

2012 Field Pea, Dry Bean and Soybean Research at the Brandon Research Centre

Annual Report to MPGA

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The 2012 dry bean and field pea disease survey activities funded by MPGA were conducted as outlined in the Pulse Science Cluster program. The soybean research activities were conducted according to the MPGA funded 3-year proposal initiated in 2012. All field activities of these studies were completed and the laboratory work is ongoing.

Root rot pathogens of field pea in Manitoba

Root rot is a major disease of field pea in Manitoba and is capable of causing significant yield reductions due to compromised root systems and reduced plant stands. Cultivars with complete resistance have yet to become available and control of root rot is difficult. Previous studies indicated that the most prevalent causal agents for root rot in field pea in Manitoba were *Fusarium solani* and *Rhizoctonia solani*. However, recent findings also indicate the presence of *F. avenaceum* in root rot affected field peas in Manitoba, Alberta and North Dakota. These reports suggest that the pathogen population may be changing over time, and emphasize the need to obtain up-to-date information on the pathogen species involved. To screen for host resistance and design effective control measures, it is critical to determine the prevalence of root rot pathogens of pea.

In 2012, the area seeded to field pea in Manitoba increased by over 50% from previous year, with growers looking to maximize the planting area and return to pre-flood levels. With funding provided by MPGA, field pea crops were surveyed for root diseases at 33 different locations in Manitoba. The crops surveyed were randomly chosen from regions in south-central and southwest Manitoba, where field pea is commonly grown. The survey was conducted from early to mid-July, with ten plants sampled at each of three random sites for each crop surveyed. The thirty pea plants were rated for severity of root rot using a disease severity scale of 0 (no disease) to 9 (death of plant). Fifteen symptomatic roots were collected per field for isolation of root rot pathogens in the laboratory. Root rot symptoms were observed in every field, and *Fusarium avenaceum* was more frequently isolated from symptomatic roots than *F. solani*. *Rhizoctonia* root rot (*Rhizoctonia solani*) was detected in one crop. In 2011, wet soils and cool conditions early in the season favoured root rot development, but such conditions were not as common in 2012, resulting in a lower mean root rot disease severity. Pathogenicity tests of the predominant isolates of *Fusarium* were conducted in order to confirm the capability of the pathogen(s) to cause disease.

Root rot pathogens of dry bean in Manitoba

In Manitoba, root rot can be a major constraint on dry bean production and can cause significant yield reductions due to seedling blight and weakened root systems of adult plants. In some cases, the whole primary root system can be destroyed. The root rot problem can be exacerbated when bean production fields are grown in short rotations and

when beans are planted into cold soil. Resistant cultivars have yet to be developed. *Fusarium solani* and *Rhizoctonia solani* were the most prevalent causal agents of dry bean root rot identified in past Manitoba disease surveys. However, other *Fusarium* species such as *F. acuminatum*, *F. redolens* and *F. graminearum* have the potential to infect dry bean cultivars as demonstrated in recent studies. Changes in the pathogen population may be occurring over time and these findings demonstrate the need to acquire new information on root rot pathogens in Manitoba bean crops in order to screen for host resistance and design effective control measures.

In 2012, funding provided by MPGA supported a survey of 40 crops of dry bean for root diseases during mid- to late July when most plants were at the early bloom stage. Protocols for plant collection, root rot rating and isolations were the same as for field pea. *Fusarium* root rot, detected in all of the 40 crops surveyed for root diseases, has remained the most prevalent root disease of dry bean for several years. The average disease severities were 3.7 and 3.2 in 2011 and 2012, respectively. During these years, average root rot ratings above a severity value of 4 (i.e., symptoms were present on 50% of the root system and plants were stunted) were observed in 39% and 25% of crops surveyed, respectively, and this would have a detrimental effect on crop yield. As with pea roots, *Fusarium* spp. were more frequently isolated from diseased bean roots than were *Rhizoctonia* spp. A number of *Fusarium* spp., including *F. acuminatum*, *F. oxysporum*, *F. redolens*, and *F. solani* were isolated from infected pea roots. Pathogenicity tests conducted using a susceptible dry bean cultivar confirmed the pathogenicity of the *Fusarium* spp. isolates.

With both dry bean and field pea, an in-depth study of root rot pathogens using molecular biology techniques has been initiated. To date, a PCR-based assay has been standardized for the rapid detection and differentiation of multiple *Fusarium* species causing root rot disease. So far, fourteen probes have been developed for detection of *Fusarium* species associated with these crops. Development of these PCR-based assays will provide fast, sensitive and specific tests for application in the diagnosis of root rot pathogens of field pea and dry bean. Species of *Fusarium* not previously associated with root rot of dry bean and field pea in Canada were identified using gene sequencing and the PCR-based assay. This information will be incorporated into future research studies on these pulse crops to develop cultivars with better root rot resistance, which will reduce yield losses and ultimately improve the profitability of pulse production in Manitoba.

Root rot pathogens of soybean in Manitoba

Fusarium root rot is also an important disease of soybean in Canada for which successful control has been elusive. Cultivars with high levels of resistance are not yet available. In western Canada, little information exists on the occurrence, distribution and pathogenicity of *Fusarium* spp. on soybean. In Manitoba and Alberta, *Fusarium* spp. were the most frequently isolated microorganisms from soybean roots of infected plants in 2012. Severe root rot was commonly observed in low-lying and flooded areas. Preliminary results from the 2012 Manitoba soybean root rot survey indicated that *F. oxysporum* was one of the more commonly observed species. As with the *Fusarium* spp. isolated from bean and pea roots, pathogenicity tests of the predominant isolates of

Fusarium from symptomatic soybean roots will be conducted using a susceptible soybean cultivar in order to confirm their ability to cause root rot symptoms on soybean.

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Caption for photo: Severe root rot of field pea caused by *Fusarium avenaceum* (L) compared to the untreated control (R).



Fusarium avenaceum

Control water