

Pea Root Rot: Surveillance and Evaluating Variety Resistance

Fusarium avenaceum was found to be the most aggressive *Fusarium* species infecting pea fields, among nine different species identified. Partial resistance to root rot was observed in a few commercial field pea varieties.

ROOT ROT IS a major constraint on field pea production in western Canada. Past annual surveys of fields in Manitoba have shown that several pathogens are responsible for root rot in peas. These include *Fusarium solani*, *F. avenaceum* and *Rhizoctonia solani*, among others. Infection by these root pathogens can reduce seedling emergence, root growth and nodulation resulting in less nitrogen fixation and lower yields.

As pathogen populations evolve, continued monitoring of pea fields is critical to evaluate the incidence and severity of root diseases. Planting resistant varieties could also provide a means for reducing the negative impact of these root pathogens on plant growth and yield. However, at the onset of this study, little information existed on the root rot reactions of pea varieties.

Two complementary studies were conducted. The first involved annual pea disease surveys from 2013-2017, where 40 fields in Manitoba were evaluated

for incidence and severity of root rot and symptomatic pea roots were used for molecular diagnostic testing. Root disease severity was rated on a scale of 0 (no disease) to 9 (death of the plant). The second study evaluated 60 pea varieties for their reactions to *R. solani*, *F. solani* and *F. avenaceum*, compared to the partially resistant line, Carman, and the susceptible cultivar, AC Reward. Field trials were conducted at Morden and Brandon.

In the first study, average root rot severity (3.3) was greater in 2013-2017 compared to the previous five-year period and *Fusarium* root rot was detected in virtually all fields assessed each year. Nine different *Fusarium* species were identified infecting pea roots according to in-depth root disease analysis from three fields in 2015. *F. avenaceum* was found to be the most aggressive species among them. In the five-year period that followed this study (2018-2022), average root rot severity (3.4) was slightly higher and *Fusarium* root rot was detected in all surveyed fields.

Advancements were made in the area of molecular diagnostics, which is a method that provides rapid and precise results. New molecular detection techniques for pea root rot pathogens were developed, including the identification of new primers for qPCR methods on *F. avenaceum* and *F. acuminatum*, and optimization of primers for the root pathogen, *Aphanomyces euteiches*.

In the second study, a few varieties consistently demonstrated partial resistance to at least one of the root rot pathogens similar to that of the partially resistant check, Carman (Table 1). Most varieties consistently had low emergence counts following infection with *R. solani* and high root rot severity ratings following infection with all three pathogens (Table 1). At both locations, inoculation with *R. solani* caused the greatest reduction in the number of emerged plants even though four times as many seeds had been planted in comparison to the experiments that were inoculated with *F. avenaceum* or *F. solani*. A few cultivars consistently displayed partial root rot resistance to at least one of the root rot pathogens similar to that of the partially resistant check, Carman.

These results have helped us stay up-to-date on pea root rot pathogens in Manitoba, they have identified the need for more research to enhance root rot resistance in high-yielding pea varieties and they have helped make important strides in molecular diagnostics.

Since the conclusion of this research, *Aphanomyces* root rot, which commonly appears alongside *Fusarium* root rot, has become widespread across western Canada. Initiatives are underway to stay ahead of this aggressive pest before it becomes a bigger problem. ▀

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Table 1. Results of pea root rot resistance experiments at Morden and Brandon (2013-2017). Seedling emergence and root rot ratings for a subset of eight commercial field pea varieties tested (of 60 total) against all three root pathogens, compared to the means of the partially resistant control, Carman.

Variety	<i>Rhizoctonia solani</i>		<i>Fusarium avenaceum</i>		<i>Fusarium solani</i>	
	Emergence (%)	Disease Severity (0-9)	Emergence (%)	Disease Severity (0-9)	Emergence (%)	Disease Severity (0-9)
Morden						
CDC Dakota	35	5.7	67	5.0	62	5.2
40-10	28	5.6	67	5.1	62	5.1
Delta	20	5.6	51	4.8	47	4.7
Abarth	26	5.9	54	5.4	49	5.4
Toledo	15	5.6	44	4.8	34	5.2
AC Reward	23	5.8	52	5.3	50	5.4
Carman	32	4.8	64	4.1	63	4.4
Brandon						
CDC April	14	3.6	61	2.8	63	3.6
CDC Mosaic	20	4.4	65	3.4	69	3.8
CDC Rocket	24	4.3	60	3.2	64	3.4
AC Reward	20	4.5	64	3.6	67	4.2
Carman	29	4.0	66	2.8	68	3.1

Bold = similar to the mean of the partially resistant check, Carman, based on least significant differences (LSD) at 5%. Disease severity scale = 0 (no disease) to 9 (death of plant).

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DURATION 5 years