Electromagnetism; a sustainable solution to nematodes

Nematodes. There may be no other creature so omnipresent around us yet so unknown outside of specialist circles. Nathan Augustus Cobb, widely recognized as the “father of nematology” summed up their ubiquity in a 1915 essay (http://https://naldc.nal.usda.gov/download/IND43748196/PDF): “If all the matter in the universe except the nematodes were swept away, our world would still be dimly recognizable, and if we could then investigate it, we should find its mountains, hills, vales, rivers, lakes, and oceans represented by a film of nematodes.”

There are several varieties, but plant-eating nematodes thrive mostly in moist earth: a single gram of soil can contain more than 1,000 plant-parasitic nematodes. While they can play a role in weed control by preventing them from germinating , they generally rank among the most persistent pest a grower or farmer can face – by feeding on the roots, they reduce a plant’s uptake of water and nutrients, simultaneously reducing its tolerance to stresses such as drought. It is estimated that annually up to 12.3% of worldwide yields ($157 billion dollars) are lost due to nematodes, meaning these unseen little pests stand as one of the biggest threats to the sustainability of agriculture.

Chemical solutions

In industrial agriculture, the most common solution up to now has been using chemical pesticides. Indeed, all the big chemical players manufacture such nematicides, including Monsanto, Bayer, BASF and Dow, with nematicides in three categories: organophosphates, carbamates and bio-nematicides.

However, there is a clear recent trend towards more natural, sustainable, and non-invasive solutions, with a paper on the nematicide industry concluding that chemical nematicides “possess very adverse side effects on the environment and health due to which many nematicide products are not able to get registered under EPA.” Indeed, some nematicides have been banned as they were found to leech through the soil and contaminate drinking water . For these reasons, the

market survey goes on to conclude that “concerns regarding ill-effects of pesticides and associated perceptions of health and environment degradation are expected to hamper the nematicides market growth.”

Electromagnetic solutions

Raymond Lescrauwaet, a Dutch expert in electromagnetism, explains the interplay between EM and nematodes as follows: “Above ground, different electromagnetic signals are generated by the plant that there is or isn’t nectar in the flowers, which attracts or rejects the bees. Underground, a similar principle seems to apply with regards to the attraction or rejection of migratory nematodes by the root system of the plant.”

This principle is chemotaxis and was highlighted by A.M. Reynolds in a 2011 paper. It is the primary means by which nematodes locate host plants, moving “in the direction of higher concentrations of semiochemicals such as plant chemical signals”. Nematodes are attracted to plant roots “via soluble and gaseous attractants produced by the root itself or by attendant rhizosphere micro-organisms.”

So, if it is possible to subtly interfere these signals, the root-knot nematodes would simply no longer be interested and would stay clear of the rhizosphere, solving the problem without directly attacking the nematodes themselves.

Enter Aqua-4D

Aqua-4D’s patented Swiss technology uses low-frequency signals which are applied to the water before irrigation. This has a positive effect on the innate structure of the water, making the minerals within more soluble, improving overall soil quality and eliminating biofilm. But at the same time, studies since 2004 have shown that root-knot nematodes exposed to this electromagnetically-treated water do indeed become stressed, disorientated, and lay fewer eggs, meaning they stay away from the root zone.

The knock-on effects of this mean healthier hairy roots and thus healthier plants and higher yields, which have been noted and backed up by countless studies carried out around the world:

- Dr. Gotthard Stielow, agriculture consultant in Hamburg, Germany, conducted a trial in 2004 to assess the effect of the treated water on nematode attacks on parsley and tomato crops. For both crops, the results showed evidence of nematode attack in the control field, with none in the field treated with Aqua-4D, along with slightly improved growth.
- In 2010 by Dr Sebastian Kiewnick at the National Competence Center for Nematology, Switzerland, looked at the root-knot nematode Meloidogyne enterolobii in high-value greenhouse crops. He concluded that “the Aqua-4D system interfered with the nematode-plant interaction” in this case, finding a “lower number of egg masses, and reduced damage for the duration of the whole growing season”.
- In 2012 Prof. Najet Raouani Horrigue and team at the Higher Agronomical Institute of Chott Meriem, Tunisia, assessed the effect of Aqua-4D’s electromagnetically treated water on root-knot nematodes in melon crops. The results showed a lower Gall Index (reduced damage), a 42% increase in production, and showed that it was more effective than the Rugby 10 G nematicide.
- A 2016 study by the Nematologist Prof. Dr. Pedro Soares at São Paulo State University researched the control and development of nematodes in soybean crops, finding a significant reduction in Pratylenchus brachyurus nematodes and Meloidogyne javanica eggs.

The last couple of years have also seen great results: with guava crops in Brazil (Pomar do Vale) and tomato crops in Mexico (Barajas), and mint crops in Colombia (La Corsaria). Enrique Rebaza was part of the Colombian study, which treated through sprinklers through the dry and rainy season. The results show a clear and significant reduction over the course of ten months:

Rebaza explained the findings as follows: “When we apply the Aqua-4D technology we are flooding the soil with electromagnetic charges diluting the ones of the exudates, making it difficult for the nematodes to find the concentrations of exudates”. These practical observations from the field are exactly what we would expect according to Reynolds’ chemotaxis principle mentioned above. Each cycle shows consistently less nematode damage due to fewer nematodes reaching the roots and thus fewer eggs being laid.

Raymond Lescrauwaet works directly with growers in the Netherlands and has continually seen several ways in which the Aqua-4D system offers an impressive return on investment. Maintenance costs associated with deep steaming and deep digging are no longer an issue, neither are costs of chemicals and

pesticides – at the same time paving the way for truly biological growing. A well-known chrysanthemum grower in Bommelerwaard, Holland, works with the Aqua-4D system and has seen exactly such positive results: "If we get rid of the nematodes and we might not have to steam anymore, then it's a small investment," says John van de Westeringh. "After a few weeks we saw more hairy roots in the first cycle, so I am very positive. Moreover, if the crop becomes stronger, you need fewer resources and that of course also means more profit."

Conclusion

Experts and nematologists agree that nematodes are virtually impossible to eliminate, so the sustainable and chemical-free solutions provided by the Aqua-4D system offer the next best thing: making root-knot nematodes disinterested and disorientated, keeping them away from the rhizosphere so that they no longer lay their eggs or pose a threat. And indeed, as many nematodes can play an important role in a biodiverse ecosystem, simply repelling them from the root zone is a sustainable, environmentally-friendly solution.

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