

Additional Question & Answers from the webinar on December 12, 2022

Responses provided by Dr. Mario Tenuta, University of Manitoba

Q: Are there beneficial nematodes in the soil also?

A: Yes. There are many more species of beneficial nematodes in soil than there are deleterious nematodes damaging crops. A handful of agricultural soil in the Prairies contains from 30-70 species of nematodes. Each species has a role in the soil food web. Some feed on bacteria, some on fungi, some on protozoa, some on plant roots, some are omnivorous (feeding on fungi and plant roots), some are predators/carnivores. Their action of feeding results in the liberation of nutrients from the bodies of their prey and make them available in to the food web, including to crop roots. The feeding action also can reduce levels of pest and disease causing organisms. This is a form of biological control regulating pathogen and pest levels in soils.

Q: Is there a way to improve the predatory nematode populations that feed on any of the parasitic species?

A: The predator nematodes are relatively long-lived, reproduce slowly and sensitive to stress (e.g., tillage, salinity and high extractable nitrogen levels). They also like soil with plant cover and activity for as much of the year as possible. A cropping system that promotes their activity with few stresses encourages their beneficial activity of preying on small pest organisms.

Q: What are best management practices for preventing soybean cyst nematode establishment?

A: Having a long soybean rotation, so one in four soybean. Using resistant varieties to SCN. Cleaning equipment and implements between fields. Having good weed control. Avoiding edible beans in the rotation. Scouting fields for dwarf/chlorotic patches in dry times, visually check roots there and then in early July to mid July for white cysts on roots.

Q: How do we differentiate a nematode root cyst from an N-fixing nodule?

A: Nodules are much larger than cysts. Nodules are 1/8 to 1/4" wide. They are roundish. Cutting them in half they have a salmon pink colour (if fixing N). Cysts are much smaller, 1/16" and smaller. Cysts will form along secondary roots whereas nodules tend to concentrate nearer to the seed. Cysts first appear white and are lemon-shaped. At this stage pinching them between your fingernails they will pop like a zit. Into late July they turn yellowish and by mid-August tan to brown and then in September dark brown/black with a hard surface (don't zit pop).

Q: Why do you think we are seeing an increase in nematode populations?

A: Some think it is because of meddling nematologists from the University of Manitoba looking for them. I beg to differ. Our rotations on the Prairies have changed with introduction of canola and pulse crops. We are now seeing a maturing of those rotations in terms of age. As a result there has been time for the nematode communities to change and adapt. It is expected that plant feeding nematodes will also adapt and increase in population with the presence of the crops they feed on.

Q: Is the range of soybean cyst nematodes expanding due to soybean crop frequency or soil movement?

A: Soil has been moving ever since we farmed the Prairies. It is definitely the introduction and now establish history of soybean in many areas of Manitoba. It takes about 5-8 crops of soybean in a rotation to have SCN catch in a field if the pest has been brought into the field. So it is a bit of both. Having soy in the field for some time and having the pest introduced to the field. Soil doesn't only move on equipment and implements but also by wind, water and birds. SCN moving down the Red River, first in Minnesota and North Dakota and now Manitoba, is classic dispersal by flooding. However, we have some fields in Manitoba far from the Red and other rivers indicating other means of dispersal.

Q: With such high levels of pin nematodes in the chickpea surveys in absence of increasing chickpea acres is there another mechanism that could be leading to these high numbers?

A: Clearly there are crops being grown that the pin nematode loves to feed on. We need to figure out what those crops are. We are rearing the nematode on chickpea in the greenhouse. So we know it likes chickpea. With such high numbers it also likes other crops in the rotation.

I have a hypothesis. The chickpea disease shows up rains break a dry spell. Under dry conditions nematodes cannot move easily and thus cannot move to feed on roots. With the soil wetting, a whole lot of hungry nematodes wake up and make a dash for chickpea roots causing a great deal of root stress. A hypothesis.

Q: How to nematicides work to control parasitic species? Are they applied to the soil, as seed treatments, or as intervention to growing plants?

A: Nematicides vary in their mode of action. Older chemistries basically affect anything with a nervous system, nematode, insects etc. You can imagine these types of nematicides are generally being used less and less with time. They are being replaced with more targeting nematicides that affect nematodes specially. Some are chemicals produced by bacteria and fungi to kill nematodes so they can have root systems all to themselves. Some irritate the surface of nematodes making it difficult for them to move and sense roots. Some are systemic in the crop and interfere with the nematode establishing a feeding site on roots. It is all rather exciting times with a great deal of development, creativity and diversity in new types of nematicides being available. Some nematicides are coatings and some are in furrow. Some are systemic and some are not.

I do think nematicides should be examined on the Prairies. At first a point to understand the damage caused by the plant nematodes. If the damage is great enough, then efficacy trials to see if use by growers is worth it.

Q: What impact do they have on other soil biology?

A: Old nematicide chemistries targeting nervous systems of nematodes also killed arthropods (insects). They affected animals with nervous systems. So they were very targeted. Fumigants were even less specific. Though not a nematicide, fumigants kill a vast array of organisms, nematodes being controlled by them very well. Modern nematicides are more targeted to kill or prevent nematodes from feeding/being active. The days of broad spectrum super effective chemistries to kill soil pests are over. Registrations require showing a narrow target of organisms being affected by nematicides.

Q: The cover crop Sun hemp (*Crotalaria juncea*) also commonly known as Indian mustard is reported as an efficient method for controlling nematodes in soils due to the production of some toxic substances to nematodes. Do you think that could be an alternative to the use of nematicides in the Canadian prairies?

A: There are many cover/green manure crops that are very effective against some species of plant feeding nematodes. Sun hemp is one, marigold, sorghum-sudan grass, arugula, mustards (though some nematodes may actually increase), castor bean and many tropical suited green manures can reduce populations of plant nematodes.

The major issue here is our short season. Most of the season is taken by growing a harvested crop. So to grow covers and green manures for control currently means taking a field out of the income stream. For some growers this can be just fine. In years with low commodity prices I field more questions from growers to use green manures, especially potato growers. In low grain and oilseed price years some don't mind the investment in the soil for the pay off in the potato year.

Q: Could there be potential to use *Ditylenchus weischeri* for control of Canada thistle in crops/grasslands? Does this nematode reproduce on other weed species or only thistle?

A: Though about this many times. If could be a control mechanisms it would have worked already. Our looking at Canada thistle across the Prairies shows the nematode is everywhere the plant is. We have looked at sow thistle and the nematode doesn't like it as much as Canada thistle.