A SURVEY OF HELICOTYLENCHUS, PARATYLENCHUS, PRATYLENCHUS AND TYLENCHORHYNCHUS NEMATODES IN POTATO FIELDS IN ALBERTA, 2018 AND 2019

CROP: Potato
LOCATION: Alberta
NAMES AND AGENCIES:

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ABSTRACT: The prevalence of *Helicotylenchus, Paratylenchus, Pratylenchus* and *Tylenchorhynchus* genera of nematodes is not well understood across the prairie provinces of Canada. These nematodes can cause economic damage by feeding on the host crop directly or serve as vectors of plant diseases. While conducting a larger project, nematode populations were quantified in the soil of three commercial potato fields planted with cultivar 'Russet Burbank'; one in 2018 and two in 2019. The nematodes were extracted from soil samples, identified morphologically, and then quantified as numbers per kg of fresh soil. All four genera were detected in all fields, but the population sizes varied between fields and across time within fields.

INTRODUCTION AND METHODS: Plant-pathogenic nematodes are of economic concern in potato crops in many growing regions. *Helicotylenchus, Paratylenchus, Pratylenchus* and *Tylenchorhynchus* nematodes have all been identified as pathogens presently affecting potato production in Turkey (Akyazi et al. 2012). The same genera have also been identified to be an issue in potato production in the state of Maine (Huettel et al. 1991). All four genera have been identified in agricultural fields of North Dakota, with a positive correlation between soil temperature, soil pH, and different genera (Chowdhury et al. 2019). Prevalence of soil-borne nematodes across the Canadian prairie provinces is not well understood. There has been one nematological survey in recent years in Alberta (Forge et al. 2019). In conjunction with a project focusing on the control of soil-borne pathogens of potatoes, the aforementioned genera of nematodes were quantified spatially and temporally from soil samples collected at three different times of each year, in each of three potato fields. The resulting knowledge adds to our understanding of the dynamics of nematode populations in Alberta potato fields.

Commercial potato production fields predicted to have early dying disease based on field history were selected in consultation with cooperating growers and local agronomists. Each field was in the Municipal District of Taber (Figure 1). The potato early dying complex, commonly caused by the root lesion nematode, *Pratylenchus penetrans*, in conjunction with the vascular wilt pathogen, *Verticillium dahliae*, was the focus of the investigation. To characterize the presence of *Pratylenchus* spp. in the three potato fields, soil samples were collected at three time points: 1) October, prior to the potato crop, 2) May, shortly after planting, and 3) September, prior to commercial harvest of the potato crop. The potato fields were part of a larger project involving soil fungicides and fumigants. Here we report results from soil samples taken from non-treated areas of the fields. The number of non-treated strips varied from field to field, and the location of soil sampling varied with sample collection timing. For example, the soil sample collected prior to the potato crop was a composite sample of forty soil cores collected from across the whole field in a repeating W-pattern. The second and third soil samples, which were collected in May and September, respectively, were only taken from non-treated control strips in the field. The second and third soil samples were composite samples of twenty soil cores collected in a repeating W-pattern. All soil was sampled to a depth of 30 cm with a Dutch auger. At each soil sampling time point, samples were bagged and placed into chilled storage (~ 4°C) until shipment in an insulated cooler with a frozen pack to the University of Guelph Agriculture and Food Laboratory for analysis.

At the University of Guelph, the Baermann pan method was used to extract nematodes from 50 g of fresh, undried soil per sample (Townshend 1963; Forge and Kimpinksi 2007). Soil was placed on 3-ply paper tissue, which was placed on a non-metallic mesh screen and subsequently

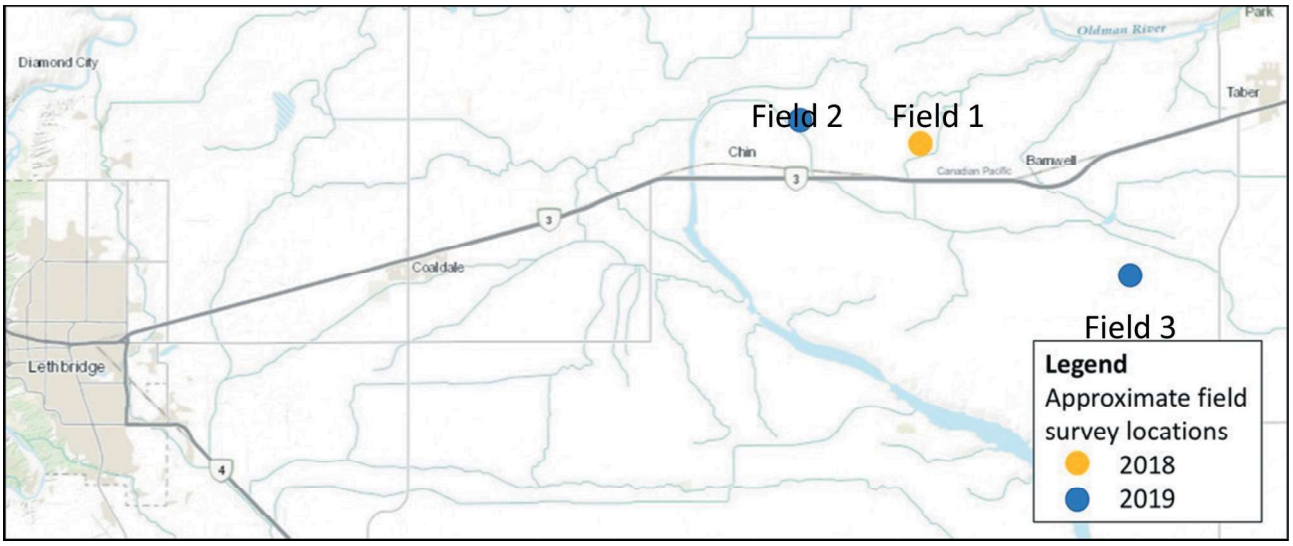

Fig. 1 Approximate locations of Alberta potato nematode field survey in 2018 and 2019.

Table 1. Nematode counts (nematodes per kilogram of soil) for four genera from three field locations. The October sample shows results from a single composite sample of 40 soil cores. The May and September samples represent the mean of three composite samples of ≥20 soil cores each.

	Helicotylenchus			*Paratylenchus*			*Pratylenchus*			*Tylenchorhynchus*		
Sample Date	1[a]	2	3	1	2	3	1	2	3	1	2	3
Oct 2017	ND[b]	20	60	ND	140	0	120	900	440	ND	20	0
May 2018	20	47	200	0	67	40	20	333	0	0	0	0
Sep 2018	60	47	40	13	0	0	1080	320	0	7	0	20

[a]Field location number.
[b]Not determined.

placed in a pan filled with water. The pan held enough water to saturate the soil without fully immersing it. Pans were stacked for efficient use of space, then covered by plastic to limit evaporation. Incubation proceeded at room temperature for 3 to 14 days with water added to the edges of the screens to maintain a consistent water level (Barker 1985). Screens were removed from pans and were rinsed into the respective pan. Contents of pans were collected into large test tubes and left undisturbed for 1 h minimum to allow nematodes to settle to the bottom. Supernatant was siphoned off to leave between 5 and 10 mL remaining. The remaining contents were placed in a counting dish. Visual identification was conducted via a stereoscope at 10 to 70x magnification after the extracted nematodes settled in the dish for a few minutes. Nematode identification was performed to the genus level using a dichotomous key and counts expressed per kilogram of fresh soil (Tarjan et al. 1977).

RESULTS AND COMMENTS: *Helicotylenchus, Paratylenchus, Pratylenchus* and *Tylenchorhynchus* nematodes were found in all three potato fields (Table 1). Field 1 showed an increase in numbers of all genera over time. An increase in the population level of one genus (*Helicotylenchus*) and a decrease of others (*Paratylenchus, Pratylenchus* and *Tylenchorhynchus*) was observed in Field 2 across time. Field 3 exhibited variable levels of all genera across time. *Helicotylenchus* and *Paratylenchus* populations increased then decreased, while populations of *Tylenchorhynchus* increased and populations of *Pratylenchus* decreased.

In comparison, results from a previous nematode survey (Forge et al. 2019) also established the presence of the four genera of focus here, in addition to others. However, Forge et al. (2019) observed that the *Paratylenchus* genus was in greatest abundance, which

was not the case in the potato fields reported herein. One possible explanation for this difference is that Forge et al. (2019) sampled at a single time point from non-potato crops, such as berries, vegetables and apples, while our study had multiple time points and a singular focus on potatoes. Changes in counts across time show that seasonal variation may affect the quantity of nematodes captured in any given soil sample. This is likely correlated with the life cycle of the nematode. In addition to shifts in nematode populations throughout the growing season, the results also demonstrate the field-to-field variability with respect to nematode presence and abundance.

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