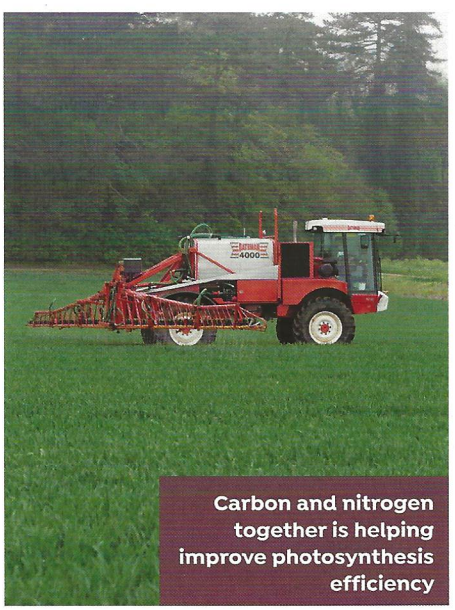
Sustainable liquid carbon enriches soil recovery

Nottinghamshire farmer John Miller is reaping the benefits of supplying nitrogen and carbon to crops at the same time

By his own admission, John Miller, of Kelham, near Newark, had been following a traditional approach of ploughing and power-harrowing, but he was becoming concerned that soils were becoming harder to work and yields were plateauing despite a high-input approach.

John farms 660ha in the Trent Valley, where soils are a mix of silt loam over gravel and sandy loam over clay. Cropping comprises feed wheat, spring barley and spring oats, along with sugar beet and forage maize for a local anaerobic digestion (AD) plant.

A former AHDB monitor farm, it opened the business up to scrutiny, forcing John to question what they were doing. "We decided we needed to rebuild soil carbon contents, and we moved over to min-till for maize, sugar beet and as much of the cereals as possible. We now no-till as much of the cereals as we can, with min-till used for sugar beet and maize."



Carbon and nitrogen together is helping improve photosynthesis efficiency

PHOTOGRAPHY: TIM SCRIVENER

The farm had been applying muck from a local beef farm on the lighter land and applies digestate from the AD plant to the maize ground to increase organic matter. But in 2018 they started applying a molasses-based liquid carbon nutrition supplement so they could apply nitrogen and carbon together.

Sustainable liquid carbon soil and crop nutrition supplements are an effective tool for soil regeneration, suggests Alistair Hugill from ED&F Man Agronomy. "Cane molasses is a natural source of both carbon and energy. The high carbohydrate content stimulates microbial populations in the organic layer and drives microbial activity through to the topsoil, stimulating greater nutrient uptake, even down to the subsoil layer."

Soil microbial activity boost

In a planned approach to improving soil health and crop sustainability, the starting point is to boost soil microbial activity. Soil microbes capture nutrients for the plant, so the more effective the microbial populations, the better the nutrient supply.

All plants provide carbohydrates to the soil in the form of root exudates – effectively a sugar solution to feed the microbes and increase the rate at which mineral nutrients in the soil are dissolved, boosting their availability to the plant.

"Plants produce carbohydrates via photosynthesis and any surplus is used for root exudates. When performing well, a plant will provide 40% of assimilates from photosynthesis into the soil via root exudates, containing carbon and sugars. Feed the plant with a source of sugar and carbon and it can meet its demand for carbohydrates for growth more efficiently and allow the production of root exudates to increase, in turn boosting nutrient supply to the plant," Alistair adds.

All fertiliser is applied in liquid form and John mixes the liquid carbon supplement in so that nitrogen and carbon are applied together. A total of five soil and foliar applications are made with an average of 50 litres/ha.

Accumulated benefits

"We are seeing the accumulated benefits from the new approach," John says. "Adding carbon and nitrogen together is helping to improve photosynthesis efficiency. In addition, the supplements include amino and organic acids to drive up protein synthesis and nitrogen use efficiency. We had been applying about 200kg N/ha, but have managed to reduce this to 150kg/ha without affecting yields. We are producing as much from a less-intensive system."

He is also seeing changes in soil structure, with less capping, and in dry conditions drought stress is delayed and crops recover quicker. "If we can build soil organic matter and promote more efficient nutrient uptake by plants, we can improve soil health for more sustainable production," John concludes.

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