



Global Warming

(credit M. Tenuta)

Figure 1: *The root lesion nematode, Pratylenchus neglectus. This crop nematode currently limits potato yield in tight rotations but could become a future problem for canola.*

What's going on?

Nematodes are small round worms that live everywhere, including in soil and plants. Those in soil and parasitizing plants are less than 1/6" long: a palm full contains 1,000 to 6,000 with 20 to 30 species. Most soil nematodes are beneficial to crops, accelerating N and P mineralization and keeping pathogens and pests in check. However, a minority of species specialize to parasitize some crops causing varying degrees of economic damage (from none to severe). Damage goes unnoticed at first. Thus as a crop nematode is establishing and building levels, growers are unaware of the damage to come in subsequent years. Even when damage is visible it is usually misdiagnosed and attributed to other issues.

Fortunately, economically important crop nematodes in the Prairies are few. Generally warmer climates have many more damaging species. In response to the sugar beet nematode (*Heterodera schachtii*), Alberta growers use rotation to keep damage low. Recently the root lesion nematode (*Pratylenchus neglectus*; Figure 1) was identified as part of potato loss in tight rotations. The stem and bulb nematode (*Ditylenchus dipsaci*) has been past observed in alfalfa and can restrict export of high quality product. The Canadian Food Inspection Agency reported an isolated and non-repeatable find of the golden nematode (*Globodera rostochiensis*) in a seed potato field. The U.S. and Canada implemented a certification process to open borders by sampling to declare fields clear.

What's coming up?

The factors most determining presence of crop nematodes are: a suitable host (crops or weeds), introduction of the nematodes to fields, and suitable soil temperature and moisture. Thus the tighter the rotation, the greater chance of developing crop nematodes. Poor in-season and shoulder season weed



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and volunteer management also can maintain crop nematode populations. Freezing soil temperatures in winter do exclude sub- and tropical¹ and Mediterranean crop nematodes. Temperate crop nematodes are not affected by freezing soil temperatures. They protect themselves from freezing damage by a variety of mechanisms^{2,3} and survival life-stages. The stem and bulb nematode can survive at least one month at -80°C because it freeze-dries itself⁴! Winter freezing of soil is expected to still be a Prairie feature by 2050 so there is no concern for sub- and tropical, and Mediterranean species establishing any time soon.

In the presence of suitable hosts, crop nematodes develop faster with increasing soil temperature. Generation time is one life-cycle from egg hatching to adult production of eggs. Temperate nematodes have generation times of 20 to 60 days depending on species, soil temperature and moisture during summer months. Summer soil temperatures at 20 cm have generally increased by 1°C from beginning to the end of the previous century across Canada⁵. Thus, we are experiencing shorter generation times for crop nematodes meaning faster ramping to damaging levels. For example, the change in the generation time for the root lesion nematode is quicker for warming at cooler temperatures (Figure 2). Thus, northern soils experiencing summer warming and greater frost-free periods, such across the Prairies, are more prone to ramping crop nematode populations.

Does it matter?

It is reasonable to expect oil seeds (canola and soybean), small grains (wheat, barley and corn), pulses and for vegetable, potato, to dominate crop land in the Prairies to 2050.

For the above established crops, crop nematode pressures should increase with cropping frequency, summer

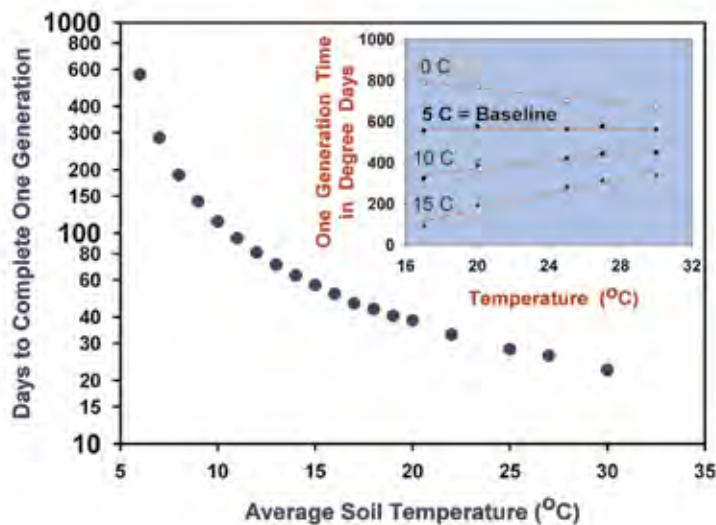


Figure 2: Modelled days to completion of one generation (egg hatching to egg production) of the root lesion nematode (*Pratylenchus penetrans*); analysis of results by Mizukubo and Adachi⁷ (unpublished, Mario Tenuta).

temperatures and shoulder periods. Canola and wheat will be susceptible to the root lesion nematode. This nematode is present in the Prairies⁶ and prefers canola and wheat. It currently damages canola in Australia and canola and wheat in the U.S. Pacific Northwest. Canola is an alternative host to the sugar beet nematode. Potato is susceptible to another root lesion nematode, *Pratylenchus penetrans*, that is currently absent but suited to our conditions. The nematode is problematic because it severely aggravates Verticillium wilt of potato present here. Potato cyst nematodes (*Globodera rostochiensis* and *G. pallida*) are of great concern because their presence would immediately stop regional export of potato tubers and any commodity with soil tags!

Soybean and corn are currently expanding in the Prairies. Expansion of new crop acreages is surely to be followed by new diseases and pests. For example, the soybean cyst nematode (*Heterodera glycines*) is the most economically important disease or pest of soybean in the U.S. and Canada. It was first reported in North Carolina in 1954, and moved rapidly to all major soybean growing areas of the U.S. and Ontario. In Canada, soybean cyst nematode was first reported in 1987 in Kent County, near the U.S. border. Since then, it spread rapidly northeast and north from New York State into the Kingston area to recently western Quebec. This nematode has expanded northward along the Red River in Minnesota to near the Manitoba border since 1978. In North Dakota, soybean cyst nematode has also quickly spread from the southeast to the Manitoba border in just four years!

What is being and can be done?

There are things we can do to limit the ramping of crop nematodes:

- Don't import dirty farm equipment and items containing soil and plant material from BC, U.S. and outside Canada,
- Be on the lookout for problem patches in fields that are tough to diagnose,
- Extension agents and crop consultants should be trained in scouting for crop nematodes,
- Rotate wisely and control weeds and volunteers,
- Train students in crop nematology to address emerging needs,
- We are developing rapid molecular diagnostics for determining crop nematodes,
- We are surveying crop nematodes of pulses and soybean, the CFIA conducts surveys of seed potato fields, and surveys for canola and wheat should be initiated,
- Continue to evaluate soybean tolerant varieties to soybean cyst nematode for suitability on the Prairies.