

Rebirth your dirt



Features Conservation agriculture

Conservation or Regenerative agriculture has long been the preserve of the no-till enthusiast, but are there valuable lessons for all? CPM gathers knowledge from Groundswell and on-farm trials.

By Tom Allen-Stevens

Groundswell, that took place in Herts last month, could be viewed as the gathering point for disciples of regenerative agriculture, expounding minimal soil movement with metal, where bare earth is viewed with disdain and biology is the celebrated saviour of an enlightened tillth.

But that could be pigeon-holing an event that has a lot to offer mainstream agriculture — look around the stands and

the packed seminars and you'll find progressive, inquisitive arable farmers, rather than ecological activists.

"It feels a bit like Glastonbury Festival meets conventional agriculture," notes Northants grower Andrew Pitts. "There's a hint of organic evangelism, blended with and endorsed by professional realism — the event seems to embrace the best of both worlds. Is this the new Cereals?"

Drew a crowd

One person you probably won't find at Cereals, but who drew a crowd at Groundswell is geologist from the University of Washington David Montgomery. His trilogy of books charts the degradation and rescue of soils, and the effect on society.

"Throughout history, communities that failed to look after their soil have suffered. Erosion takes place at 1mm/yr, which sounds slow, but to a geologist, that's screamingly fast."

It's meant that those who farm in the flood plain, such as the delta of the Nile in Egypt, benefit from fertile farmland at the

expense of places like Ethiopia and Somalia, from where the soils are washed, he says.

But equally, he's been surprised at the "transformative change" to soils where conservation agriculture has been adopted. There are three core principles he expounds that are the mantra of regenerative agriculture and resounded around the event:

- Minimise soil disturbance
- Keep the ground covered throughout the year
- Have a diverse crop rotation

It's inspired farmers like Keith Thompson, with 1000ha near Osage City, Kansas in the United States. "Regenerative agriculture is about keeping something growing in the ground all the time. The key for me was cover crops, and the power of the mix — you put a load of different plants in the ground and there's a symbiosis that goes on."

All he does to his soil to put those plants there is "cut, place, firm, cover", with his drill that's adapted from a John Deere 750A. "I know my soil's improving

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Progressive, inquisitive arable farmers crowded around stands and packed out seminars at the Groundswell event in Herts.



deserves. “Both partners get something out of it, with plants getting better access to nutrients and water and organic carbon transferred to the fungus,” she explains.

“We think it also upregulates the efficiency with which plants process water and nutrients. It’s a relationship that’s been in existence for 460M years, so plants probably couldn’t have survived without it.”

Soil fertility

Mycorrhizal fungi perform certain services, in terms of soil fertility “The most significant is cycling and mineralisation of nutrients. They work with N-fixing bacteria, but there’s also a lot they do to make P available. Manage this activity correctly and you don’t need to apply any.”

Research suggests that in the presence of mycorrhizae, plants will opt to get the fungi to do all the work on processing P. This is also known to take place to a point with N and with zinc.

“The symbiosis the fungi has with the plant root also has the effect of increasing overall surface area of ‘root’

by 100-1000 times. The fungal network extends into the soil far further than the root itself, and it’s also very fine, accessing resources that would otherwise be unavailable to a plant.”

There are other services the fungi perform, she explains, including:

- Improving soil structure — through the physical properties of the fungal ‘root’ network
- Supporting healthy plant growth — microbiota work with the plant
- Stress alleviation — they aren’t anti-pathogenic, but are believed to upregulate the plant’s natural immune system
- Drought tolerance — through the extended ‘root’ network
- Degrading pollutants — they help break down pesticides and can clean up heavy metals from the land.

There are different types, but one of the most significant are arbuscular mycorrhizal fungi (AMF), continues Jamie Stotzka. “These actually grow into the root cell. 90% of crop plants want to support this symbiosis, but some don’t ▶

because I’m getting much better infiltration rates. But every farmer can do it — I’ve never met a farmer who doesn’t want to leave his soils in a better state than he found them.”

Could mycorrhizal fungi be the key to doing this? For Jamie Stotzka, head of R&D at PlantWorks, these essential soil organisms form part of a symbiosis with plants that rarely gets the credit it

6m no-till contenders at Groundswell

Make	Model	Row Spacing (mm)	Hopper (litres)	Weight (kg)	Coulters	Price (£)
Dale Drills	Eco L	125/250/ 500	3 or 4 tonnes	7000	max 48	66,000
Horsch	Avatar 6 SD	167	3500	9300	36	80,000
John Deere	750 A	166	2300	6300	36	100,862
Primewest (NOTE: 5m width)	Cross Slot PW5-23	217	2600	8000	23	135,000
Ryotec	Ma/Ag SS P 60 T	182	2500	6250	33	69,495
Simtech	T-Sem 600AC	188	4100	5550	32	70,000
Sly	Boss	167/188/ 200/250	2000	6000	max 36	From 54,000
Sumo	DD 6	200	3600	8300	30	87,243
Weaving	GD6000T	168	3800	9000	36	64,400



For geologist David Montgomery and biologist Anne Biklé, it's possible to bring transformative change to soils.

► — oilseed rape, sugar and fodder beet, cabbage and quinoa are the main ones.

"So if you grow OSR, for that growing season your population of AMF will start to be depleted, unless you are companion

cropping with another host plant. If AMF do not find a host plant they will die back," she notes.

It also exclusively and profusely produces glomalin. This is a glycoprotein that was only discovered about 20 years ago and is understood to be one of the key components that binds soil particles, helping improve water stability and decreasing soil erosion. "If you want more organic matter and to build carbon content of your soil, you need AMF — without it you will waste a third of the carbon you apply."

Requires a scientist

So how do you tell if you have AMF? "You can't see it with the naked eye. You can do a test, but it's not simple and requires a scientist," says Jamie Stotzka.

But you can influence it. "Soil disturbance has the biggest destructive effect. So min-till and no-till systems encourage AMF. Keeping continuous

crop cover, ensuring there is always a host plant, will keep the population high. Also be careful with your rotation — brassicae will not help AMF, and mustard may actually drive down the fungal community."



Jamie Stotzka believes mycorrhizal fungi form part of a symbiosis with plants that rarely gets the credit it deserves.

Lessons learned in first year of trials

Blackgrass does not make a good cover crop. That's the conclusion from the first year of adopting a no-till and cover-crops approach at College Farm, near Huntingdon, Cambs, now the UK showcase farm for the system favoured by Sky Agriculture.

The plan is to emulate the success of Ferme de la Conillais in Brittany, N France, (see *CPM*, May 2016) that hosts training sessions for farmers, alongside trials and rotations that have developed a system focused on soil improvement.

At College Farm, there's 100ha of arable crops, that sit alongside 120ha of grass grazed by the farm's flock of pedigree Suffolk sheep. The mainly Hanslope series clay "grows blackgrass well", says James Woolway of Opico, the UK distributor for Sky whose family farm at

The spring wheat is growing clean of blackgrass, but where it overwintered, it left the soil sour.



College Farm. "But blackgrass leaves the soil sour," he adds.

Having sold the machinery last July, all crops have been established with a Sky EasyDrill. The first year of trials have revolved around three fields — Gypsy Lane Field was "reset" with the plough in the autumn, with peas established this spring into bare soil, explains Joe Redman, product specialist for Sky Agriculture, who's been carrying out the trials.

"In hindsight, we should have ploughed earlier and established cover crops, because there are wheelmarks now in places that would have held the traffic better if there'd been cover over the winter," he says.

Home Field has gone into spring wheat, and the plan had been to trial direct-drilled against min-tilled cover crops. "In the end, the trial didn't come to anything because of the dry conditions last autumn. There was some cover where it was direct drilled, but in the cultivated part, only blackgrass grew.

"However, there was a difference in soil structure — where the cover crop grew well, you dig up a good spit with the spade. Where just blackgrass grew, the land is blocky, sad and difficult to dig," he reports.

In Brickyard, three different dates for establishing cover crops was tried — August, Sept and Oct. "The earlier two were much more successful than the Oct-established part.

"In the spring, we've found that if blackgrass is well established, you need to spray it off well



Christophe de Carville (left) notes the experiences of Joe Redman (right) are typical of those farms that make the transition from metal to biology.

before establishing a crop. We left two tramlines unsprayed until close to drilling, and this area did not establish well. But where there is a successful cover crop, you can spray later and drill with ease."

This first year reflects the lessons learned from La Conillais, notes Christophe de Carville of Sky Agriculture, and it's often seen as farms make the transition from "metal to biology" as the main means of working the soil. "It looks a mess, but with a good cover crop, you can spray it off just before drilling and go straight in with the EasyDrill," he says.

"Cover crop roots will go far deeper than any metal you can pull through the soil. Establish them early and you will feed your soil, turning free sunlight into roots, rather than tilling it with metal driven by diesel that you pay for.

"But don't rely on blackgrass as your overwinter cover. Yes, you'll get it to chit, but it will leave your soil in a poor state," he says.

The use of fungicides is known to reduce AMF, although the effect differs by product. "But it won't wipe them out, and fungicides aren't nearly as destructive as cultivation. Most herbicides are compatible."

You can also apply AMF, effectively inoculating your soil. It comes as a granule, a bit like Avadex, and would be applied with a similar applicator at a rate of around 10kg/ha. "Each granule contains active propagules including spores, hyphae and colonised root fragments, and the germinating seed needs to find the spore for the symbiosis to start. So a high seed rate is recommended," she says.

PlantWorks supplies two products suitable for broad-acre crops. Smart Rotations 2 (SR2) contains AMF and plant growth-promoting rhizobacteria (PGPR).

Jackie Stroud is investigating earthworms at Rothamsted Research to gauge the extent to which Lumbricus terrestris underpins successful zero-tillage agriculture.

These complementary bacteria work with the AMF to fix nitrogen, produce phytohormones, solubilise P, and enhance plant systemic resistance, says Jamie Stotzka. SR3 is a purely bacterial inoculant.

"SR2 costs around £38/ha and is best applied to a cover crop with a high seed rate so that the population has built ready for the following cash crop. SR3 comes in three crop-specific formulations, and growers should specify this when ordering. The cereal formulation costs £23/ha," she says. ■



Double the EFA benefit from the cover-crop conundrum

Cover crops established this autumn could count towards the Ecological Focus Area (EFA) of your 2017 BPS payment, notes Ian Gould of seed specialists Oakbank. "You can only claim them as part of your 2017 EFA if you've already completed and submitted the paperwork," he points out.

"However, those who have claimed for an EFA cover crop could use that same crop as their 2018 EFA, assuming the rules remain the same."

This option may be especially useful for those planning not to crop part of the area they're putting down to cover crops. "For a farm that needs 20ha of EFA for the 2017 BPS claim, you'd need to establish 67ha of cover crops this autumn, and it must remain until 15 Jan 2018," he explains.

"If you leave 20ha of that area, you can claim it as fallow in your 2018 BPS, giving you your full 20ha of EFA, provided you don't crop the

land until after 30 June. Under EFA rules for fallow, you can cut it as often as you like after 15 Jan, although you can't forage harvest or graze it."

What's more, plant the right mix and it'll do wonders to the soil, he points out. Demonstration plots at College Farm, Cambs, have been planted with different crops or mixtures to see how they perform. "Before you plant, be sure to check the current approved list of species for your EFA Cover Crops — oil radish has been added for 2017, for example," he notes.

"Radish is an excellent phosphate (P) hunter, and roots can go down as deep as 1.5m. It will stimulate legumes in a mix to fix N, because its cruciferous roots will draw the N out of the soil, although cruciferous plants don't encourage mycorrhizae." He favours Daikon radish, that puts its energy into the root, or oil radish, which puts more into the leaf.

"Rye has strong roots and will scavenge N well, but be careful as it has a high carbon-to-nitrogen (C:N) ratio, so may take up a lot of N as it decomposes," advises Ian Gould.

Sunflowers and buckwheat don't qualify for EFA, he notes, but grow fast and make good catch crops, capturing energy from the sun and turning it into biomass that can be destroyed before a late autumn crop.

"Buckwheat germinates in extremely low moisture, and it covers the ground very quickly. Sunflowers can be drilled deeper into moisture, but you only need 3-4 seeds/m². They're also great at encouraging mycorrhizae.

"Linseed is useful as it's deep-rooting and a different crop type to others in the rotation —



Those who have claimed for an EFA cover crop in 2017 could use that same crop as their 2018 EFA, notes Ian Gould.

worms like it a lot. The same goes for phacelia, which has a lovely fine root structure creating a good tilth and it's incredibly easy to establish.

"Vetches do well if left in the ground for a few months — they're legumes that fix N. They cover the ground and will keep the moisture in the soil.

"It's best to establish a multi-species mix that aids nutrient-cycling and creates a lot of synergies between plant types. These may cost a little more (£30-40/ha), but you can bring the cost down if you bulk it up with home-grown cereals, such as oats or your own field beans," notes Ian Gould.

Daikon radish, that puts its energy into the root and is an excellent phosphate hunter.

