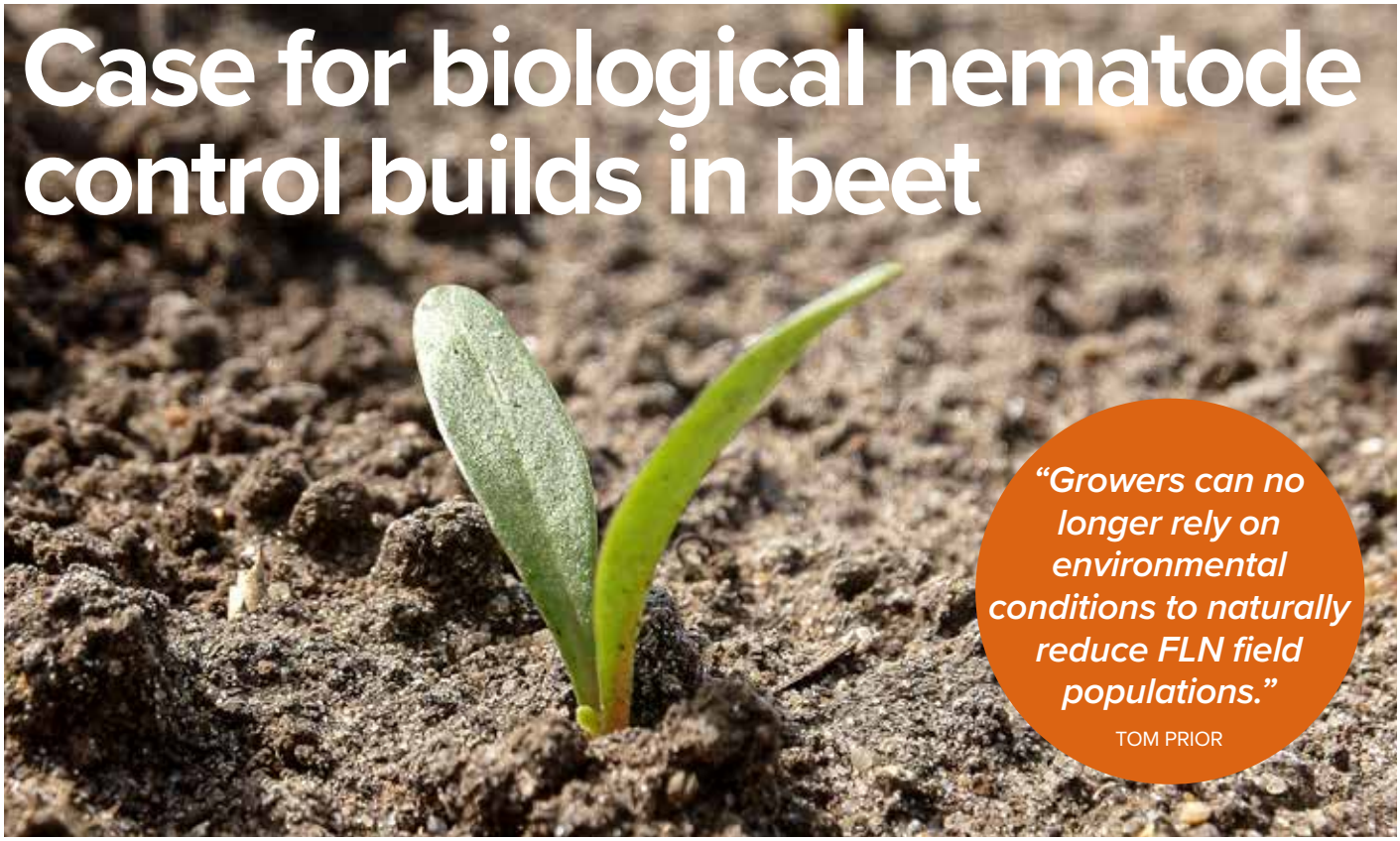
Case for biological nematode control builds in beet



"Growers can no longer rely on environmental conditions to naturally reduce FLN field populations."

TOM PRIOR

The risk of free-living nematode damage in sugar beet crops is increasingly being influenced by changes in climate and farm management practices, which could strengthen the case for using a bionematicide where risk is identified. *CPM* finds out more.

By Rob Jones and Janine Adamson

Docking disorder – a condition caused by free-living nematode (FLN) feeding damage on the roots of young sugar beet plants – should be a familiar problem to growers on light, sandy soils.

In a bad year, it can cause losses of up to 50% through the characteristic 'fanging' of roots, which are fragile and often break off during the mechanical harvesting process.

Unlike beet cyst nematode (BCN) – the other major nematode problem affecting sugar beet – there are no genetic traits which can help crops to tolerate attack and manage populations, so growers are left with few control options.

Currently, the only approved chemical treatment is biorational nematicide NEMGuard DE, a garlic extract-based granule applied in-furrow at drilling, and the case for its use in risky situations continues to build, according to experts.

The symptoms which characterise docking disorder are caused by two key FLN species: stubby-root nematodes (Trichodorus and Paratrichodorus spp.) and/or needle nematodes (Longidorus spp.).

As generalist feeders, they attack and feed on a range of plant species, swimming through moist soil to a suitable plant root before stabbing it with a stylet. The turgor pressure then releases sugars and water for the nematode to feed.

GENERALIST FEEDING

The generalist nature of nematode species can make it difficult to manage populations in the soil because they'll likely have a food source to feed on consistently throughout the rotation. This is particularly true now cover crops are becoming more common ahead of spring-sown crops like sugar beet, with the recently published British Beet Research Organisation (BBRO) cover crop guide shedding some light on such green bridge risks.

Aside from his role as a BBRO crop protection scientist, Alistair Wright is also experienced in growing sugar beet on his family's light land farm in North Norfolk, which has a history of FLN.

He says all of the cover crop species listed are also FLN hosts and the only cultural means of reducing risk would be a sterile fallow leading into the sugar beet crop, along with vigorous cultivation before drilling.

However, because cover crops have ▶

Cover crop conundrum

BBRO's Alistair Wright says cover crop species are also FLN hosts and the only cultural means of reducing risk would be a sterile fallow leading into the sugar beet crop, along with vigorous cultivation before drilling.

Climate change influence
In addition to agronomic practices like cover crops influencing nematode risk, climate is a significant factor, according to FERA's Tom Prior.

Should growers test soils for FLN populations?

Sampling and testing for free-living nematodes can be challenging and costly but could prove beneficial for growers

FERA's Tom Prior believes sampling is a useful tool in understanding baseline populations of species in certain fields.

He says it gives growers an insight into host range, pathogenicity and biology of the nematodes within their soil and help inform management decisions and their potential impact, including rotation length, nematicide use and cover crop choice.

Tom adds that a nematode assessment pre-planting can indicate if FLN populations are high enough to stunt the growth of seedlings or to reduce establishment. Whereas a post-harvest FLN assessment indicates the effect the growing crop had on populations, helping to obtain a baseline of FLN field pressure.

"Combining pre- and post-harvest sampling will give very robust information for the farm's decision-making process.

"Should growers wish to assess non-plant-pathogenic nematodes, these species are excellent environmental indicators and can provide additional management information on soil health elements such as disturbance, biodiversity and cover-crop impact," says Tom.

For more information on nematode testing options and costs, contact your local British Sugar agriculture manager or visit www.fera.co.uk/crop-health/nematodes

other agronomic and environmental benefits, such as improving soil structure and capturing nutrients, he believes growers may continue to accept the trade-offs.

"Destruction timing ahead of sugar beet is important and we'd recommend that they're killed at least six weeks before drilling. Free-living nematodes will still be there, but they'll be below that level of destruction caused by primary cultivation," he explains.

In addition to agronomic practices like cover crops influencing nematode risk, climate is a significant factor according to FERA's senior nematologist, Tom Prior. He says free-living nematode populations have historically been reduced over winter, by extended periods of low soil temperatures and hard frosts, which aren't conducive to breeding.

With the UK now experiencing warmer and wetter winters than reported 50 years ago, FLN testing data shows that in general, populations of nematodes are exhibiting a lower natural decline during the winter months.

"Growers can no longer rely on environmental conditions to naturally reduce FLN field populations and this could increase the burden of plant parasitic nematodes on young seedlings," notes Tom.

As cultural interventions for FLN are limited, growers may consider using a nematicide to protect crops from feeding damage in the weeks after drilling. But there's now only one option – NEMGuard DE – which root crop growers have been steadily building confidence in since carbamate nematicide Vydate (oxamyl) was withdrawn in 2021.

Alistair says studies carried out at the University of East Anglia have proven its mode of action and efficacy against the nematodes which cause docking disorder. When applied in-furrow at drilling, NEMGuard DE granules absorb moisture and release diallyl polysulfides, the active substances present in garlic extract.

These then penetrate the nematode's skin – a semi-permeable membrane which allows it to breathe and absorb water – leading to a chemical reaction that causes death by oxidative stress.

"It's very hard to do replicated small plot trials because the nematodes that cause docking disorder are such patchy pests. However, from strip trial work, we've seen improvements in root shape and quality, and improvements in yield using NEMGuard.

"This was particularly evident in the

Docking disorder
Docking disorder is a condition caused by FLN feeding damage on the roots of young sugar beet plants.

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On-farm trials

With the sugar beet price dropping slightly, AICC member Penny Oakes wanted to revisit the return on investment from NEMGuard DE by conducting on-farm trials.

NEMGuard assessment

Hand digs ahead of harvest showed visible differences in root quality between treated and untreated.

high-risk year of 2021, when sugar beet plants were much greener and taller in season and root quality much better in the treated at lifting. I could see the benefits that season," says Alistair.

Association of Independent Crop Consultants (AICC) member Penny Oakes oversees sugar beet crops on some high-risk land across Norfolk and has been advocating the use of NEMGuard DE in recent seasons.

With the sugar beet price dropping slightly she wanted to revisit the return on investment from NEMGuard DE when conditions are conducive to FLN attack. To do this, she set up on-farm trials for the 2024-25 campaign, filling half of the applicator units across a 12-row drill with the product, creating 12-row treated and untreated strips across a high-risk field.

A wet and mild winter and a raised water table created seemingly ideal conditions for FLN and Penny expected to see differences above ground in the untreated strips.

As the summer remained relatively wet and warm, she says plants established and grew away quickly, and weren't put under any significant drought stress so little impact of FLN, such as stunted tops, was observed.

However, when doing hand digs ahead of harvest, there were visible differences in root quality between treated and untreated (see photo).

IMPACT OF CONDITIONS

Although this didn't translate into a significant yield increase in 2024-25, both Penny and Alistair agree that if it had been a dry summer limiting water availability, fanging symptoms and losses would have been much worse.

"Where we've historically had a problem, I'll definitely be recommending NEMGuard again and will keep encouraging growers to do more strip trials," highlights Penny.

"Growers want to be able to justify its use. I think it would only take one bad year where we have FLN damage followed by a drought and they'll never consider not using it again."

She adds that evidence on cover crops potentially increasing risk, presented in recent media coverage, could make treatment a good insurance policy.

While such on-farm trials are important in gaining grower confidence in a product, Alistair says BBRO will be looking at expanding FLN control options for sugar beet growers in its own work during the 2025-26 campaign.

The work includes assessing the impact of endophyte grasses, brown mustard, and vetch and rye cover crops on FLN populations. These cultural measures will then be overlayed with a NEMGuard DE treatment in the following sugar beet crop to look for any complimentary or additive effects, he says.

"We don't want to rely on NEMGuard completely and the work should give us a good idea of what else works, and what doesn't," concludes Alistair. ●

A sweeter nitrogen for beet?

Both yield and sugar content in sugar beet can be increased by using a different type of nitrogen, according to new trials

Not all nitrogen is created equal, and a new sugar beet trial further indicates the benefit of a more controlled approach to nitrogen.

"When we think of 'nitrogen', it's a universal term that denotes uniformity," says Dr David Marks, founder of Levity Crop Science. "In fact, it's become a catch-all term that lumps together all nitrogen-containing molecules such as nitrate, amine or ammonium."

Yet that doesn't reflect the performance of these molecules within the plant – influencing everything from appearance to internal biochemical processes, including photosynthesis, in different ways, he adds.

"If we're more judicious about the types of nitrogen we use and when, we can exert much greater control over the crop and its metrics: yield, size, composition and even marketability."

David says this 'smart' approach also improves resource-use efficiency. "Particularly with nitrates, we apply two-thirds more nitrogen than the crop uses. The rest is lost to volatilisation, leaching and mineralisation. Amines and ammonium also degrade to nitrates once in the soil."

The effect on crops is akin to humans consuming all of their carbohydrate requirements as sliced white bread, he suggests. "It doesn't promote good health and often results in sluggish performance.

"Moreover, because the plant converts nitrates into ammonium to access the nitrogen, there's an energy cost – about 12 times as much. Remember the plant only gets energy from photosynthesis – that's energy diverted from growth."

According to David, Levity has built a 'smart' nitrogen fertiliser around an amine molecule, stabilised using a unique chemical linkage – termed LimiN – that prevents its breakdown by soil bacteria. Labelled as Lono, its premise of increased yield and better nitrogen-use efficiency is already commercially recognised in crops including cereals, potatoes, and onions, where growers have reduced nitrogen applications by up to 95% without affecting yield, says David.

Furthermore, independent trials conducted under commercial field conditions were commissioned by Levity in 2024, evaluating Lono's effect on growth, yield and quality. A control application of full-rate N at 120kg/ha split between two applications at drilling and after establishment was compared with plots subject to combinations of full-rate, half-rate and one or two Lono applications.

MEASURED METRICS

Measurement-wise, canopy cover, leaf count, crop colour and vigour were assessed in the field. Harvest metrics included yield, number of beets/m^2, beet length and diameter, and levels of sugar, amino-N, sodium and potassium.

"Canopy differences in Lono-treated plots were among the first observations," notes David. "Half-rate fertiliser plus two Lono applications achieved the maximum canopy cover with 33.81%, outperforming full fertiliser at 18.4%.

"Half-rate fertiliser alone at 26.38% also exceeded full-rate, suggesting reduced fertiliser inputs encourage greater root-to-shoot resource allocation, better nutrient uptake and increased photosynthetic efficiency, all improving stress resilience," he comments.

However, it's beet density and length that underlines how the stabilised amine in Lono contributes to different plant physiology, highlights David. "While full fertiliser produced the heaviest beets, these plots had the lowest beet density whereas Lono-treated beets were nearly 20% longer than full-rate beets.

"This confirms the improved nutrient uptake thesis. Combined with root diameter measurements, it seems Lono shifts plant resources to promote growth aspects such as root elongation. Meanwhile, the highest yield of 122.73t/ha was recorded with half-rate fertiliser plus two Lono applications. The control plot yielded 110.6t/ha."

Extrapolating these findings from Levity's work with other crops, David believes the amine helps promote root development as it's processed in roots, where it stimulates production of the hormone cytokinin.

It's the increased sugar content, however, that he says is most pleasing. "Two applications of Lono consistently resulted in higher sugar percentages whether used with full or half-rate fertiliser. This appears to result from enhanced physiological efficiency and improved nutrient uptake optimising the plant's metabolic processes for sugar production," he surmises.

"We'd like to repeat these trials on a larger scale but these are currently very encouraging results. To increase sugar by more than 6% with a higher overall yield while using half the fertiliser – that's definitely a step forward for productivity and resource use."

Smart fert

Levity has built a 'smart' nitrogen fertiliser around an amine molecule, stabilised using a chemical linkage that prevents its breakdown by soil bacteria, says the firm's Dr David Marks.

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