



BBRO

CASE STUDY

How BBRO is pioneering sustainable soil management in sugar beet farming.



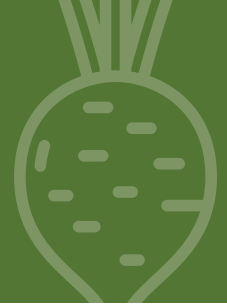
CropHealth

Science-led solutions for crop health problems



Original thinking... applied

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How BBRO is pioneering sustainable soil management in sugar beet farming.

The British Beet Research Organisation (BBRO) is a non-profit making company set-up jointly by British Sugar plc (BS) and the National Farmers' Union (NFU). BBRO's aims are to develop research to solely benefit the UK's home-grown sugar beet crop.

It has a team of scientists and field trials operators that work hard to conduct robust research projects and deliver technical information

through a wide range of knowledge exchange activities e.g. technical publication, summer open days, winter conferences, demonstration farm events and a range of social media activities.

Georgina Barratt is an applied crop scientist at BBRO leading in the areas of crop production. This includes soil health and undertaking research to identify how the crop can be managed to meet ever

more demanding sustainability requirements.

Alistair Wright, a Scientist in the Crop Protection team, researches sustainable, integrated solutions for sugar beet pests and diseases. He earned his PhD from the University of Nottingham, studying sugar beet's interactions with beet cyst nematode, and collaborates with Fera on nematode management.

Key farm facts:

<p>18HA FIELD</p>	<p>WINTER WHEAT, BARLEY, MAIZE, SUGAR BEET AND POTATOES IN THE ROTATION</p> <p>SANDY LOAM SOIL</p>	<p>REPLICATED STRIP TRIAL LOOKING AT FOUR DIFFERENT CULTIVATION APPROACHES</p> <p>SANDY LOAM SOIL</p>
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Challenge.

There is increasing pressure on growers to reduce tillage intensity, but this is challenging when growing sugar beet, as it requires a fine seedbed for successful plant establishment.

Avoiding ploughing where possible is a start, but finding ways to reduce tillage remains key to meeting the demands of sugar buyers seeking more regenerative agricultural practices in sugar beet crops.

While BBRO has experience in assessing the physical aspects of soil, it is now expanding its focus to include the biological factors.

To measure the impact of these changes on soil biology, Fera researchers were consulted.

"Nematode populations are excellent bioindicator of soil health," says Fera's Bex Lawson. "Analysing and classifying nematode population dynamics within soil samples gives us an indication

of soil biodiversity and a measure to access changes over time, this enables growers to monitor the impact of management changes."

The sugar beet's industry practices have been viewed by some as incompatible to certain regenerative agriculture principles, with the use of ecological indices BBRO hope to evaluate the levels of soil disturbance and ecosystem recovery in soils under beet.



Solution and approach.

Fera conducted Nematode Bio-Indicator analysis, to identify and analyse shifts in the nematode community to determine whether the chosen agricultural practice initiative is beneficial for a good soil functioning over time.

Why Nematodes? **NEMATODES ARE ECOLOGICAL INDICATORS:**

- Small, **diverse, abundant** and ubiquitous:
 - *They interact directly with soil (physical, water and chemistry)*
 - *Resident within the soil food web*
 - *Cover all the soil trophic groups within the food web.*
- **Indicator of soil disturbance and impact on communities** – constant soil disturbance does not allow enough time for nematodes groups with a longer life span and low fecundity to recover, this can eventually eradicate them, having an immediate effect on soil biodiversity.
- **IPM control** – certain nematodes feed on insect larvae, other nematodes, slugs and snails, playing an important role on soil biological control and crop rotation strategies.
- **Stimulator of nutrient cycling** – by feeding on bacteria and fungi, it stimulates these populations to renew consistently, maintaining the release of nutrients.
- **Indicator of soil contamination** – nematodes are very sensitive to pollutants, chemicals, and N fertilizers, being often used to evaluate soil toxicity and its effect on communities.

Project scope and methodology.

The aim of the project was to identify how tillage can be reduced to improve soil health without compromising sugar beet yields.

The project was undertaken with the help of the host farmer and their array of tillage equipment.

The grower undertook very light cultivations at 5cm down to 30cm as well as strip tilling (just disturbing the soil where the beet will be drilled).

It was important to measure soil health. Traditionally BBRO does this using physical parameters only, such as visual evaluation of soil structure and compaction.

However, this needs to be complemented with an understanding of the effects on the biology in the soil as understanding soil health now goes beyond just looking at structure.

One measure of soil biology is the CO₂ burst test, which primarily measures microbial respiration.

For this trial, using nematodes as ecological indicators was of interest to provide a detailed picture of the soil food web dynamics and the effects of the different cultivation methods.

The project involved:

- Soil samples were collected 4 weeks after soil disturbance and sowing.
- Extraction of nematodes from soil using whitehead tray method.
- Taxonomic identification and counts of nematode genera / species, trophic groups assessment using dissection / compound image analysis microscopy.
- Assessment of nematode population dynamics using ecological indices.



Results and impact.

Reduced tillage did not negatively impact yields and provided the conditions for a maturing soil ecosystem.

The field's light, sandy soil was well-suited to less intensive tillage, and results showed that all tillage methods produced comparable yields, confirming that reducing tillage was not detrimental.

Although the trial took place during a wet season when differences

might have been more apparent under drier conditions, the findings were encouraging and support the use of reduced tillage as a viable option for establishing sugar beet on this type of soil.

The trial also revealed interesting effects on soil health. Nematode population dynamics reflected the level of soil disturbance, highlighting varying degrees of ecosystem maturity across the four samples. The farmer's adoption of

regenerative soil practices, such as cover crops, further contributed to a maturing ecosystem with good overall soil health.

The three least invasive tillage methods had distinct impacts but consistently supported a maturing ecosystem. In contrast, the most intensive tillage method disturbed the soil ecosystem, reinforcing the advantages of adopting less invasive soil management practices.

How has this project benefitted BBRO and the wider Agricultural sector?

The analysis provided valuable insight into soil disturbance and ecosystem communities and the impact of different soil practices. This showed that the nematode communities responded differently and in a predictable way to the increasing levels of soil disturbance.

Nematode Bio-Indicator analysis can help researchers and farmers, such as Alistair and Georgina evaluate the impact of crop husbandry practices providing a sound evidence-based approach to aid informed decision-

making for optimised sustainable land management while maintaining productivity.

Furthermore, identification and understanding of beneficial nematode populations ensures IPM strategies can be tailored for best effect. Pest host preferences can be considered during crop planning to help reduce crop damage.

The findings contribute to the wider agricultural sector by highlighting the power of ecological ecosystem assessments to enable growers to

use ecosystem changes to monitor management decisions. This knowledge will help support growers in risk-based decision making to enable provision of more resilient soil management strategies, such as IPM strategies and reduction of the use of chemicals.

While some may perceive beet industry practices as challenging to align with certain regenerative agriculture principles, BBRO is committed to leveraging ecological indices to assess soil disturbance and track ecosystem recovery in soils cultivated with beet.

Why Fera?

With over 100 years of nematology experience, cutting edge microscopy imaging suite and the world's largest type nematode reference collection, Fera nematologists are ideally placed to provide nematological services. Fera experts represent England, Wales & Northern Ireland internationally, contributing to EPPO and IPPC protocols.

