> *If we're able to manipulate the endophytic grass a little better using this knowledge, it potentially could be another control option.*

Sugar beet agronomy

Pest-killing grass

A grass containing endophytes is showing promise in controlling two key sugar beet pests. *CPM* speaks to researchers to find out more.

By Mike Abram

Endophytic grasses have the potential to play a role in management strategies for two key sugar beet pests, according to the latest research. In fact, two projects investigating practices to control free-living nematodes and aphids transmitting virus yellows have tested the use of such a grass, which has been bred in New Zealand.

Marketed by CropMark Seeds, 'Barrier festulolium' is a cross between ryegrass and meadow fescue, explains University of Nottingham MRes student Athreya Shetty, who's been investigating their use to combat aphids.

"What's special about this grass is it associates with a free-living mycorrhizal fungus in the soil, which forms a symbiotic relationship with the grass, living in the seeds, leaves and stems. We think when the grass is stressed, it triggers a defence response in the fungus to secrete alkaloid-based materials called lolines," he adds.

These are thought to repel insect pests and alter soil chemistry – in New Zealand and Australia, the grass is used to protect grazing pastures against root and top feeding insect pests such as grass grub larvae, black beetle adults, porina caterpillars, Argentine stem weevils, red-headed cockchafers and root aphids.

This has led now led to the two BBRO-funded projects investigating whether the grass can be integrated into UK sugar beet rotations as an alternative to neonicotinoid seed treatments or nematicides.

Masters research

For aphid control, Athreya is trialling different methods of incorporating the grass into the sugar beet crop for a one-year masters project, co-funded by The Morley Agricultural Foundation.

Two main methods have been trialled so far – grinding the grass seed into a meal and incorporating into the soil, or growing the grass as an overwinter cover crop.

Early glasshouse findings with the seed meal have shown some promising results, says Athreya. "With higher doses of the

Student Athreya Shetty is trialling different methods of incorporating endophytic grass into sugar beet for a one-year masters project. Photo credit: Mike Abram.

Barrier festulolium is a cross between ryegrass and meadow fescue.

Two BBRO-funded projects are investigating whether the grass can be integrated into UK sugar beet rotations as an alternative to neonicotinoid seed treatments or nematicides.

endophyte grass seed meal there seems to be a much healthier beet canopy. It hasn't prevented virus infection in the beet, but it does seem to make the it more resistant.

"There's definitely some kind of growth-boosting effect that the seed meal is having, but we don't know what specific chemical in the meal is causing that effect," he adds.

Three different management tactics are being tested with the overwintered cover crop field trial – spraying the grass off with glyphosate before drilling beet, using shallow tillage and incorporation before drilling, or leaving the grass as a strip crop in between beet rows.

Alkaloid secretion

"The idea is to look at whether the sugar beet can pick up the alkaloids the grass has secreted into the soil, and whether that affects virus behaviour and also aphid migration patterns in beet generally," explains Athreya.

In the trial, the grass was sown in October with its development slowed by winter weather. In years of better vigour, mowing or grazing might be useful as it would trigger fresh growth, he suggests. "The more you disturb and stress the grass, the more chemical will be secreted."

And unlike some endophytic grasses, Barrier festulolium has been found to be completely livestock safe, he notes.

A previous trial carried out by Dr Alistair Wright at BBRO suggests leaving the endophytic grass growing in strips between the beet reduces virus yellows infection, but also reduces yield because of crop competition.

"So we're trying to define what timing you should kill the grass, or how long you can leave it," says Athreya. "A third option which could be used for future work is to apply the grass as a dried hay amendment or mulch."

Growing the endophytic grass as a cover crop is also one of the potential solutions for controlling free-living nematodes that cause Docking disorder in sugar beet. Caused when stubby root nematodes feed just behind the root cap of tap roots, the disorder, named after the Norfolk village where it was studied extensively, produces brown necrotic lesions, fanging and yield loss of up to 50%.

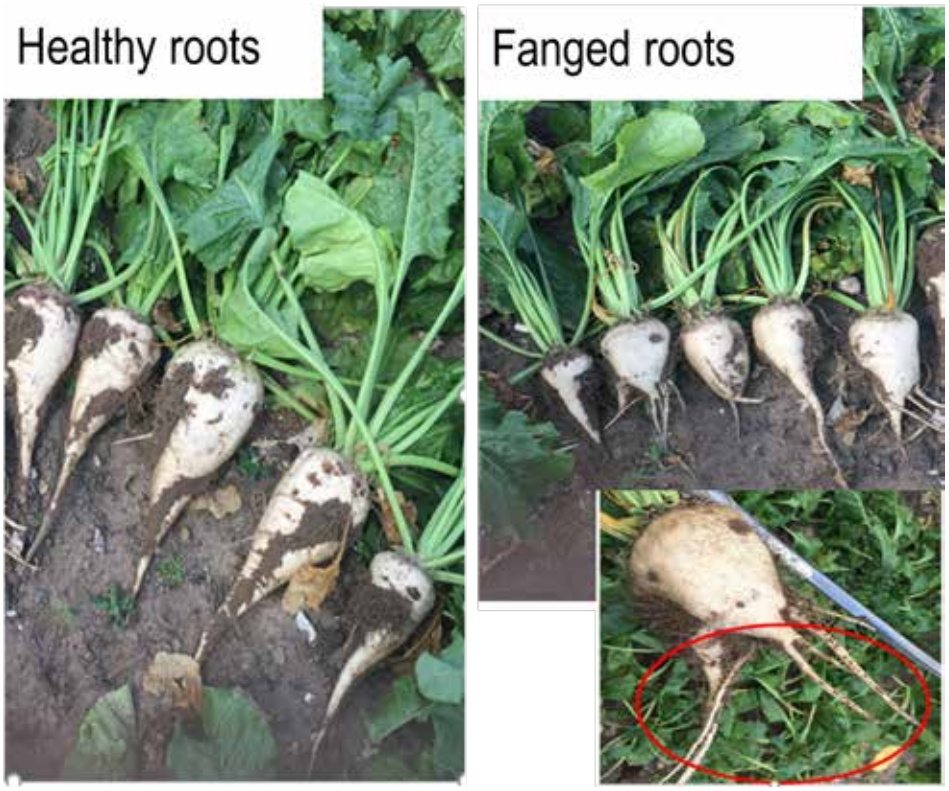
Feeding by another free-living nematode, longidorus needle nematodes, can also cause patches of uneven sized beet plants, sometimes with nitrogen or manganese deficiency. Swellings or galls can occur at the root tips often with local necrosis around where feeding took place.

Since the ban on Vydate (oxamyl), chemical management options for free-living nematodes have been limited to a nematicide made from garlic extract. That led to Nyambura Mwangi's PhD project which looks at cover crops as an alternative way to suppress stubby root nematodes.

Two main types of cover crops have been tested within the project – brassica species and endophytic grasses, explains Nyambura, with work taking place in field trials in Norfolk and Suffolk.

"In Suffolk we investigated the brassicas Indian mustard, oilseed radish and Daikon radish. At this site we observed suppression of nematodes where we grew and incorporated the cover crop compared with leaving the land fallow overwinter."

The brassicas contain compounds called glucosinolates which when broken down form isothiocyanates, which have been shown in previous studies to be



Docking disorder in sugar beet is caused when stubby root nematodes feed behind the root cap of tap roots producing brown necrotic lesions, fanging and yield loss of up to 50%.

REVYSTAR® XE

Endurance. Versatility. Resilience.
It's in our chemistry.

Unlock the potential of your sugar beet with Revystar® XE.

Revystar® XE is your reliable disease control partner in cereals, and now it is approved for use in sugar beet too. Offering long-lasting control against cercospora, rust, powdery mildew and ramularia, Revystar® XE helps crops stay disease free and greener for longer.

Visit **agricentre.basf.co.uk/Revystar-XE** to find out more.

PhD researcher Nyambura Mwangi's is looking at cover crops as an alternative way to suppress stubby root nematode.

nematicidal, she says. "So we checked in the lab and found the nematicides were sensitive to isothiocyanates."

The second trial in Norfolk included brassicas and cover crops species from other plant families, including endophytic grasses. "Unfortunately, we didn't see the same effect from the brassicas that we saw in Suffolk," says Nyambura. "We think the main reason was, unlike in Suffolk, we didn't achieve a good biomass from the brassica cover crops."

Biomass importance

Biomass plays a critical role in nematode suppression as it's directly correlated with the amount of glucosinolates and subsequent release of isothiocyanates the nematodes will be exposed to in the soil.

The Norfolk trial did pull out some differences in performance from the brassicas, which had also been evident the year before, she comments, with higher multiplication of nematodes in the Indian mustard than in the oilseed radish.

That perhaps points to different mechanisms in how the cover crops could impact nematode numbers, says project supervisor Dr Matthew Back, from Harper Adams University.

"You can have plants that are a poor host for nematodes and act as a trap crop, and then also the partial biofumigation effect," he says. "At the Norfolk site, there were very small Indian mustard plants which probably weren't exerting much of a biofumigation effect yet were hosting the nematodes to some extent.

"But it was the other way around in Suffolk, where there were decent sized plants, the only possible explanation [for the suppression of nematodes] if the mustard is a host, is through partial biofumigation."

The results suggest growing a high biomass crop of Indian mustard is crucial for nematode suppression. "We're looking for around 50t/ha fresh material," suggests Matthew. "Having a material rich in glucosinolates that's chopped and incorporated, as well as pumping out the compounds while growing, will help suppression.

"These stubby root nematodes are very susceptible to soil disturbance, so if you disturb the soil you will see some suppression, but if you have a lot of material rich in glucosinolates that'll be broken down into isothiocyanates, you're going to achieve an even more powerful result.

"So the message with Indian mustard is you have to grow it well in order to achieve this kind of suppression," he stresses.

That could mean adding 80-100 kgN/ha to help with biomass development. "We'd also suggest applying 25kgS/ha because sulphur increases the concentration of the glucosinolates as they're sulphurous molecules."

It also means establishing it in the summer months – perhaps in July rather than August – to achieve the biomass required.

Growing oilseed radish is lower risk, in comparison, with a more flexible drilling

Low carbon beet scheme offers incentives

A pilot scheme incentivising growers to use nitrogen placement to apply fertiliser near sugar beet seed, increasing nitrogen use efficiency and lowering carbon emissions associated with the crop, has been launched by NFU Energy and Nestlé.

The scheme, which offers a payment of £28/ha from Nestlé, was fully subscribed within 24 hours of its launch in June with around 20 growers taking up the available contracts.

Developed by NFU Sugar in partnership with NFU Energy and Nestlé, it's being delivered via the Landscape Enterprise Network (LENs). A key aim is to test whether such incentives can be used to encourage uptake of lower carbon production methods, such as N placement, which typically requires less nitrogen to be applied.

Nitrogen placement involves using either specialised or retrofitted equipment to place fertiliser around 5cm to the side and 5cm below seed. Research suggests this improves nitrogen use efficiency allowing applied nitrogen to be decreased by 10-20%.

Reductions in applied nitrogen would lower Nestlé's scope-3 greenhouse gas emissions for its products using sugar. A reduction in scope-1 emissions is also possible through reduced fuel use and lower nitrous oxide emissions from the soil.

If successful, NFU Sugar hopes the pilot will pave the way for further opportunities to work with supply chain partners in incentivising growers to adopt lower carbon production methods.

Working directly with supply-chain partners offers the opportunity to inset home-grown sugar emissions, unlocking value that already exists within the beet supply chain to reduce the carbon footprint of not only farmers, but processors, manufacturers and retailers further down the chain, says NFU Sugar.

"Direct grower-customer projects ensure that funding targeted towards the delivery of environmental services on-farm is ringfenced for growers, while empowering them to broker the terms of delivery," it suggests.

A pilot scheme incentivising growers to use nitrogen placement to apply fertiliser near sugar beet seed has been launched by NFU Energy and Nestlé.

CHANGE

has arrived for Sugar Beet Growers!

Changes by NFU Sugar and British Sugar give growers earlier access to varieties and more treatments.
For 2024/2025, our portfolio includes: new **Gadwall** with significantly improved yields; new **Hoopoe**, an improved solution over **Jackdaw** to beet cyst nematode; whilst proven performers **Wren, Magpie, Adder, Tawny** and **Osprey** have demonstrated excellent establishment and robust yields.
Our extensive trials using commercial primed and pelleted varieties across all sugar beet areas is the foundation for selecting varieties and critical to maximise yields.
Contact us for more information.

SESVANDERHAVE

SESVANDERHAVE UK LIMITED
Heath Farm, Pottergate Road,
Wellingore, Lincoln LN5 0DW
T: 01522 442000
SalesUK@SESVANDERHAVE.COM
follow us on

period. "It's almost a sure-fire system in that it's clearly a poor host and it might also have some partial biofumigation effects. A little like Indian mustard, if you grow a better crop, there's more root material, which in theory means you have more surface area to release compounds."

Promising results

Results from growing the endophytic grass also show promise with multiplication rates in plots with the endophyte lower than where the grass was grown without any endophytes, says Nyambura.

As with aphids, the hypothesis is that the endophytic grass can suppress nematodes due to the production of lolines. To examine that theory further, Nyambura tested crude extracts from grass with and without endophytes, and also from different ages of grass – eight, 12, 16 and 20 weeks old.

This showed that nematode mortality at eight and 12 weeks wasn't any different in grass with and without the endophyte, she says. "However, at 20 weeks, nematode mortality was greater in grass with the endophyte than without."

Delving deeper to understand these results, she then measured loline, phenolic and flavonoid alkaloid levels in different grass-age combinations. "These showed that the phenolic and flavonoid compounds followed a similar trend to observed mortality, where they decreased as the plant is aging.

"Lolines, on the other hand, increased with increasing age, which was the opposite of the mortality trend, which decreased as the plants aged."

Nyambura has since concluded that the phenolic and flavonoid compounds play a significant role in nematode suppression when the grass is young, while as it ages there might be an effect of the lolines, as observed in the 20 week old grass being more suppressive than grass without endophytes.

"Given the consistency of suppression of the grass with endophytes, it would deliver more efficacy than grass without the endophyte," she says.

The data is encouraging, adds Matthew. "We think if we're able to manipulate the endophytic grass a little better using this knowledge, it potentially could be another option, but we require more field work."

As a grass it's more flexible to use as a cover crop over winter than perhaps the brassica options, which have a narrower planting window, he notes. Overall, he sees promise in the use of cover crops as biofumigants for free-living nematode control. "Nematicides were never that consistent against free-living nematodes, even if we think of them as bullet-proof.

"With a trap crop, I think you have a little more control if you get the agronomy right. Once optimised, while they're never going to eradicate the pest, they're going to have a knockdown effect – perhaps of 45-70% – that is going to be useful for farmers," he concludes. ■

According to Harper Adams University's Dr Matthew Back, growing a high biomass crop of Indian mustard is crucial for nematode suppression.

Keep tuber quality secure into harvest with Ranman Top.

You're almost there. Simply time your final application of Ranman Top fungicide to maintain protection against all genotypes of foliar and tuber blight as you go into harvest.

You can also conveniently tank-mix Ranman Top with desiccant Gozai when used for haulm removal. It's the ideal combination.

Choose the UK's leading potato fungicide. Visit www.certisbelchim.co.uk/ranmantop

RANMAN® TOP

Certis Belchim
GROWING TOGETHER