Racing to the roots: Soil moisture impacts the speed of nematodes

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Image of second stage juvenile Meloidogyne ethiopica, a highly aggressive plant-parasitic species of nematode. This species is concerning to many farms in Chile, and many other countries. A recent study provides the basis for farmers to control irrigation rates to reduce the harm this nematode causes to crops. Credit: Sebastián González-Bernal

Did you know one of the oldest life forms on Earth can be found in your backyard? Soil nematodes have been thriving in habitats around the world for at least 400 million years. Even though they are only 1/500th of an inch wide and 1/20th of an inch long, these worm-like animals are an important part in almost every ecosystem.

Soil nematodes are grouped by what they eat. They can eat a diet of bacteria, fungi, plants, and more. While most nematodes are good for the soil, the nematodes that eat plants are a concern to farmers around the world. These nefarious nematodes are called plant-parasitic nematodes.

Plant-parasitic nematodes are unwelcome guests in agricultural soils. They attack plants at their roots and use the plant as a food source to support their own reproduction and growth. By stealing the plant's resources to grow and multiply, nematodes cause yellowing, stunting, wilting, and declines in yield.

Understanding the movement of nematodes through the soil is important to helping farmers protect their crops. How fast do they move? How far can they travel? How does soil moisture affect their movement? Answers to these questions could help prevent crop damage and losses.

Sebastián González Bernal is a researcher at Pontificia Universidad Católica de Valparaíso in Chile. He studies a type of nematode called Meloidogyne ethiopica. This is a highly aggressive plant-parasitic nematode species. His team examined the speed of Meloidogyne ethiopica under different soil moisture conditions.

Three to four-week-old tomato plants grown as part of the experiment. At this stage, the tomato plants have optimal root systems that attract the hungry nematodes. Researchers studied how soil moisture affects the speed at which nematodes can migrate toward tomato roots, which can help farmers make water management decisions. Credit: Sebastián González-Bernal

This study was published in *Agronomy Journal*.

Using tomato plants, the researchers set up an experiment. The plant-parasitic nematodes were placed into the soil at different soil moisture levels and multiple distances from the plant roots. The researchers then monitored a microscopic race to see how long it would take for the

nematodes to reach the tomato plant roots.

The nematodes were given up to 26 days to reach the finish line. "Knowing the speed of migration nematodes has enormous applications for farmers because they can control damage to plants by managing irrigation frequency," González Bernal explains.

Nematodes in the driest soil were the slowest, showing little to no movement. This indicates that nematodes can't travel as quickly in soils with less moisture, which is useful information for farmers. "Damage to plants could be controlled through proper management of the frequency of irrigation," González Bernal says.

Four rows of soil containers used during the experiment to evaluate the speed of the plant-parasitic nematodes. The nematodes were placed into the soil at four different locations in the soil container. The distance from the inoculum to the top of the container, and the time of migration, generated the multiple distances that were evaluated in this experiment. Credit: Sebastián González-Bernal

Most of the nematodes did not move at all or moved so slowly that the researchers weren't able to detect their speed. The slow speed is good news. According to González Bernal, this implies that unless the roots were close to the nematode, they will not be infected.

González Bernal is excited about this research and its overall importance to agriculture. "By studying the basic biological behavior of nematodes, we have found a possible management solution for farmers/producers that benefits the plants and their root systems."

More information: Sebastián González-Bernal et al, Velocity of Meloidogyne ethiopica second-stage juveniles in sandy soil under several soil moisture conditions, *Agronomy Journal* (2022). DOI: 10.1002/agj2.21103

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