Healthy soil for healthy yields

Sugar beet agronomy

Soil conditions are nothing new, but a new five-year trial highlights the benefits of improved soil health across the rotation. *CPM* finds out more.

By Rob Jones

Soil health has risen to the top of the agenda in recent years, with many farmers reducing tillage to promote the microbial communities that lie at the heart of creating soil that is workable, free-draining and packed with available nutrients.

Within the past decade, few growers had considered the soil microbial population, let alone how it might affect the water-holding capacity of soils, ease of cultivation and nutrient availability to crops.

Root crops can raise considerable challenges to those on a soil health journey. It's an established fact that compaction, poor porosity and stunted root growth cause all crops – and root crops, in particular — to perform below their optimum. However, a recent trial series using a biostimulant soil activator across a five-year crop rotation, with sugar beet as the fifth crop, has shown its potential to improve soil structure, health and return on investment for beet.

And, while important to all crops, soil structure is particularly important to sugar beet and other root crops like potatoes, which need to get their roots down especially deeply. Too much compaction, and beet crops won't maximise their potential. Too little water retention, and a hot, dry summer like 2022 brings yields crashing down.

Results from a recent trial provide insights into how soil activators, aimed at improving soil fertility, could help turn things around.

> *"Humus is a key factor in allowing microbes to feed themselves."*

Five-year trial

The five-year trial carried out in the Czech Republic showed that using Neosol — a mineral complex rich in trace elements and derived from seaweed — reduced compaction and fuel consumption, boosted humus quantity and quality, and improved both yields and return on investment.

The Agricultural Research Institute, Troubsko, Czech Republic, invited Olmix to take part in the field trial in Litobratrice in South Moravia from 2017 to 2021. The trial, supported by the Czech Republic Ministry of Agriculture, looked at technologies for soil protection and erosion control.

The area where the trials were hosted is hot and dry — rainfall in 2017 was 380mm and in 2018, 411mm. Straw is returned to the soil after harvest and the cultivation system is min-till. Soil is moderately heavy to heavy clay.

Initially, the trial was scheduled to take place for three years, but this was extended to five. It was based on a five-year rotation of spring wheat, winter wheat, oilseed rape, winter wheat and sugar beet, with each treatment area being 36m wide and 850m long to reflect farm conditions.

Neosol was applied at 150kg/ha in spring 2017 then 120kg/ha in autumn of each year, with the last application made in autumn 2020. The control treatment in the trial was Amophos 16/20 (ammonium phosphate) applied at sowing at 150kg/ha. During the growing season, the plots received 200kg/ha (54kgN/ha) of YaraBela N + MgO (27% + 4%), and liquid nitrogen (29%) twice at 100 l/ha.

The team measured soil characteristics each year over five years, comparing Neosol with the control. "In year five, average soil density, which expresses soil compaction, fell by 21.2% to 1.13g/cm^3 compared with the control at an average of 1.37g/cm^3," says Olmix's Benoit Le Rumeur.

Water infiltration into the soil was also much better in the treated area, with 22.6mm absorbed in 15 minutes which was 64% more than the 13.8mm absorbed by the control. ▸

The first picture in the series represents the rooting depth in year one of the trial (2017), compared with the control treatment in 2019 (middle), and finally the increased rooting depth in the Neosol treatment (2019).

▸ A soil's unsaturated hydraulic conductivity is a measure of its water-retaining ability when soil pore space isn't saturated with water. The higher the value, the more water fills the soil pore spaces. For treated soil the hydraulic conductivity measured 1.74mm/minute compared with 0.9mm/minute for the control — nearly twice as much.

"This reduces water erosion risk by more than 50%. Moreover, the less water that is running on the soil surface, the more that enters the soil for plants to use," says Benoit.

Humus quantity and quality is also an important parameter of a soil's fertility, he adds. "Humus influences structural stability, water retention, micro-organism activity and plant feeding. A high quantity of humus also allows nitrogen fertiliser applications to be reduced.

"In the trial, there was faster humus synthesis from organic matter residues in the treated soil. After five years, humus comprised 2.68% of the soil treated with Neosol compared with 2.09% in the control plot.

"This equates to 28% more humus in the same volume of soil. Also, a greater humic/fulvic acid ratio shows a higher quality of humus. In the trial, humic/fulvic acid ratio for the treated plot was 1.73 compared with 1.09 for the control."

All of these measurements point to a better functioning microbial community in the treated soil. When microbial activity is healthy, microbes are much more able to transform organic matter into humus, says Grant James, Olmix manager for UK and Ireland.

"Humus is a key factor in allowing microbes to feed themselves and it's also involved in soil stability, as well as the soil's capacity to maintain a balanced pH."

Fuel consumption

The five-year trial also looked at fuel cost, which has become very topical in the past year as oil prices have risen in astronomical levels. It showed that by year five, fuel consumption related to growing the sugar beet crop was 16.6% lower in the treated area, at 131 litres/ha compared with 157 litres/ha for the control.

"Regular use of the soil activator led to a better soil structure, making it easier to work and this led to the improvement is fuel consumption figures after five years," says Benoit.

Using the soil activator also improved yields (see table). The first year of trials was somewhat of an anomaly and led to low yields. The autumn/winter before planting the first crop in the rotation, spring wheat, was very wet and originally the researchers had intended to plant winter wheat, he explains.

"The spring wheat growing period was then very dry, which could have caused the low yields, and the researchers described years four and five as having exceptional growing conditions. Whatever the climatic conditions, Neosol led to better soil structure and higher yields, allowing crops to meet their genetic potential," says Benoit.

"These soil structural improvements provide better conditions for plant growth, allowing improved rooting and nutrient take up, as well as better water availability," he adds.

Sugar beet saw the third highest percentage yield increase of the five crops in the trial, with the treated beet delivering 12.5% (9t/ha) more — nearly £400/ha more than the control, based on 2023 prices.

"Neosol helps in soil restructuring, allowing beet roots to establish quickly and attain a good depth," explains Benoit. "The growing cycle of sugar beet is short, so fast establishment is key to maximising yield. If a soil has poor porosity, beet roots will hit compacted areas and go sideways, losing yield."

The trial showed it was possible to increase the sugar beet return on investment (ROI) by €355/ha (£322.50) in year five of the trial (2021), based on prices at the time of the trial. This was the highest ROI of all trial crops.

"This trial shows how, in normal farming conditions over large areas, it's possible to improve soil quality and productivity in a more sustainable way," he adds. "It's about doing more with less — less fertiliser and less water. We can increase soil productivity through better soil functioning with a new generation of inputs like Neosol, to provide essential nutrients to soil life and by working with less synthetic fertiliser." ■

Yield comparison in 5-year trial

Treatment	Spring wheat (t/ha)	Winter wheat (t/ha)	Oilseed rape (t/ha)	Winter wheat (t/ha)	Sugar beet (t/ha)
Neosol	1.97	4.47	4.3	8.51	81
Amophos (control)	1.66	4.04	3.5	7.59	72
% yield increase over control	18.6	10.6	22.8	12.1	12.5

Agricultural Research, Troubsko (Czech Republic), 2022