> *Regular sampling helps build a picture over time of what's going on in the soil.*

Soil pH survey

Lucky number (pH) 7

Good soil health is down to an amalgamation of factors. *CPM* explores how growers can optimise these in order to achieve the best performance.

By Charlotte Cunningham

Soil is often thought of as a farmer's greatest asset, but the health of this brown gold can greatly impact the performance of the crops grown in it.

Of course, soil health encompasses a number of factors, as highlighted in a recent *CPM*/LimeX survey which showed that structure, pH, nutrient indices and organic matter levels were all deemed by growers to be similarly important aspects.

"Soil health is a balance between good structure, good biology and good chemistry – a balance between physics, chemistry and biology," explains Elizabeth Stockdale, head of farming systems research at NIAB. "One isn't more important than the other – we often use the three-legged stool analogy and soils require all of these things together to work at their optimum."

Although soil health has arguably always been important, there appears to have been a tangible shift in mindset and priorities during recent years, with 54% of growers revealing they believe it's more important than they thought it was five years ago.

However, for Suffolk farm manager Edward Vipond, good soil health and management has long been a fundamental part of the 1800ha system at Troston Farms. "I'm not a lover of the word regenerative – I think it's an overused phrase which has become fashionable. This fashion has resulted in a tidal wave of opinion on the use of various techniques which have been used for years, so from that perspective, good soil health is nothing new."

Elizabeth concurs: "Five years ago we were at the beginning of the Soil Health Programme funded by AHDB, which was responding to farmer questions and needs about soil health and actually, I think this increase in interest has been growing steadily during the past 20 years," she says. "In the past five, it's almost become normal to talk about soil health – not just nutrients, but having a more rounded, holistic discussion around soil management."

Soil management

This shift in mindset over time has also triggered a change in soil management, with 87% of growers saying they now carry out fewer cultivations and the same percentage noting they're now actively increasing organic matter levels within the soils.

Correcting pH issues is something 61% of growers say they're now doing – with the majority (71%) sampling soils every 3-5 years – while others noted fixing drainage, improving nutrient indices and the use of cover/catch crops as other key changes they've made.

"The adoption of these practices is definitely helping to get the overall balance right and it's all about going back to basics with good old fashioned soil husbandry," says Elizabeth. "There's not one perfect thing to do – it's all about adopting a range of practices which put your soils in the best position possible on your farm. This will mean a slightly different combination of factors on every farm."

When it comes to making changes to soil management to prioritise health, Edward says he decides which measures to carry out on a year-by-year basis. "Soil health to me is all about keeping the soils busy. The area I farm has massive variation – from Breckland blowing sand to heavy clay and everything in between. I have to treat these soils so differently depending ▶

Nitrogen use efficiency reduces by 10% at pH 6.0 and phosphate use efficiency reduces by 50%, so pH management is vital for productive crops and ensuring valuable nutrients aren't wasted, says Glenn Carlisle.

The value of calcium

With nutrient analysis tests able to reveal a myriad of data, experts say including a calcium analysis in this metric could be useful – despite 52% of growers saying this isn't something they've done during the past three years.

"Calcium is almost the forgotten macronutrient, but it's really important for all plants – particularly for cell wall structure where calcium binds the pectin molecules together creating stronger and more malleable cell walls. This helps the plant's natural defence against pathogen attack," says Glenn.

Elizabeth adds: "You don't have to test for it every time – not every 3-5 years – because what it's essentially telling you is something about the parent material that your soil comes from; the skeleton, the bones of your soil.

"In the AHDB soil scorecard we looked at calcium, and although it doesn't have a set of indices, there's a typical range within UK soils. While 80% of soils will fall within this range, there's a minority that won't and so soils with very low calcium – a score of less than 1000ppm – suggests that it might be being constrained by the availability of calcium, which is important for some crops including potatoes and sugar beet.

"This is particularly likely in light soils and is an issue in Wales. The rocks in Wales don't contain a lot of calcium, so it's often worth carrying out an analysis in these scenarios as it may help guide some different decisions for liming, for example. It's not a costly addition and this analysis requires the same extraction as a normal routine test."

Glenn picks up the point about liming decisions in relation to calcium and concludes: "There are subsequent benefits from liming for calcium too. The very fine particle size in a product like LimeX increases the available calcium in the soil which benefits soil structure particularly in heavier, high clay soils. The benefit of good structure is good drainage and aeration which, when paired with neutral pH, are the key properties of a soil that allow biology to thrive."

Testing soil pH and correcting any issues are regular parts of Edward Vipond's strategy.

on what's in front of me that season.

"This season crops established behind the plough have outyielded others drilled after non-inversion tillage, next autumn the reverse might be true, being flexible is a major part of my strategy."

Testing soil pH is a regular part of the strategy, however, with Edward regularly testing and correcting issues. "We routinely test for pH every four years and more frequently when ahead of sugar beet. Any issues are corrected with lime immediately after testing."

pH benefits

Delving deeper into the value of correcting pH – 92% of growers said optimum pH improves nutrient use efficiency, 84% believe it helps to optimise crop yields and 72% highlighted the importance pH plays in creating the best conditions for soil microbiology to thrive. "pH is really important for nutrient use efficiency and maximising what we have in the soil to make it as available as possible for crops," says Glenn Carlisle, business manager at LimeX.

As such, keeping it at target level is vital and where soil sampling shows pH to be suboptimal, 65% of growers say correcting this with lime is essential and should be done at the first available opportunity.

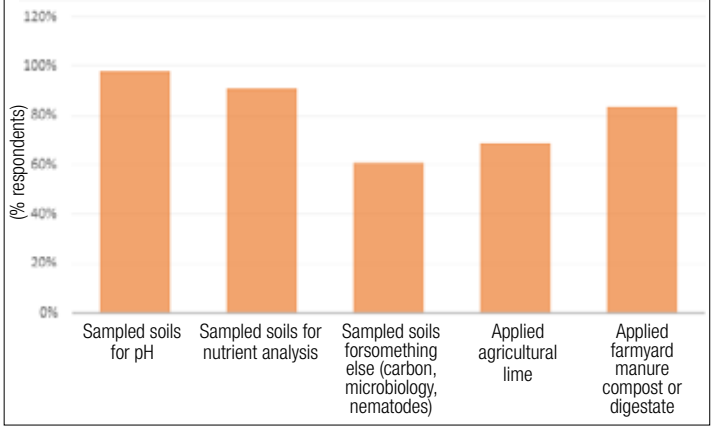
In terms of the trigger point for them applying lime, the majority of growers (50%) said they'd do so at a pH of 6, while 40% said they'd do so when pH levels reach 5.8. "Most arable crops function best at pH 6.5 and above, so anything below this could lead to yield impacts and lower nutrient use efficiency.

"Nitrogen use efficiency reduces by 10% at pH 6.0 and phosphate use efficiency reduces by 50%, so pH management is vital for productive crops and ensuring valuable nutrients aren't wasted," says Glenn.

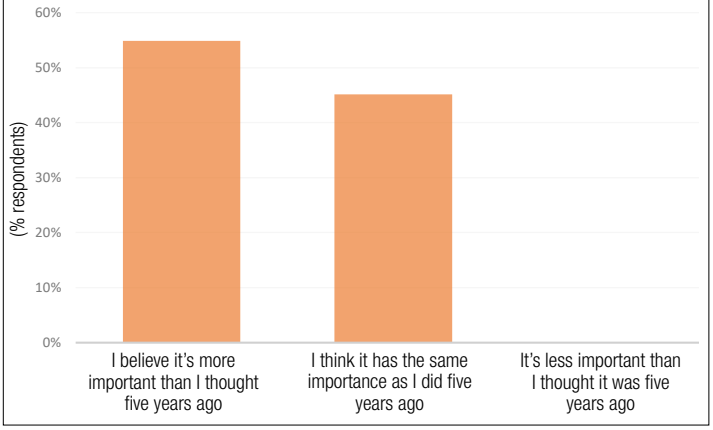
Elizabeth adds: "The direct effect on crops of keeping pH in the optimum range is predominantly about the mediation of nutrient availability – only at really low levels do we have toxicity issues where iron or aluminium become a problem.

"Because pH also affects biological activity – which has a very similar optimum to plants – that means it has a knock-on effect for factors like soil structure. If we slow the breakdown of organic matter and the activity of

Have you undertaken any of these actions during the past three years?



How has your opinion of soil health changed during the past five years?



In the past five years, it's almost become normal to talk about soil health – not just nutrients, but having a more rounded, holistic discussion around soil management, believes Elizabeth Stockdale.

microorganisms, we get poorer structure. So getting pH right will also positively impact the wider soil health picture."

While there are growers who may say they don't have to lime – those who might have soils that are naturally high pH, for example – it's still vital to measure this regularly to keep track of any changes, warns Elizabeth. "The natural processes we have in the UK – the rainfall we have – are slightly acid, meaning that a soil which is only just buffered from its underlying material could actually become more acidic over time. Regular sampling helps to build a picture over time of what's going on in the soil.

"That said, except soils with low buffering capacity, such as very sandy soils, pH changes relatively slowly so having a plan to maintain pH plan and checking this by measuring every 3-5 years is perfectly adequate."

In terms of sampling accuracy, Elizabeth adds that it's important to carry out testing at the same time of year ideally using geolocated sites.

Then, when it comes to product of choice, key grower priorities included locality and availability (33%), neutralising value (26%) and fine-ness and reactivity (11%), with 44% of growers opting for straight ground limestone products. Almost a quarter (20%) noted LimeX as their go-to, so what are the benefits of using this co-product?

LimeX product

"LimeX is a co-product of sugar beet manufacturing derived from high-purity limestone that's used to clarify and filter 'raw juice' – the liquid sugar that's produced when sliced sugar beet are diffused with hot water," explains Glenn. "Once the precipitated lime has purified the juice, it's pressed, conditioned and stored at the factories as LimeX.

"As a product, LimeX has the combination of a good neutralising value and high reactivity. It's 100% reactive where a lot of ground limestone alternatives are only around 60-70% for comparison, which means 100% of the tonne of LimeX applied to the soil will do the job of raising the pH."

Glenn explains that this is due to the product's very fine particle size, where 100% is finer than 150microns. "Other ground limestone products can contain large proportions of larger particles which don't break down in the soil and don't have an effect on acidity.

"What's more, LimeX also contains valuable quantities of phosphate, magnesium and sulphur that can be included in nutrient management plans."

LimeX is a go-to product for Edward, particularly ahead of sugar beet, he explains. "Neutralising value is what we're looking for but also the location of the product is key for us. I like LimeX, it's a good product and it's local – I'm only six miles from the factory.

"I also like that it's a recycled product – it makes sense to use that. As soon as the previous crop is clear, we test and then lime is spread; it's the bread and butter of our system. Soil is my medium – if I abuse it, I'm a fool."

Turning focus to this season, with talk of the unprecedented rainfall likely to have impacted pH and nutrient levels, carrying out additional pH testing this year may be wise in higher risk soils, says Glenn.

"Soil testing every 3-5 years is a good rule of thumb, but it also depends on past issues in specific fields, if you're growing acid-sensitive crops like sugar beet or barley, and if we've had a tricky year like the one we've just been through with high rainfall. It costs little to do, but might reveal some pH issues which could prove to be very costly if not rectified.

"A lot of the results we're getting in through our soil sampling service at the moment are showing a significant impact of the weather on pH levels, so there's definitely a lot of value in sampling soils early and applying lime where required this year in particular." ■

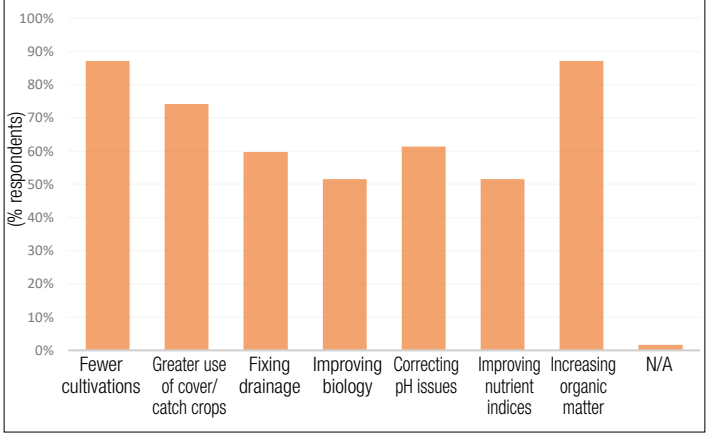
Winner announcement

Congratulations to prize winner Chris Blaxell from North Walsham who responded to the *CPM*/LimeX survey and provided insight on soil pH. Chris has won an OONI Karu multi-fuel pizza oven, worth £699.

He correctly answered the tie-breaker question of "According to RB209, what's the target pH for arable soils?" With: "6.7."

To engage with future surveys, visit the *CPM* website and sign up to the newsletter.

What have you changed about your soil management since then?



What's your attitude towards applying lime to your soils?