PLENTYSENSE OFFERS REAL-TIME MONITORING OF SOIL NITROGEN AVAILABILITY UNDER GROWING CROPS

Around 50 percent of nitrogen (N) applied to crops is not taken up and can leach into the environment. Now sensors developed by PlentySense, a spinout from John Innes Centre, can measure the amount of nitrate taken up by the crop and the reserve available in the soil, thereby optimising fertiliser usage.

Speaking at the Agri-TechE REAP conference, Professor Tony Miller, Chief Scientific Officer at PlentySense, comments that the sensors were initially developed to support the 'Wish Roots' research, which aims to improve the impact of wheat root architecture on soil health and N use efficiency.

He says: "We found it was difficult to gain real-time measurements of the nitrate in the soil so we designed the sensors to give us accurate information. The initial studies were in soil columns and provided proof of concept and then we moved to field trials with Agrii. This year we have studied bioavailable nitrate under wheat, potato, and onion crops and gained some interesting results."

Nitrogen is present in the soil in different forms; the PlentySense technology is looking initially at nitrate dissolved in the soil water. Roots exude sugars to feed a network of fungi and other microbes in the soil. These organisms help to scavenge mineral nutrients such as nitrates and phosphates from the soil water and make this available for the plant. The microbial action also improves the soil health and water holding capacity.

The important synergistic role of the soil microbiome on crop nutrition, and the impact of the roots of cover crops and legumes on nitrate levels, is being increasingly recognised by researchers, and the PlentySense sensors will improve this knowledge.

Prof. Miller explains that nitrogen is an expensive nutrient and to improve efficiency it is important to know how it is being cycled in the soil. "Traditional soil testing requires removing a core of soil for mineral analysis in a laboratory. By reviewing the real-time usage of nitrates under a growing crop, combined with environmental measurements such as soil moisture, we are gaining valuable information that can be used by farmers and agronomists to inform their decision-making."

He explains that if there is heavy rain after fertiliser is applied it can leach away into rivers before crop roots can acquire it, and farmers may need to repeat an application.

"In our trials we saw that a second application wasn't always required as nitrate was still present in the soil.

"The sensors are in sets of three, at 10/20/40 cm depths, to measure nitrate levels through the soil profile. Wheat has deep roots so nitrates washed down and stored at lower levels can be used later in the year."

Prof. Miller also explains that N stored in the plant's lower leaves is mobilised later in the season and moves to the wheat ear. This process can negate the need for a later N application which aims to increase the protein value of the grain.

The PlentySense sensors can be positioned across the field at the start of the season using the farmer's yield maps, which can indicate where more information would be valuable. They communicate across a LoRaWan (Low Power Wide Area Network) providing data in real-time, and are reusable for further seasons.

The first sensors are designed to measure nitrate, but Dr Yi Chen in Prof. Miller's team is working on adjusting the sensor chemistry to quantity other nutrients, including potassium (K) and phosphate (P).

He says that the sensors give early actionable insights: "If aerial or satellite imaging used to measure the health of the crop indicates a yellowing of the leaves, then it is too late – yield has already been affected.

"Our sensors enable action to be taken that will ensure that the plant has the right amount of nutrition throughout the year without waste or yield penalty; this will have a huge financial and environmental benefit."

Find out more about PlentySense at plentysense.io

Find out more about REAP at reapconference.co.uk

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REAP Conference 2023: Adaptation Through Innovation; Beyond the Comfort Zone
Wednesday 8th November, 9:30 am - 6:30 pm, Rowley Mile Conference Centre, Newmarket

Surviving and thriving under increasingly extreme and unpredictable challenges is the theme of the 2023 REAP conference. To build a productive, profitable and sustainable agri-food industry, we must move away from the comfort zone and become open to the new opportunities that exist when we 'stretch'. Delegates are being invited to be part of that future – by bringing themselves and their ideas to REAP.
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