Scorecard reconnects farmers with soil

AHDB

from theory to field

> *"The apparent disconnect between farmers and their soils had eroded confidence in their ability to assess soil health."*

A five-year project has just come to an end and will have a significant impact on how soil health is measured and managed in the UK. *CPM* takes a look at one of its most useful outputs — the Soil Health Scorecard.

By Adam Clarke

With UK crop yields and margins plateauing, interest in soil health has been reinvigorated and AHDB has invested significantly in soils research over recent years.

One of the early outputs of a recently completed five-year project was the Soil Health Scorecard and this simple, practical tool for use by farmers has now been tested and validated in multiple trials.

Its creators hope it will help restore the connection between farmers and their soils, which has, on some farms, been lost because of increased mechanisation and reliance on artificial inputs.

The Soil Biology and Soil Health Partnership started back in 2017 and researchers have been trying to work out the best way of helping farmers reconnect with, and improve, the health of their soils.

All known indicators of soil health had to be identified and expert inputs were used to distil these down into a shortlist, with the plan to use those indicators to produce a traffic light do-it-yourself scorecard system.

This would see green-amber-red represent low-moderate-high risk of reduced crop yield and sub-optimal soil conditions, or an increased risk to the environment, especially for available soil phosphate, according to the project's research lead, NIAB's Elizabeth Stockdale.

She says the initial indicator list was 45 strong and these were reduced to just eight, which include one physical, four chemical, two biological and a microbial where additional detail on soil biology is considered useful.

Co-development process

"The apparent disconnect between farmers and their soils had eroded confidence in their ability to assess soil health. The scorecard we've produced can help regain that confidence and put them in control, without bamboozling them with complicated tests or datasets.

"In the end, what we have is an apparently simple thing, and that comes from the co-development process. Farmers have been part of the journey the whole way," she explains.

Initially, when the concept was first pitched to farmers at discussion groups, the Soil Health Scorecard was met with scepticism and, in some cases, bemusement because assessments have to be carried out in the busy autumn or spring periods, says Elizabeth.

"However, its simplicity means it takes a mere 30 minutes or so to carry out each assessment and once tested, they became very enthusiastic about its value as a management tool," she adds.

"There's a sound understanding now of why it matters, so people are making time to work through the assessments, even when they're busy."

The information collected using the scorecard is essentially a GP check-up for soil, with observations on soil structure and earthworm numbers made, and samples for laboratory analysis collected at the same time, with the location georeferenced.

This allows the farmer to come back to the same place each time to benchmark progress on a rotational basis. To that end, assessments should be done in similar conditions each time, she explains.

Elizabeth stresses that the scorecard doesn't always indicate the interventions or management tweaks required but acts as a signpost to where more investigation ▸

It takes a mere 30 minutes or so to carry out each assessment for the scorecard and once tested, growers are enthused about its value as a management tool, says Elizabeth Stockdale.

Studies indicate that those growing roots or other field vegetables can improve soil health by doing the right things in between crops like potatoes and sugar beet.

▸ is required.

"In the same way that a doctor would refer you on to a specialist, it might say your pH is a bit low and prompt you to go and have a look at your liming plan and test a wider area. It could be that one patch is low, but equally it might be the whole field," she explains.

Once the Soil Health Scorecard was conceived, it was tested to prove the indicators provide the correct information to help improve soil management. As the wider project was mainly focussed on soil biology — the least known aspect of soil science — it also aimed to improve understanding in this area.

To achieve these goals, ADAS principal research scientist Anne Bhogal used the scorecard in trials on seven sites already hosting long-term experimental work, including two in Scotland looking at pH and rotation.

A site at Game and Wildlife Conservancy Trust's Loddington experimental farm was used to assess the impact of cultivation on soil health and ADAS Boxworth in Cambridgeshire hosted work on the impact of mole draining.

Finally, the impact of typical farm rates of organic matter additions, such as green waste compost, farmyard manure and slurry, was assessed using the scorecard at three long-term trial sites around England.

One of the key messages from the testing is that site is very important when considering soil management, says Anne.

While the effects of treatments

Soil Health Scorecard

Attribute	Control	FYM (23 years)	Green compost (13 years)
Soil organic matter (%LOI)	3.0	4.1	4.0
pH	6.4	7.0	7.0
Ext. phopshorus(mg/L)	56	73	60
Ext. potassium (mg/L)	80	311	187
Ext. magnesium (mg/L)	44	87	63
VESS score	2	2	1
Earthworms (number/pit)	11	13	11
Potentially mineralisable nitrogen (mg/kg)	23	90	43
CO_2-carbon (mg/kg)	198	228	222

Source: AHDB, 2021

Soil Health Scorecard indicators

- Soil organic matter (%)
- pH
- Phosphate
- Potassium
- Magnesium
- Earthworm numbers
- Visual Evaluation of Soil Structure (VESS test)
- Microbial activity (Solvita CO_2 burst)

gave similar responses (increasing soil organic matter with repeated organic material additions, for example), the actual values of the soil health indicators varied considerably depending on location, she comments.

This is due to differences in soil texture, rainfall and other climatic factors, plus rotational history, explains Anne. "It showed us that you can't rely on generalised information — getting measurements and interpretation of what they mean for a particular site is key. The scorecard helps growers do that."

Encouragingly, testing showed all indicators chosen for the Soil Health Scorecard gave a strong baseline for soil health at a site-specific scale. It picked up positive effects of organic matter amendments, grass leys and reduced tillage intensity, with pH seen to be one of the most important basic elements to get right, says Anne.

"You can do all sorts of other elaborate tests, but if you haven't tested your pH, then you are in the wrong starting place. The key is to get these basics right first," she adds.

One of the surprises from the work were the cultivation results at Loddington, where a long-term no-till field was ploughed, and the scorecard used to assess its impact.

Doing the right thing

Anne says she expected a much more dramatic effect: although the plough did reduce earthworm numbers, it wasn't devastating, and the impact on soil organic matter after one year was negligible.

This hints that growers moving to a no-till system should not feel guilty about using targeted cultivations, she highlights, providing it's agronomically justified and they return to no-till as soon as possible.

Similarly, those growing roots or other field vegetables can improve soil health by doing the right things in between crops like potatoes and sugar beet, without the fear of going back to square one when those crops are planted.

"By bringing in cover crops and only tracking on land when conditions are right, it can be manageable. However, that can be tricky with increasingly unpredictable seasons," notes Anne.

The design of the Soil Health Scorecard has been inclusive of growers from the outset.

Elizabeth adds that cultivation decisions shouldn't be made solely on soil health grounds, with targeted operations helping to control problem weeds like brome or blackgrass.

"Tillage may help reduce herbicide use or control a weed that you might not be able to control without that intervention. The same as any other input, ask yourself: do I need to do it? Can I do it more gently? The advice remains the same — only move soil when you need to," she says. ▶

Tool for the masses will help improve soil health

After being involved in the development of the Soil Health Scorecard, Yorkshire grower and contractor David Blacker sees it as a simple and valuable tool for any farmer looking to improve soil health.

Farming about 200ha in hand and a further 600ha on contract agreements, he's been paying much more attention to soil health since 2012, an extremely wet year that exposed soil structural problems across the UK arable area.

His soil types are mostly clay loams and being in a wetter part of the country in North Yorkshire, land can lay saturated over winter and anaerobic conditions do not favour soil biology.

Just prior to 2012, David had started doing his own research in soil science and whether his land would be suitable for direct drilling, rather than the plough or min-till system that he employed at the time.

He started to experiment with cover crops and immediately saw a benefit from different roots to open structure and capture carbon. The farm then moved to a Mzuri strip-till system to establish crops in his wheat-oilseed rape-wheat-spring beans rotation.

More recently, he invested in a Shelton CT150 trencher, with the aim of renewing 8ha of land drains a year to improve drainage and avoid such conditions in wet winters.

Through most of the process, David had used a spade and gut feel to monitor progress but since he became involved in the development of AHDB's Soil Health Scorecard, he now has a more structured way of assessing and recording changes, he says.

His assessment sites are recorded on the What3Words app for repeatability, and he carries out the VESS test and worm count concurrently, so can finish the whole process in a rapid 15mins. Samples are then taken and sent to the lab.

"I think the VESS is a subjective thing, so it's very important that the same person is doing the assessments each time.

"The scorecard looks at organic matter levels and I can see from testing that it's a slow process building it up. I'm using cover crops and chopping residues and my results over five years show levels haven't increased much, but they certainly aren't going down," he says.

David does caution that the scorecard only gives information on set criteria, so in addition to doing the assessments, it's important to step back and look at the big picture, too.

David Blacker believes the scorecard's simplicity allows any farmer to gather valuable site-specific information on soil health and make positive changes to its management.

"When I was a monitor farmer, one of the best fields on the Soil Health Scorecard was the worst performing field for yield because of an underlying drainage problem. There could be a lot of factors outside of the scorecard criteria that might be limiting yield," he adds.

Even though the scorecard has its limitations, David believes its uncomplicated process allows any farmer to gather valuable site-specific information on soil health and make positive changes to its management.

"It is a great baseline to help you see if you're going backwards or forwards, which we didn't have before, and if it gets people out with a spade, then it can only be a good thing," he says.

Amanda Bennett says farmers at the beginning of a soil health improvement journey are better placed focussing on the basics, rather than investing in more complex tests.

▸ A bonus of the Soil Health Scorecard is that parts of it align with Defra's Sustainable Farming Incentive (SFI) arable and horticultural Soils Standards.

This currently requires entrants to measure organic matter levels across all land entered in the scheme. Soils should also be assessed, and a soil management plan produced, she notes.

"Farmers adopting the Soils Standard is a no brainer for me. It's sensible soil management that will benefit the farm — it's not just about a box ticking exercise for Defra payment," says Elizabeth.

In addition to producing and testing the Soil Health Scorecard, the project also aimed to plug gaps in knowledge of soil biology — a complex area to study and understand.

One area explored was the value of two laboratory tests used to assess microbial activity in the UK, including potentially mineralisable N (PMN) and the CO_2 burst, as part of the Soil Health Scorecard process.

The former measures the amount of nitrogen readily decomposed under anaerobic conditions; the latter measures the amount of carbon released as carbon dioxide when a dried soil is rewetted.

Both processes are dependent on the size and activity of the microbial biomass in the soil, so the greater the final value the higher the microbial activity, she explains.

AHDB's senior environment manager Amanda Bennett says the main issue with the two analyses is that interpretation frameworks were based on data from the United States.

The project aimed to benchmark guideline values relevant to UK soils and to some extent, that has been achieved, but more work and data gathering is required to extract full value out of the tests for UK growers, she believes.

Amanda says farmers at the beginning of a soil health improvement journey are better placed focussing on the basics, rather than investing in more complex tests.

"With all soil biology reliant on having a food source for survival, namely organic matter, looking to improve that on mineral arable and horticultural soils is a good starting point.

"The Solvita CO_2 burst and PMN tests are potentially ones for consideration where a grower has a good grasp of the basics, is technically much further forward and wants to take their understanding of their soils to the next step," says Amanda. ■

Research roundup

From Theory to Field is part of AHDB's delivery of knowledge exchange on grower-funded research projects. *CPM* would like to thank AHDB for its support and in providing privileged access to staff and others involved in helping put these articles together.

For further info:

AHDB Project 91140002: Soil Biology and Soil Health Partnership was project managed by NIAB, with scientific partners including ADAS, FERA, GWCT, ORC, SRUC, Natural England and University of Lincoln. Industry partners included BASF, Frontier, Innovation for Agriculture, LEAF, NRM and Wye & Usk Foundation. The project cost AHDB and BBRO £999,807.