Blackleg label for canola hybrids coming soon

Luis del Río

Blackleg is once again the most important disease affecting canola production in North Dakota. Blackleg resurgence is powered by its ability to produce new races. Before 2000, the most prevalent races could not infect hybrids carrying resistance genes *Rlm1*, *Rlm2* or *Rlm3* and were identified as belonging to pathogenicity group (PG) 2. By 2009, most races could infect hybrids carrying either of these resistance genes and we identified them as belonging to PG-4. A survey conducted early in the 2018 season in northeastern North Dakota indicated four of every 10 fields had blackleg symptomatic plants and almost one of every six fields had blackleg incidences of 30% or higher (Table 1).

Table 1. Blackleg prevalence in canola fields in North Dakota between 2016 and early 2018

Summary	2016	2017	2018*
Number of fields scouted	82	83	26
Mean incidence (%)	14	10	10
Percentage of fields with blackleg	73	41	42
Percentage of fields with blackleg >30%	17	16	15

* 2016 and 2017 data generated by end-of-season surveys conducted in 21 ND counties. Data for 2018 generated by surveys conducted at 4th-6th leaf growth stage in Northeast ND.

Blackleg races are formed when unique combinations of avirulence genes are produced in the pathogen. These avirulence genes allow the pathogen to conduct certain non-essential functions (fitness, toxins) and in general their absence does not prevent the pathogen from causing disease. When blackleg spores land on canola plants, the activity of each avirulence gene will be detected only by a specific resistance gene in the plant. Sixteen avirulence genes have been identified worldwide. They interact with 16 resistance genes. In North Dakota the most prevalent avirulence genes are *AvrLm4, AvrLm7,* and *AvrLm11*. This means the most effective resistance genes must be *Rlm4*, *Rlm7*, and *Rlm11*.

Resistance genes that interact with avirulence genes in the pathogen are called major resistance genes. Major resistance genes confer complete protection to the plants but are activated only if the corresponding avirulence gene is present in the pathogen. In this way, a canola hybrid carrying resistance gene *Rlm1* will be resistant to any blackleg race carrying its corresponding avirulence gene, *Avrlm1*, but susceptible to a race that does not carry it or that carries other *AvrLm* genes. The protection provided by major genes can be expressed at any stage of plant development and in any plant part. This type of resistance is known as qualitative resistance, complete resistance or seedling resistance. The latter term referring to the fact that it is usually seen first at the seedling stage.

Continuous planting of hybrids with the same major resistance gene provides greater opportunity for races capable of infecting it to increase in prevalence until the hybrid's resistance becomes useless. This has already happened here and in other parts of the world! To extend the shelf-life of major resistance genes, it is necessary to rotate their use. To help growers start their own major-gene rotation programs, the canola seed industry in Canada will start using a label system to identify the major resistance genes present in the hybrids (Table 2). These labels will be on seeds for the 2019 planting season.

The label system addresses major resistance genes only. However, some hybrids also have adult plant resistance or quantitative resistance. This type of resistance can reduce yield losses but not to the extent major genes do.

To reap benefits of the labeling system, growers should know the avirulence genes that are prevalent in their regions. Our laboratory has the capability to process samples. Instructions on how to prepare samples for identification will be available later this season.

Table 2. Characteristics of genes with major and minor effects on resistance to blackleg

Blackleg hybrid label	Effective against races with avirulence genes	Major resistance genes in hybrids
A	*AvrLm1* and/or *AvrLep3*	*Rlm1* or *LepR3*
B	*AvrLm2*	*Rlm2*
C	*AvrLm3*	*Rlm3*
D	*AvrLep1*	*LepR1*
E_1	*AvrLm4*	*Rlm4*
E_2	*AvrLm7*	*Rlm7*
F	*AvrLm9*	*Rlm9*
G	*AvrLmS*	*RlmS*
H	*AvrLep2*	*LepR2*
X	Not determined	unknown

This information as well as other useful information for growers are available in apps for Android (https://play.google.com/store/apps/details?id=edu.ndsu.canoladoctor) and iOS (iTunes App Store: https://itunes.apple.com/us/app/ndsu-canola-doctor/id1397239260) devices.