noticeable differences in his Spring crops in the first year of ownership was the consistency across all his different blocks of fields, as well as a staggering improvement of consistency within each field.

This consistency is most remarkable on a headland of Spring Barley that was earmarked for woodland due to its consistent poor performance. "The headland in front of the wood has always performed poorly and lies very wet. With the Mzuri, it's allowed me to drill when its ready and the front leg lifts out wheelings giving me good establishment edge to edge – it's all good."

Part of the reason Chris believes the Mzuri Pro-Til performs so well on headlands is down to the patented independent pivoting coulters. Accommodating both horizontal and vertical movement, the coulters pivot to follow the front legs even around tight corners and places the seed in the centre of the tilled strip, the perfect position for quick, even germination.

It's this ability to bring all areas of the field up to a good standard that Chris believes will give him the edge on yield. With a lot of smaller fields, headlands can make up a large proportion of the cropping area and having these perform as well as the middle of the field should see a big impact on the farms average yield.

Chris puts this consistency down to the Pro-Til's leading leg which loosens his heavy clay soils and prepares a nursery seedbed to drill into, whilst leaving structured soil between the rows. The drills central row of weight bearing wheels spread the weight of the machine evenly over the tills and allow for even reconsolidation of the seedbed. This has been particularly beneficial for fields that were to be conventionally drilled in the Autumn and cultivated with a Vaderstaad Top Down in preparation for drilling but can be prone to slumping

in high rainfall. In this situation, Chris says "The Pro-Til's leading leg cultivates just enough to allow the crop to root well early on and gave it the best start."

The drills leading leg has also allowed Chris to place his seedbed fertiliser below the seed which he suggests is another reason why his crops perform so well in the Spring. Chris believes there could be a real benefit to placing all of the fertiliser requirement below the seed at drilling. He will be continuing to trial this and hopes this will not only give the crop all the nutrition it needs where it needs it, but also minimise his risk against dry weather, and reduce the need for additional passes saving time and money.

Favouring the targeted applications of strip tillage, Chris also places his seedbed slug pellets down with the seed. "There's no need to waste it between the rows, instead we've applied it exactly where it's needed" Using a relatively low dose, this targeted application should see the active be just as effective as broadcast, if not more so and more responsibly used.

Being a relatively new user, Chris has been very impressed with Mzuri's level of service and support that is available to operators. He has even seen an increase in interest for his contracting services since adopting the new system and after picking up further income drilling Maize, it seems there could be further demand for strip tillage establishment in the area which the family are well placed to accommodate.

As a leap of faith that has paid dividends so far, Chris's takeaway message for anyone considering the strip tillage system is that it can often be a change of mindset but you will get out of the system exactly what you put in. He suggests by working with the system and understanding what you're trying to achieve - the results speak for themselves.

STRATEGIC FARM REPORT DECEMBER 2021

Tis the time of year to reflect on progress, thing you' change and things you'll keep just as they are.

In this spirt, its time to review progress at AHDB's Strategic Farms and share some results with you. From the 15 of November, we ran Strategic Farm week with four distinct themes.

- Can flower strips reduce insecticide use?
- Managed lower inputs
- Catch and cover crops
- Cultivations and soil management

We'll take a brief look at the Wildflower and grasses mix establishment and the beneficial insects it attracts and how far they can migrate.

Can flower strips reduce insecticide use?

Patrick Barker of CJ Barker & Son, Lodge Farm, Suffolk AHDB Strategic Farm East grows wheat, barley, rye grass for seed with a strong emphasis on conservation management and healthy soils as the foundation of the farm.

"We know BPS schemes are being phased out and we are already preparing for that" he said. "the farm margins must be included as the whole farm management and employed to deliver a viable farm business"

Establishment, into a ryegrass stubble, Sumo Trio pulled through, then power harrowed and used a tined seeder at half rate and covered twice and rolled.

Thistles were dug out and hand, one plot established in spring 2020 and central plot established in the following autumn.

What's the biggest lesson? Ensure the conditions are right, fine seedbed with warmth, moisture with rain in the forecast.

Overall, however, 'farm like an environmentalist' confirms Patrick.

David Aglen, Farm Manager at Balbirnie Home Farms, has hosted Strategic Cereal Farm Scotland since September 2020, a 1,200-hectare mixed farm with 800 hectares of arable crops and 200 suckler cows and a diverse rotation including oats, spring barley, winter wheat, spring beans, potatoes and brassica vegetables

Key areas of focus include regenerative agricultural practices,

Strategic Farm East Grass Species Mix	
%	Common name
5	Common Bent
20	Crested Dogstail
15	Sheep's Fescue
20	Red Fescue
15	Chewing's Fescue
5	Smaller Cat's-tail
20	Smooth-stalked Meadow-grass

Strategic Farm East Grass Species Mix	
%	Common name
2.5	Yarrow
12.5	Common Knapweed
7.5	Wild Carrot
2.5	Field Scabious
12.5	Oxeye Daisy
15	Black Medick
5	Wild Parsnip
15	Salad Burnet
12.5	Selfheal
10	Red Campion
5	Bladder Campion

Strategic Farm East Grass Species Mix			
%	Common name	%	Common name
1.5	Yarrow	12.5	Oxeye Daisy
5	Agrimony	12.5	Musk Mallow
4.5	Betony	2.5	Ribwort Plantain
25	Common Knapweed	2.5	Salad Burnet
5	Hedge Bedstraw	10	Meadow Buttercup
5	Lady's Bedstraw	2.5	Yellow Rattle
1.5	Meadow Crane's-bill	2.5	Common Sorrel
1.5	Field Scabious	1.5	Sheep's Sorrel
0.5	Rough Hawkbit	5	Bladder Campion

ABACUS AGRICULTURE

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Ian Knight

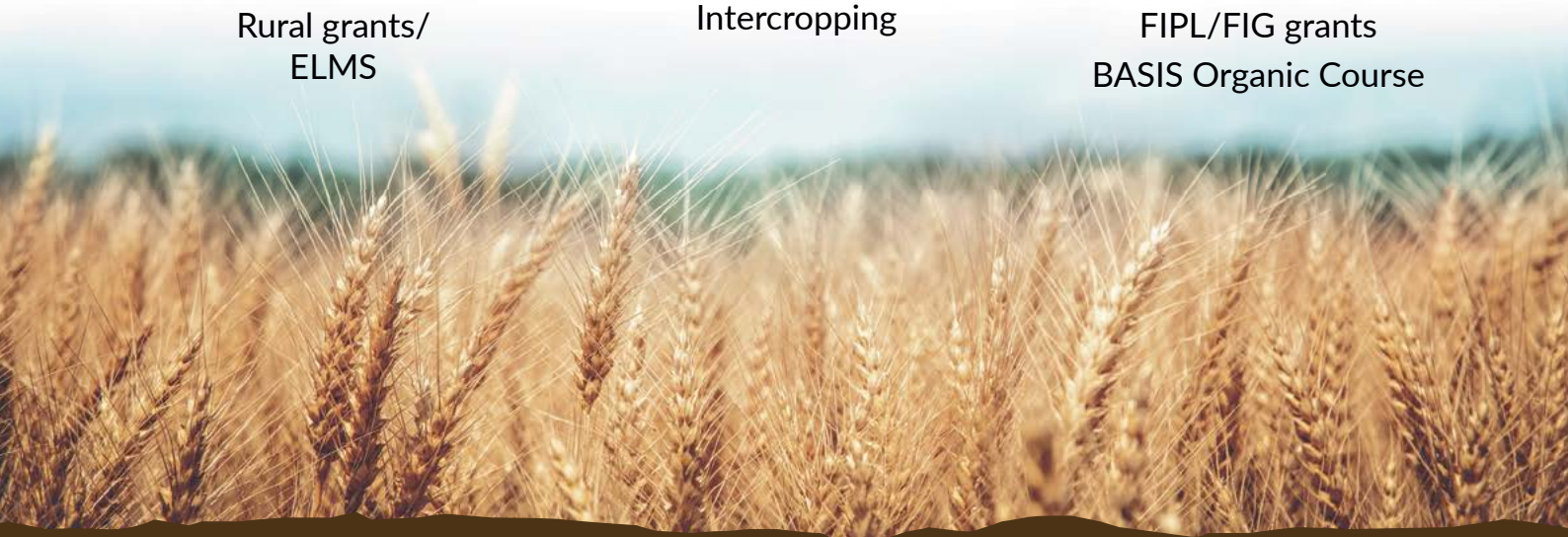
Soil management
Organic farming
Livestock farming
Agroforestry
Rural grants/ ELMS

Andy Howard

No-till farming
Soil Management
Reducing Synthetic Inputs
Intercropping

Stephen Briggs

Organic Farming
Agroforestry
Soil Management
SFI/CS/ELMS
FIPL/FIG grants
BASIS Organic Course



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plant and soil health and reduced inputs

His Strategic Farm has just started last year and is at a much earlier stage, in fact at the baselining stage of the project. Not in any environmental schemes as they are too difficult to incorporate into the business. We are looking to introduce more livestock into the arable side of the business. As for flowering strips, they are established on the field veg side of the fields ends and within the tramlines to help with soil erosion and to see if more beneficial insect species into the fields as well as pollinators. As, yet Scottish policy makers have not published what farmers should focus on.

Aoife O' Driscoll, Crop scientist at the NIAB Group, specialising in pathology and entomology and strategies for disease management,

Looking at establishment of species it should be remembered some will take longer to establish and will become prominent in the next few years. No encroachment is seen yet but is expected from year 2 and beyond.

No two floral strips were alike in their plant species composition, think about location, establishment, and management:

Location

- Select sites that don't have existing/near to noxious weeds problems
- Less fertile soils are better to discourage grasses
- The wider the sown area the better to avoid ingress from the edges.
- Selecting plant species appropriate for the soil type and climate
- Even better if they already occur in other areas on the farm,
- Grasses can be included but usually establish anyway.

Establishment

- To cultivate, direct or plough?
- If you have a weed burden, keep cultivating pre-sowing, no real benefits seen between ploughing and cultivating but either practice must see a warm, moist seedbed.
- Weed problems: repeat the process of cultivating and letting weeds emerge as many times as possible before broadcasting on to a fine seedbed then roll.
- Sow when warm and into a moist soil March/April or August/ September
- Avoid dry periods.

Management

- Options: Cut and collect, cut and leave or cut in spring?
- Avoid cutting all areas at the same time to ensure that flowers are constantly present somewhere.
- Leaving some scruffy areas or allowing weeds to survive in the crop also has value e.g., for bees.
- Many hedgerow plants are also valuable and should be encouraged e.g. hogweed, wild parsnip

Hoverfly larvae are great little predators, eating 100s of aphids before pupating and emerging as flies. The flies don't eat aphids but need to find pollen and nectar – so floral strips are really important for them around arable crops.

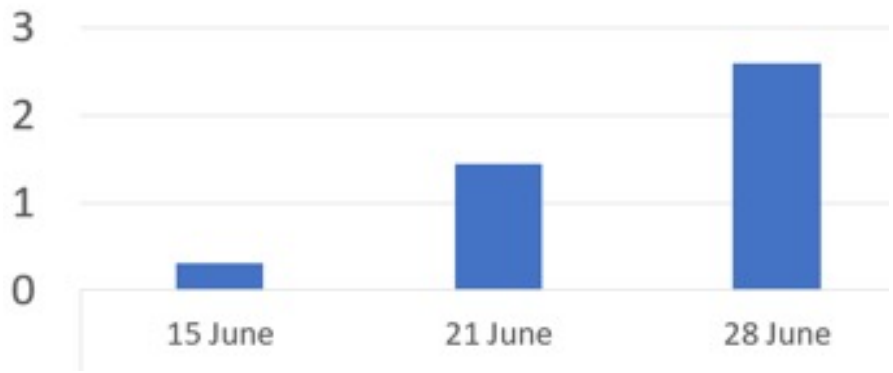
Key take home messages; Pests & natural enemies

- Predators disperse into the field at different rates and can complement each other
- Grassy beetle banks can provide infield overwintering habitats
- In field flower strips can provide forage for parasitic wasps and hoverflies when adults
- Multifunctional margins: Flower strips + tussocky grass species, or alternate grass and flower strips
- Diversity of habitats support a diversity of natural enemies & pollinators

As Strategic Farm Scotland further established into the project more data and answers will emerge. Clear there is plenty more work and analysis to complete. Stay tuned within these pages and look-up AHDB Strategic Farm on-line for much more information.

Pests, natural enemies and flower strips at Strategic Farm West.

Above; The abundance of aphids and their natural enemies and parasitoid across all locations from 15 – 28 June 2021.



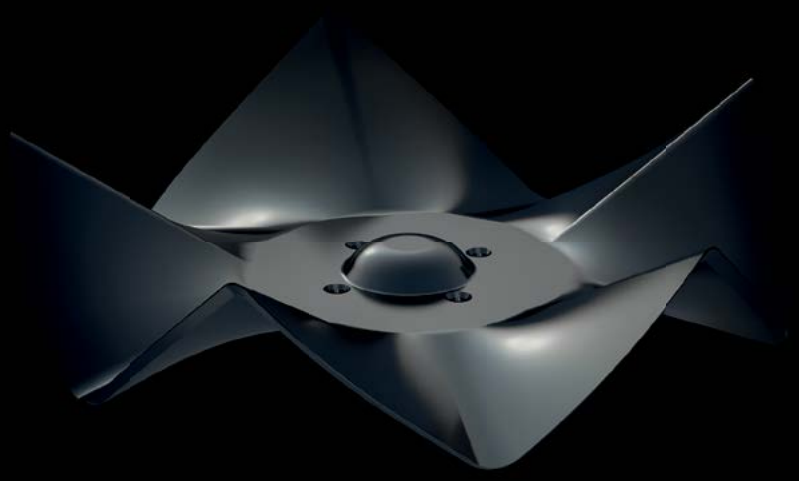
Above;Average number of hoverfly larvae per trap

MACHINE OF
THE YEAR 2018

CrossCutter by Väderstad

Ultra-shallow tillage

Ultra-shallow tillage by Väderstad CrossCutter Disc provides full cut at only 2-3cm working depth. The unique cutting profile crushes, chops and mulches in one single pass. It is excellent in oilseed rape stubble, cover crops and grain stubble.

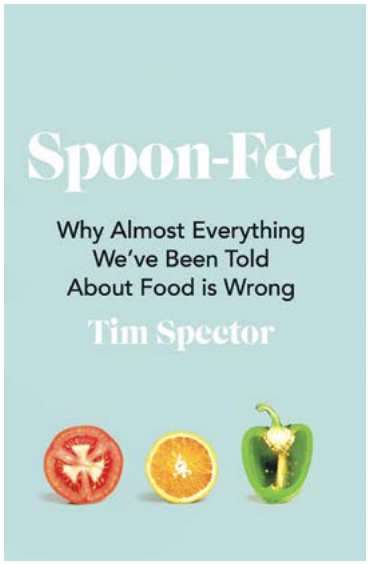


Learn how ultra-shallow tillage by Väderstad CrossCutter Disc will help give a perfect start to your next crop at vaderstad.com

VÄDERSTAD

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.



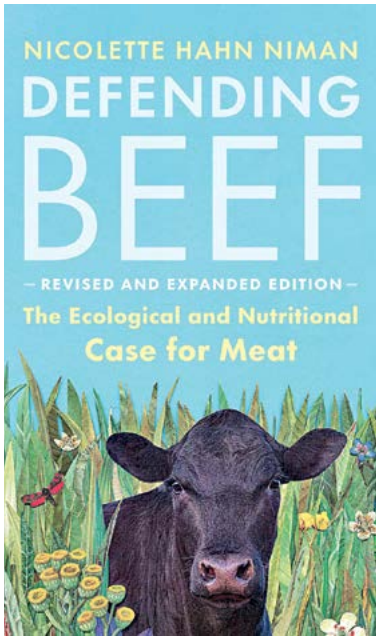
Spoon-Fed

Is breakfast really the most important meal of the day?

Is there any point in counting calories?

Is there any evidence that coffee is bad for us?

Through his pioneering research, Professor Tim Spector busts these and many other myths about food. Spoon-Fed explores the scandalous lack of good science behind many diet plans, official recommendations and miracle cures, and encourages us to rethink our whole relationship with food - not just for our health as individuals, but for the future of the planet.

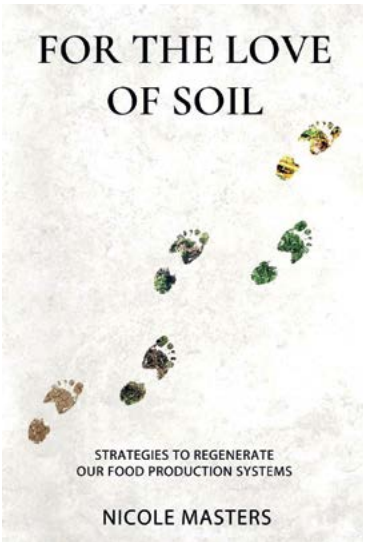


Defending Beef: The Ecological and Nutritional Case for Meat, 2nd Edition

"We all need to understand the story behind our food. This is the strongest and most articulate case for understanding the central importance of grazing livestock in sustainable food systems that I've read." Says Patrick Holden, founder and chief executive, Sustainable Food Trust.

With more public awareness of the connection between health and diet, food, climate and farming, Defending Beef – a modern classic on sustainable food culture – has never been more timely. As the meat industry – from small-scale ranchers and butchers to sprawling slaughterhouse operators – respond to climate threats, a pandemic and the rise of plant-based and lab-produced meats, environmental lawyer turned rancher Nicolette Hahn Niman delivers a passionate argument for responsible grassfed meat production and consumption in this updated and expanded new edition of her bestselling Defending Beef.

Hahn Niman dispels popular myths about how eating beef is bad for our bodies and the planet. The impact of grazing can be either negative or positive, depending on how livestock are managed. In fact, with proper oversight, livestock can play an essential role in maintaining grassland ecosystems by performing the same functions as the natural herbivores that once roamed and grazed there. Grounded in empirical scientific data and citing examples of regenerative agriculture from around the world, she illustrates how cattle can help build carbon-sequestering soils to mitigate climate change, enhance biodiversity, prevent desertification and provide essential nutrition.



For the Love of Soil: Strategies to Regenerate Our Food Production Systems

Newly Edited Version Learn a roadmap to healthy soil and revitalised food systems for powerfully address these times of challenge. This book equips producers with knowledge, skills and insights to regenerate ecosystem health and grow farm/ranch profits. Learn how to:- Triage soil health and act to fast-track soil and plant health-Build healthy resilient soil systems-Develop a deeper understanding of microbial and mineral synergies-Read what weeds and diseases are communicating about soil and plant health-Create healthy, productive and profitable landscapes.Globally recognised soil advocate and agroecologist Nicole Masters delivers the solution to rewind the clock on this increasingly critical soil crisis in her first book, For the Love of Soil. She argues we can no longer treat soil like dirt. Instead, we must take a soil-first approach to regenerate landscapes, restore natural cycles, and bring vitality back to ecosystems. This book translates the often complex and technical know-how of soil into more digestible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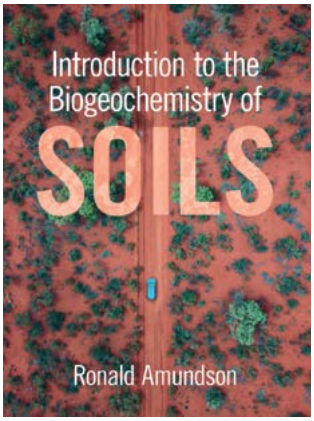
terms through case studies from regenerative farmers, growers, and ranchers in Australasia and North America. Along with sharing key soil health principles and restoration tools, For the Love of Soil provides land managers with an action plan to kickstart their soil resource's well-being, no matter the scale. "For years many of us involved in regenerative agriculture have been touting the soil health - plant health - animal health – human health connection but no one has tied them all together like Nicole does in "For the love of Soil"! " Gabe Brown, Browns Ranch, Nourished by Nature. "William Gibson once said that "the future is here - it is just not evenly distributed." "Nicole modestly claims that the information in the book is not new thinking, but her resynthesis of the lessons she has learned and refined in collaboration with regenerative land-managers is new, and it is powerful." says Abe Collins, cofounder of LandStream and founder of Collins Grazing. "She lucidly shares lessons learned from the deep-topsoil futures she and her farming and ranching partners manage for and achieve." The case studies, science and examples presented a compelling testament to the global, rapidly growing soil health movement. "These food producers are taking actions to imitate natural systems more closely," says Masters. "... they are rewarded with more efficient nutrient, carbon, and water cycles; improved plant and animal health, nutrient density, reduced stress, and ultimately, profitability."In spite of the challenges food producers face, Masters' book shows even incredibly degraded landscapes can be regenerated through mimicking natural systems and focusing on the soil first. "Our global agricultural production systems are frequently at war with ecosystem health and Mother Nature," notes Terry McCosker of Resource Consulting Services in Australia. "In this book, Nicole is declaring peace with nature and provides us with the science and guidelines to join the regenerative agriculture movement while increasing profits."Buy this book today to take your farm or ranch to the next level!



Introduction to the Biogeochemistry of Soils

The first process-based textbook on how soils form and function in biogeochemical cycles, offering a self-contained and integrated overview of the field as it now stands for advanced undergraduate and graduate students in soil science, environmental science, and the wider Earth sciences. The jargon-free approach quickly familiarises students with the field's theoretical foundations before moving on to analyse chemical and other numerical data, building the necessary skills to develop questions and strategies for original research by the end of a single semester course. The field-based framework equips students with the essential tools for accessing and interpreting the vast USDA soil dataset, allowing them to establish a working knowledge of the most important modern developments in soil research. Complete with numerous end-of-chapter questions, figures and examples, students will find this textbook a multidisciplinary toolkit invaluable to their future careers.

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GEORGE SLY - MANAGING DIRECTOR

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Thank you to those who has signed up to be a Direct Driller Patron after the last issue. Our farmer writers are now rewarded for sharing their hard-earned knowledge and our readers have the facility to place a value upon that. The Direct Driller Patron programme gives readers the opportunity to "pay it forward" and place a value on what they get from the magazine. But only once they feel they have learned something valuable.

We urge everyone reading to consider how much value you have gained from the information in the magazine. Has it saved you money? Inspired you to try something different? Entertained you? Helped you understand or solve a problem? If the answer is "Yes", please become a patron so that we can attract more new readers to the magazine and they can in turn learn without any barriers to knowledge.

Simply scan the QR code to become a patron and support the continued growth and success of the magazine. Pay it forward and pass on the ability to read the magazine to another farmer.

Clive and the rest of the Direct Driller team

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