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# Soil with true resilience

## Green Horizons

Whether they’re capable of record-breaking wheats or full of blackgrass, soils can be enriched without compromising productivity, according to forward-thinking farmers in Agrii’s Green Horizons network. In this new series, *CPM* shares their sustainability improvements.

By Tom Allen-Stevens and Rob Jones

Two farmers with heavy land at opposite ends of Agrii’s UK-wide Green Horizons Network have each implemented a single-minded drive to improve their arable sustainability. Compost, cover crops, rotations and reduced tillage are threads that run through both.

But while these are often means to maintain yields while reducing reliance on agricultural inputs, these farmers have aimed to take their systems the other way. “For me, it’s about taking what we know as a packet and applying it as blanket,” says Rod Smith, at Beal Farm on the northeast coast of Northumberland.

“I know there are parts of our fields that will yield over 20t/ha of wheat, but we’re averaging between 12-14t/ha. So how can I sustainably raise the average?”

It all makes sense, especially for Rod who achieved the world record with his wheat crop in 2015. This was notched up with a field of Dickens that averaged 16.52t/ha, bringing the wheat record back to the UK from New Zealand. “I was actually disappointed with the average, as the combine monitor was regularly clocking up over 23t/ha while the Guinness adjudicator was sitting next to me,” he comments.

So the aim now is to bring every m<sup>2</sup> of crop to its optimum performance. That not only brings his cost of production down, it’s also recognised as the most sustainable way to produce food, on a per kg basis. And that doesn’t mean beating productivity out of every m<sup>2</sup> of soil — this is earth that can take a bit of pushing, and Rod demonstrates how. Standing in a field of cover crops, he digs in his spade to reveal its roots; and it bristles with life, intermeshed with fungi.

He’s joined by his Agrii agronomist Andrew Wallace, who explains the cover crops are employed as part of a true regenerative approach. “For Rod, if reducing spend results in a reduction in yield, that’s not the way to go,” he says.

“What we’re aiming for is a soil that is at its peak level of performance, and all the inputs and management practices, including the cover crops, are geared towards that.”

They’ve settled on a mix of 3-4 different

plants for the cover crop, which is “more than enough to do the job”. Two different types of radish penetrate the soil at depth and scavenge nutrients. These complement phacelia with some cheap cereal mixed in with more fibrous roots, to keep a good tilth in the drilling zone.

It’s a far cry from the soils on the 400ha all-arable farm Rod took on over 20 years ago. “We have heavy clay and it used to be horrible stuff. We’d got out of livestock some years before and the break crops weren’t enough to keep the nutrients cycling. Everything was ploughed and often moved three times before we could get a seedbed.”

Gradually cultivations have reduced. These days, a Challenger MT755E puts the grunt in front of a 7m Horsch Cruiser, ▶



Digging a spade into the cover crop reveals its roots; and it bristles with life, intermeshed with fungi.



*Rod Smith wants to take what he's learned growing record-breaking wheat and apply this over every square metre of his crop.*

► providing the primary cultivations. "It's all about timing — there's not much of a cultivation window where we are, so ideally it's just once in with the Cruiser, taken from 25-150mm depth as required, aiming for a billiard-table finish," he explains.

"Ideally we'd be direct drilling, but the land's not quite there yet. We currently use a 4m Sulki power-harrow combination for the main cash crops, set at 1700 revs and going at speed." Cover crops are established using a seeder unit attached to a 12.5m set of Dalbo rolls, and it's these that are helping feed the soil.

Rod believes it's the well composted manure he adds that could be bringing the most benefit, however. He has a straw-for-compost deal with a near neighbour which is managed carefully to build body into the clay soils. He grabs a handful of the compost and inspects it as it crumbles through his fingers, taking in the good earthy smell.

"By the time it reaches the land, there's half the tonnage but it's nutrient dense. We used to spread in autumn but now top dress in spring with a HiSpec Xcel 1250 spreader. It spreads well to 18m, which fits with our 36m tramlines."



*The seed rate on the headlands at Beal Farm is stepped up by 40-50% to ensure they have the same potential yield as the field centre.*

The composting process also kills the weed seeds — brome is the main issue — and Rod has seen a lift in soil organic matter of 0.5-1.5% over a six-year period. "It's helping to make our soils more aerobic which encourages the microbes and this in turn cycles the nutrients."

The compost is applied to the cover crops in a system that ties in well with another local aim of reducing nutrient run-off. Lindisfarne is not only a tourist hotspot, drawing in around a million visitors a year, it's a nature reserve that helps safeguard internationally important wintering bird populations. Rod is one of a number of farmers working with the Environment Agency and the local water company to improve the quality of the water that runs into the nature reserve.

"We don't like to see land left bare over winter. The cover crops do an excellent job of taking up to 60-70kgN/ha that you capture into a green mulch. This is usually then followed with a low input spring barley," he says.

Vining peas provide a valuable and soil-enriching break in the rotation, with OSR now reintroduced just once every eight years. This is the system that's provided the framework for the record-breaking wheats, and Rod and Andrew wander over to the wheat next door.

As soon as you step onto the headland it's evident the benefits are feeding through into the main cash crop — the uniform lines of smartly tilled plants that snake right up to the field edge have just claimed the space between each row.

"One of the biggest changes we've made is to vary seed rates. There's no reason why the headland should yield less than the middle of the field, and we step up the seed rate there by up to 40-50%," explains Rod.

While he's maintained wheat yields, Rod admits that the output over the whole rotation has dipped below the highs he's achieved in the past with the introduction of the cover crops and low input barley. But there have been other spin-off benefits from the changes he's made. "The farm's wildlife has improved — we have 40-50 pairs of grey partridge where we used to have 20. It's not rare to see 20-30 brown hares in a single field."

But for Rod, the key difference is with the way his soil behaves. "What we have is a soil that's enriched — you can see the life in it, and you can feel that it's working with you. I have the confidence now to push it with the knowledge it has the resilience to perform. I don't want a 12t/ha wheat, nor even an average of 14t/ha. There's no

reason why we shouldn't get an 18t/ha crop, because this land can achieve it."

## Soil-centred sustainability drive

A single-minded drive to improve its arable sustainability has helped Tom Hughes bring into line various aspects of the family farm at Salford Lodge, Pitchill just outside Evesham over the past decade.

Home-made compost, reduced tillage and determined cover cropping have helped with the challenging silty clay land, contract-farmed with heavy kit for many years, and lighter sandy gravel ground that continues to be rented out for field vegetable production. The aim for Tom has been to match both the productivity and low environmental impact of the substantial broiler business developed and run by his parents, Malcom and Liz.

Working with his Agrii agronomist, Kathryn Styan, considerable improvements have already been made, including reductions in blackgrass and brome problems, better structured and more resilient soils, and in the all-important bottom line. Some of these successes have been captured in the first year of ADAS YEN Zero benchmarking.

Fresh from working on a progressive Wiltshire downland unit, Tom came back to the family business in 2013 to take the land in-hand. He recalls 'jumping in at the deep end' with the 120ha of heavy ground not in vegetable production, full of enthusiasm for the no-till approach.

"With all the land rented out until then, we had no machinery at all," he explains. "The ground had been demanding increasing amounts of horsepower to support deep-working and power-harrowing. Unsurprisingly too, given the poor soil conditions, blackgrass counts were knocking on the door of 1500 heads/m<sup>2</sup>"

Tom gleaned some knowledge on how to progress from Agrii's heavy land trials site at Stow Longa, Cambs. "We were tempted to do a reset with the plough. Instead, though, we decided on a winter of intensive multiple stale seedbeds followed by five years of no-till spring cropping. At the same time, we mole-ploughed the whole area to link-in with the drains my parents had installed in the 1980s."

After alternating spring wheats and linseeds followed by canary seed, the first crop of winter wheat in 2019 averaged 10.75t/ha with no blackgrass in sight.

In 2016, the vegetable ground was brought back into the rotation to address worryingly low organic matters and poor structure, making the soils very prone to capping in the wet and baking hard in the



*Forced to cover over fresh poultry manure by avian flu regulations, Tom Hughes has been trying out Bokashi anaerobic compost making alongside his traditional practice this year.*

dry. By cropping the ground themselves three years in every four and working closely with their vegetable-growing partners, the team has made sure their soil improvement efforts are not compromised by the land's year in vegetables.

"We now have full overwinter cover ahead of every spring-sown crop, together with a programme of sustained annual organic matter addition," notes Tom.

"When we hand ground back for the vegetables — generally after a winter cereal — our partners spread certified green waste. We then establish the winter cover with a mix of species designed to suit their following crop on contract. At the same time, we are working closely with them to reduce their tillage in a number of ways."

Integrating this land into the arable business instead of leaving it permanently rented out has added a further complication. Poultry litter from the family's ten broiler sheds has been important in improving the rest of the acreage, but this cannot be applied directly within the vegetable rotation.

To address this issue, Tom has developed his own composting operation. This involves mixing the litter with chopped straw from the farm's 100ha of soft wheat — grown for the broiler rations — and grass silage from its 35ha of zero input grassland — which has to be removed annually under the Stewardship agreement.

"The grass silage adds extra green material which aids the composting process," notes Kathryn Styan. "With a nicely balanced analysis, including 24kgN/t and good amounts of phosphate, potash, magnesium, calcium and sulphur, the 1000t made annually has proven a much better manure than pure poultry litter.

"It's also just right for spring top dressing

the winter wheat, overcoming the fundamental conflict between direct drilling and the requirement to incorporate organic manures."

Worm populations have improved sharply, and organic matter levels are up to 8% in places, with all the soils holding water and draining better, says Kathryn. "Ground we could seldom walk in the winter without getting covered in mud or sinking in now scarcely leaves a mark on our boots, or on the soil."

With organic manures providing 20-35% of the nitrogen applied to the wheat, only 180kgN/ha (40kg/ha reduction) was applied for a crop that averaged 9.8t/ha last season.

Results from six fields of winter oats, winter wheat and forage maize were entered into the initial year of YEN Zero last season as part of the Green Horizons initiative, she continues. "The yields Tom has been averaging for each crop are at the top end of the project results, whilst the greenhouse gas emissions remain some of the lowest. All crops scored especially well for emissions from the key areas of operations and synthetic nitrogen production and application."

Central to this is the 4.8m trailed Weaving GD drill used for all arable and cover crop sowing. Tom and Kathryn also have a keen enthusiasm for cover crops, currently trying a 12-way mix based on vetch, sunflower and black oats. There are also four species of clover, fodder and tillage radish, buckwheat and phacelia on the heavy ground ahead of linseed, and on the light ground ahead of maize.

Covers are matched to time of sowing and following crop, with more complex



*Tom Hughes and Kathryn Styan test the latest batch of Salford Lodge compost.*

mixes established after early harvested vegetables before autumn-sown cereals or maize (grown for a local AD plant). Something "simpler and cheaper" at a higher seed rate may go in as late as October.

Other notable successes on the cereal side include variable rate seeding to even-up field performance; using LiquiSafe liquid fertiliser treatment to eliminate at least one spring pass; better balancing crop nutrition to improve overall nutrient use efficiency; use of biologicals at T0 and T3 to reduce reliance on fungicides — all yield-mapped, with progress tracked.

"We are putting lots of little things together within our broader soil-focussed approach to improve what we do in crop production alongside and as closely as we can with all the other environmental and carbon improvements being made by our broader family business," concludes Tom. ■

## Green Horizons

The farmer network is part of Agrii's ambitious Green Horizons plan of practical action to improve the sustainability of UK food and farming.

Focussed on increasing farm productivity and viability, providing integrated whole farm solutions, improving soil resilience, enhancing the environment, and extending stakeholder engagement, this initiative brings together the best scientific intelligence and farm experience to inform future improvement action.

Network growers are working alongside Agrii's extensive variety, soil resilience, IPM and other trial work, and collaborative projects with a range of partners to share ideas, test approaches and showcase progress.

Up-to-date information and a series of specialist insight reports is available from [www.agrii.co.uk/greenhorizons](http://www.agrii.co.uk/greenhorizons)

