

“Putting life back into our soils has worked wonders for natural predators.”

Companion and covers work together

Sustainability

Farmers are leading the way when it comes to developing practices to improve arable sustainability. CPM visits a regenerative farmer in Durham to learn more about his journey.

By Rob Jones

Trials are assessing a broad range of regenerative farming practices at David Hankey's 160ha farm and it's putting some solid science into efforts to make the most of both above and below ground biology.

Now into their third season, the Agrii Green Horizons trials at Dunkirk Farm are overlooking Gateshead's Angel of the North. They're examining the impact of a wide variety of cover and OSR companion cropping approaches, as well as in-field wildlife strips. In-depth assessments are being made of just about everything that can be measured to assess both their specific contributions and, more importantly, the benefits they bring to overall farm sustainability.

David made the decision to 'go regenerative' to address a serious deterioration in the health and condition of his sandy loam soils, which became starkly apparent in the wet winter of 2012. Since then he has done away with cultivations, broadened his rotation, developed his own cover and companion cropping regimes

and given-up using insecticides entirely.

At the same time, he has been routinely applying around 25t/ha of compost and other manures to approximately half his land each year, more than replacing the value of the cereal straw — all of which is baled for the very valuable local market.

As well as dramatically reducing problems of surface erosion on the farm's exposed and sloping ground, this approach has transformed soil health and workability, boosted organic matter levels to 5-6%, lifted worm counts to as many as 30 per spadeful, and generated a good surface tilth to aid crop establishment.

Paying dividends

This has resulted in malting barley yields of 7.5t/ha or more on his light land, with little more than 120 kg/ha of nitrogen applied. Oilseed rape performance has been equally good, with average yields of 4t/ha from just 106 kgN/ha, together with reductions in fuel use at establishment of around 80%.

"Taking the regenerative route has paid dividends from day one," says David. "Our soils have become that much easier to work, they don't slump anymore, and we seldom see water on the surface for more than a day. Putting life back into our soils has worked wonders for natural predators too. When we see aphids in our beans we no longer panic — within a few days they're being decimated by ladybirds.

"Initially we went into strip tillage with a contractor but invested in our own Claydon in 2015. It didn't take us long to replace proprietary cover crop mixes with our own designs — the best of which we've christened

Jeremy (Clarkson) for its combination of speed and power," he says.

"Having tried a variety of no-till disc drills, we've finally settled on a Horsch Avatar multi-hopper model to give us greater flexibility to further develop our 'whole food web' regenerative ideas," he says. "The science Agrii and its partners are bringing to our efforts means we're able to do this with a very much better understanding of what's going on ecologically."

In the past year, the Agrii team led by local specialist Rob Bowes, has been examining eight cover crop mixes of three to 13 different species on a field scale after winter wheat and ahead of spring barley.

Costing from £26 to £86/ha, these have resulted in very different levels of soil nitrogen, phosphate and potash as well as overall organic carbon, active carbon (available for soil microbes), total microbial biomass and earthworm counts.

The more diverse mixes have generally delivered greater nutrient and biological



David Hankey (left) and Robert Bowes are working to put science and practical know-how together to evaluate sustainable farming techniques.



Cover cropping and direct drilling have really improved the soils at Dunkirk Farm.

benefits, says Rob. "While they have also tended to be more costly, this certainly hasn't always been the case. Two of our three-species mixes, for instance, varied in cost from £26 to £54/ha, with the cheapest one making a noticeably greater contribution to the main soil nutrients and organic carbon (see table).

"The mixes have also had very different carbon:nitrogen ratios which is important in managing residues, fertiliser regimes and nutrient cycling," he adds. "In general, the bigger the above and below ground biomass, the higher the carbon content, the slower the cover will release its nutrients and the more nitrogen it will use to do so.

"We reckon a C:N ratio of around 30:1 offers the best balance between reasonably rapid residue breakdown and soil surface protection in most cases. Having said that, the best ratio for any particular situation will depend on the relative importance of those two priorities."

For OSR companion crops, rapid residue breakdown — which ties-up as little N as possible — is likely to be preferable, and this favours lower C:N ratio species like legumes, he highlights.

This, and Dunkirk Farm's experience to date, is why the parallel companion cropping trials have primarily involved mixtures of buckwheat with vetch and berseem clover — plus phacelia and fenugreek to explore if these add anything in crop growth, nutrient contribution, soil structuring

or CSFB confusion.

"As well as concealing the OSR from migrating adult flea beetles, our work confirms buckwheat is making a particular contribution to soil phosphate," notes Rob. "We also believe its early flowering is helping support the wasps that parasitise both flea beetle adults and larvae.

"We're finding the vetch which takes over as the dominant companion after the buckwheat dies back is valuable in maintaining crop cover for pigeon deterrence, while the berseem clover is giving us great soil structuring. And both are contributing extra nitrogen in the spring and early summer.

Better nutrient uptake

"Our comprehensive soil and tissue testing indicates the companions are delivering around 50kgN/ha to the crop.

At the same time, we've recorded noticeably higher levels of phosphorus, potassium and sulphur, as well as boron and molybdenum in OSR leaf tissue testing where companion crops are grown. Levels were particularly elevated where we had a more diverse companion mix and replaced seedbed DAP with a specialist protected phosphate Agrii-Start fertiliser," he notes.

The visible differences in both crop health and grassweed control recorded in the Agrii trials at David's farm have been obvious too. Adult flea beetle damage has been negligible in both of the trial fields despite serious levels of grazing damage to the brassica components in adjacent cover crops — another valuable lesson in integrated farm-wide pest management, highlights Rob.

The cover crop in the nearby field, sown a couple of weeks later than OSR and its companions (12 August), emerged into the peak of CSFB migration and clearly acted as a useful trap crop, he believes. "This sequence of sowing is an inevitable consequence of our OSR going in after winter barley and cover crops following winter wheat ahead of spring barley in

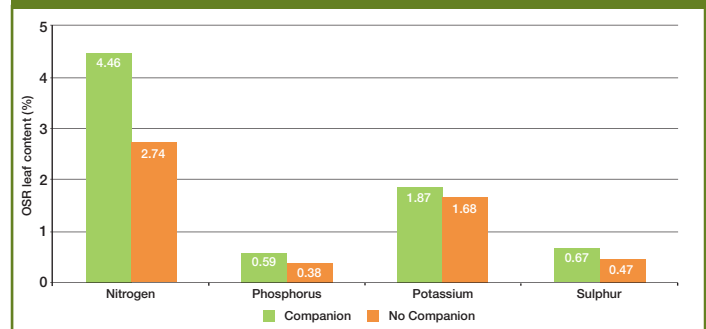
Cover crop trials

Cover crop mix	Number of species	Cost (£/ha)	Nitrogen* (Kg/ha)	Phosphate (Kg/ha)	Potash* (Kg/ha)	Organic (Carbon # (t/ha)	Earthworm count
A	6	70.00	48.62	6.06	38.47	129.2	16
B	6	52.50	43.59	5.52	31.04	94.1	18
C	5	57.50	30.34	3.76	21.36	112.2	8
D	5	46.25	22.28	2.86	13.71	132.6	19
E	13	85.50	35.61	4.01	25.07	145.1	14
F	3	53.70	28.97	4.46	22.70	120.2	22
G	3	25.65	40.44	5.18	30.45	165.5	16
H	5	40.00	28.14	3.83	20.91	145.1	18
Fallow	0	0	0	0	0	104.3	4

Agrii trials at Dunkirk farm in 2020, * Tissue analysis just prior to spraying-off covers, # Soil analysis in early spring.

Source: Agrii, 2020

Companion crop trials



Tissue analyses in early spring ahead of first fertiliser application in OSR trials at Dunkirk farm.

Source: Agrii, 2020

our six-year rotation," says David. "As the beetles arrive in September, the OSR is reasonably well-established and is nicely sheltered by buckwheat on the one hand, and fresh brassicas just coming through in neighbouring covers on the other.

"The scientists tell us flea beetles have a marked preference for younger plants, and this is crystal clear from the fact that our OSR volunteers are seldom touched. Getting companion and cover crops to work together in this way gives us what is basically a 'pop-up rainforest' harvesting sunlight and carbon, while really making trap-cropping work."

Another element of wider IPM looking very positive in the current Dunkirk Farm trialling is wildlife strips within crops to provide readily available food and cover for predators. Three metre strips of bee and pollen and nectar mixes have so far been sown into the centre of two fields of spring barley, with an average of 25 carabid beetles/trap collected in each of their three pitfall traps last summer. "That's a healthy population for beetles the

experts tell us we should only be finding within a few metres of our field margins," points out David. "What's more, we think they're going for slug eggs — carabid caviar perhaps? We're certainly not having to use nearly as many slug pellets these days."

"There's a lot more our trials work here, and on farms across the country, is looking at to help understand about these and other aspects of biological crop management," adds Rob. "As well as the best place to use covers and companions, and the best species to include for particular circumstances, we could also do with more intelligence on when and how it's best to establish and remove them; especially where soil types, elevations etc are more challenging than most.

"It's really good to work with someone as enthusiastic and committed as David. Together we're putting sufficient science and practical know-how into strategies to help growers make the most of the many benefits these techniques are able to provide, in a future increasingly built around sustainability." ■