Minnesota Canola Council

2019 Canola Symposium

New insights that help manage canola diseases

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NDSU Plant Pathology

- Sclerotinia stem rot
- Blackleg
- Clubroot

NDSU Plant Pathology

Disease survey

State-wide summary

Diseases	2016	2017	2018	2019
Fields scouted	82	83	70	84
Mean SSR incidence (%)	7	<1	<1	<1
Fields with SSR (%)	49	5	6	12
Mean blackleg incidence (%)	14	10	2	4
Fields with blackleg (%)	73	41	14	44
Fields with blackleg >30% (%)	17	16	2	4

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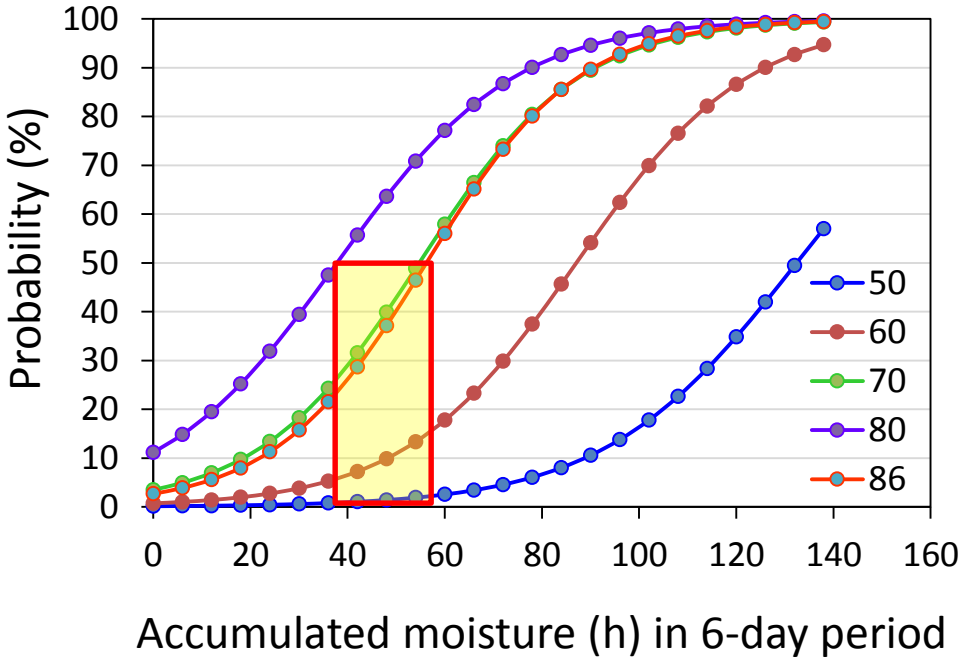
Sclerotinia stem rot of canola

Sclerotinia sclerotiorum

Sclerotinia stem rot

- Effect of leaf wetness duration and temperature
- 4 wetness durations (6, 10, 14, and 18 h daily)
- 5 daily mean temperatures (50, 60, 70, 80, 86 °F)
- 55 h moisture needed for infection at 70 °F or 86 °F but only 38 h at 80 °F



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Sclerotinia stem rot

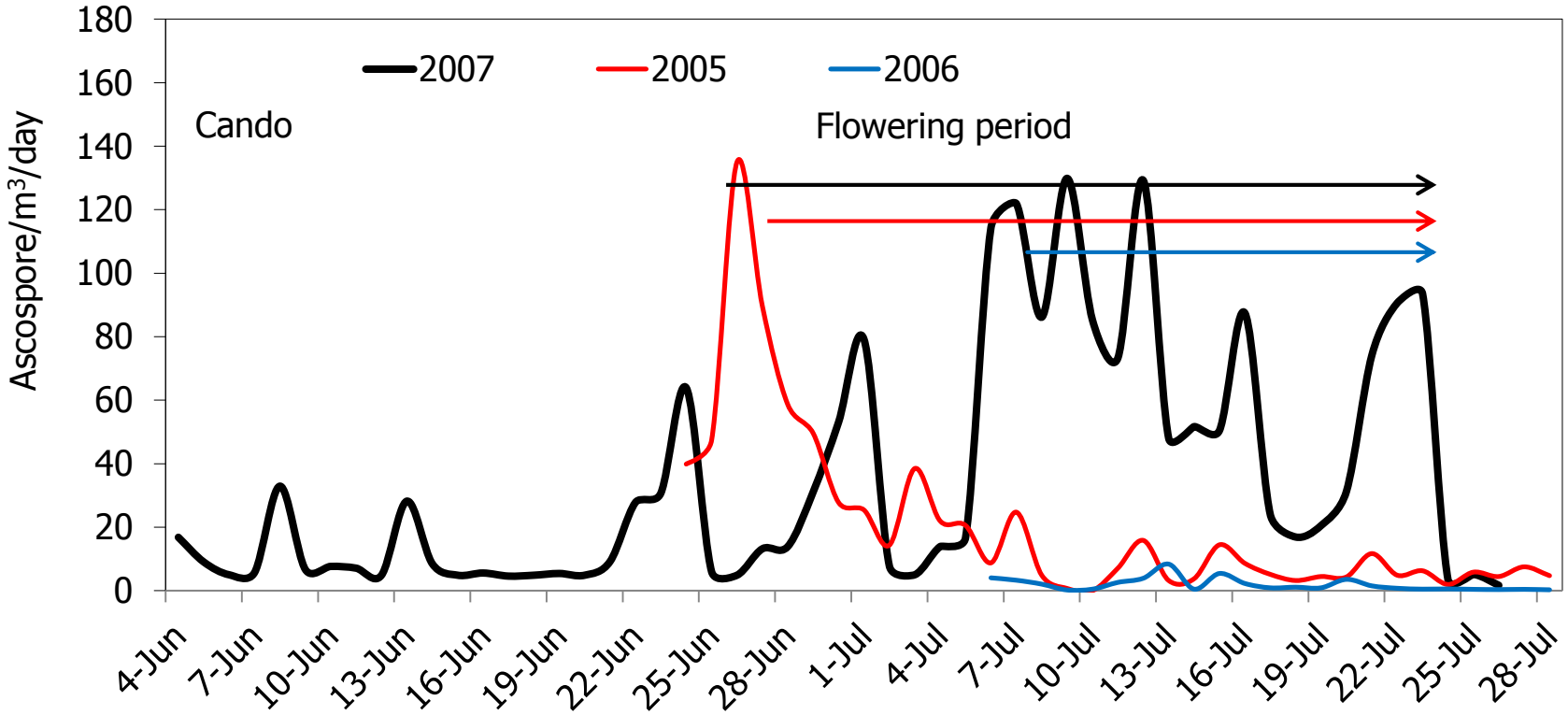
- Effect of leaf wetness duration and temperature
- Wetness duration needed for disease development depends on temperature
- While 80 ^{o}F is optimum, dew is more likely to form at 70 ^{o}F and less likely to form at 86 ^{o}F
- At 70 ^{o}F, 9 h wetness daily for six days = 50% chance while 10 h daily = 80% chance

Sclerotinia stem rot

- Chemical control
- 13 fungicides registered for managing Sclerotinia
- Most applied at 20 to 50% bloom

Sclerotinia stem rot

- Multiple ascospore showers with variable intensity
- Not necessarily associated with flowering



Source: Qandah and del Rio, 2011

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Sclerotinia stem rot fungicide trials

Moderate to low disease pressure

Treatments	Doses/A		Incidence (%)	DSI (0-5)	Yield (lb/A)
Non-protected control	-		28	1.2	3248
Experimental	13.7	oz	9	0.4	3566
Proline	5.0	oz	17	0.8	3529
Priaxor	4.0	oz	22	1.1	3716
Quash	3.0	oz	20	0.8	3571
Topsin	1.0	lb	17	0.8	3556
Quash + Topsin	3.0+0.5	oz+lb	18	0.8	3828
LSD 5%	NS		NS	NS	NS

Chapara and Arens, 2018.

NDSU Plant Pathology

Sclerotinia stem rot fungicide trials

Moderate to low disease pressure

Treatments	Doses/A	DSI (0-5)	Yield (lb/A)
Non-protected control	-	1.5	3769
Aproach	9.0 fl oz	0.0	3794
Endura	6.0 fl oz	1.3	4086
Proline	4.3 fl oz	0.3	4200
Quash	3.0 fl oz	0.2	3968
Topsin	0.5 lb	0.2	4372
LSD 5%		0.6	NS

Arens and Chapara, 2017.

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Sclerotinia stem rot fungicide trials

High disease pressure

Treatments	Doses/A	Incidence (%)	DSI (0-5)	Yield (lb/A)
Non-protected control	-	74	3.6	1421
Priaxor	6 fl oz	10	0.4	2053
Proline	5 fl oz	7	0.3	2081
Quash	3 fl oz	7	0.3	2214
Endura	5 fl oz	53	2.5	1480
Topsin	2 lb	7	0.3	1874
LSD 5%	NS	13	0.6	347

Arens and Chapara, 2016.

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Sclerotinia stem rot

- Chemical control
- Fungicide efficacy associated with disease pressure
- Late applications typically do not produce positive economic returns
- Better results in recent trials obtained with Quash, Proline, Priaxor and Topsin

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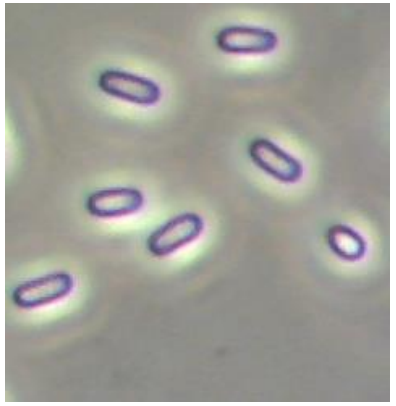
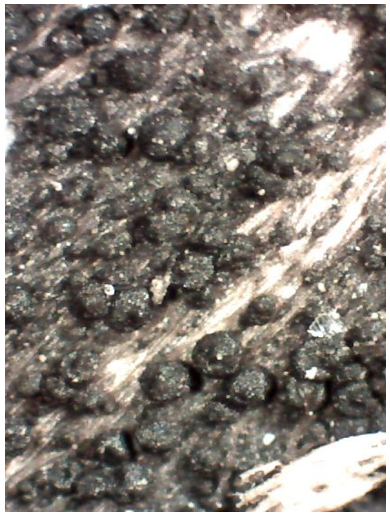
Blackleg

Leptosphaeria maculans





Blackleg

- Efficacy of seed treatments against blackleg
- Five compounds evaluated greenhouse and field

Treatments	Severity[1] Seedling		Adult plants	
Control	7.3	a	89	a
Prosper	5.0	b	83	ab
Dynasty	4.5	b	78	abc
Helix	4.3	b	74	bc
Maxim	4.0	b	91	a
Obvius	2.8	c	68	c

[1] Seedlings evaluated using 1-9 scale, adult plants evaluated using percentage discolored internal stem crown tissues

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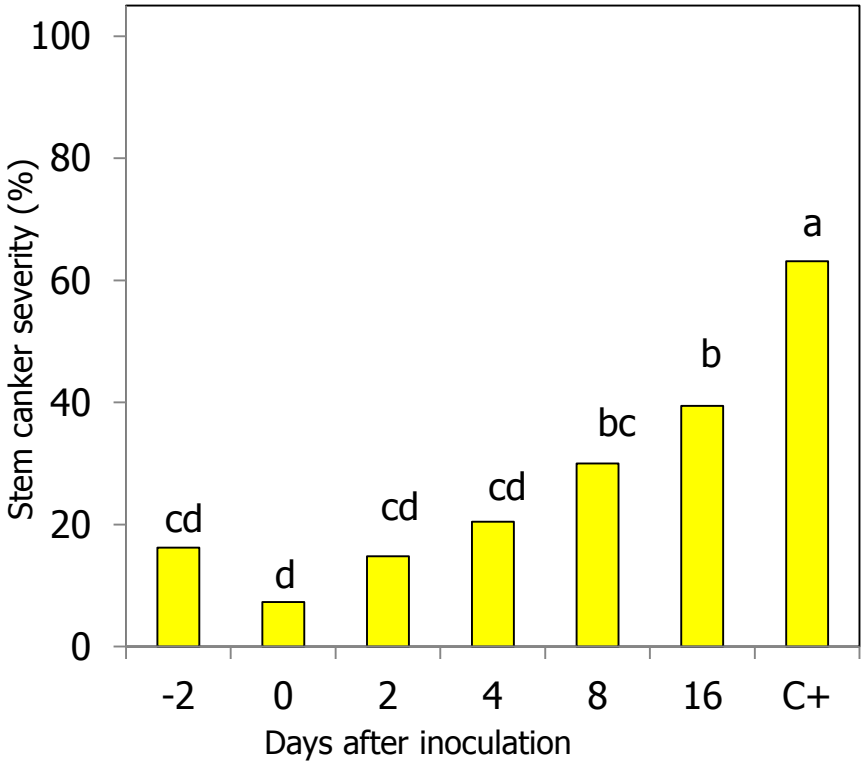
Blackleg

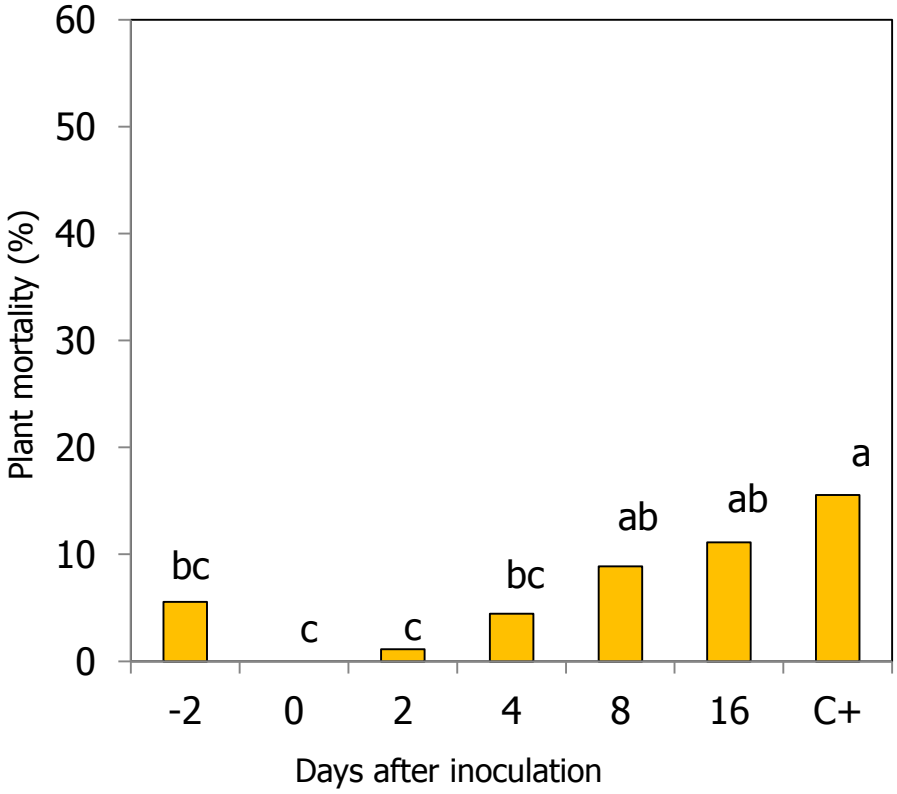
Effect of seed treatments on plant stand, blackleg and yield

Treatments	Prosper			Langdon		
	Plant stand	Blackleg severity	Yield (lb/A)	Plant stand	Blackleg severity	Yield (lb/A)
Control	11 b	82 ab	380 a	30 a	66 a	1144 ab
Prosper	20 a	80 ab	150 a	36 a	75 a	960 b
Dynasty	11 b	85 a	391 a	38 a	71 a	1087 ab
Helix	21 a	76 bc	426 a	41 a	70 a	993 b
Maxim	12 b	68 c	286 a	37 a	65 a	1345 a
Obvius	14 ab	82 ab	418 a	38 a	70 a	1138 ab

Blackleg

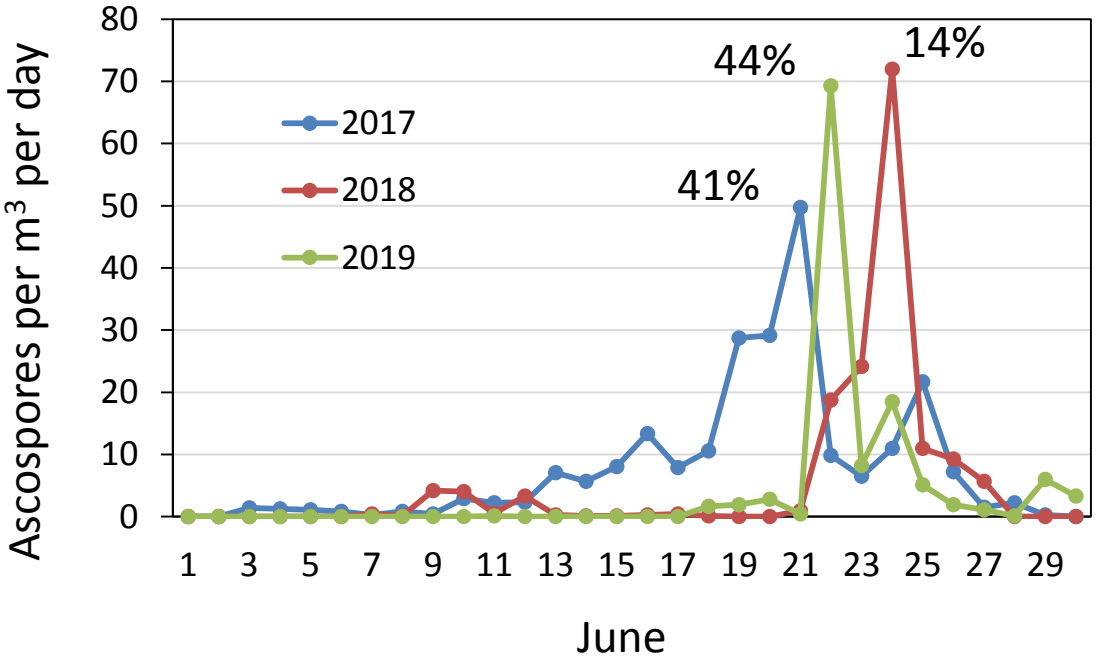
- Efficacy of foliar fungicide applications
- Timing of fungicide application matters
- Six timings of application of Quadris





Blackleg

- Efficacy of foliar fungicide applications
- Timing of spore release matters



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Blackleg fungicide trials

High disease pressure

Treatments	Doses/A		Incidence (%)	DSI (0-5)	Yield (lb/A)
Non-protected control	-		59	1.4	2736
Experimental 1	8.2	oz	22	0.3	3034
Experimental 2	12.3	oz	35	0.5	2815
Experimental 3	16.4	oz	46	0.7	2797
Headline	5.5	oz	42	0.9	2848
LSD 5%			16	0.6	NS

Chapara and Arens, 2018.

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Blackleg fungicide trials

Moderate disease pressure

Treatments	Doses/A	Incidence (%)	DSI (0-5)	Yield (lb/A)
Non-protected control	-	36	0.5	2646
Headline	6 fl oz	29	0.3	2385
Priaxor	6 fl oz	21	0.3	2479
Proline	4 fl oz	20	0.3	3121
LSD 5%		NS	NS	438

Arens and Chapara, 2017.

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Blackleg fungicide trials

Moderate to low disease pressure

Treatments	Doses/A	Incidence (%)	Severity (%)
Non-protected control	-	26	42
Headline	6 fl oz	9	23
Priaxor	6 fl oz	10	15
Proline	4 fl oz	11	15
LSD 5%		8	19

Arens and Chapara, 2016.

Two applications (2-4 leaf stage and 14 days later)

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Blackleg

- All seed treatments reduced disease severity in greenhouse
- Mixed results in fields suggest use of seed treatments as only management tool may not be enough
- Best return from fungicides occurs when applied within four days from infection
- Double fungicides application may be more effective

Blackleg

- Prevalence of blackleg races
- Races created by presence/absence of 16 avirulence genes
- Avirulence genes interact with specific resistance genes in plants

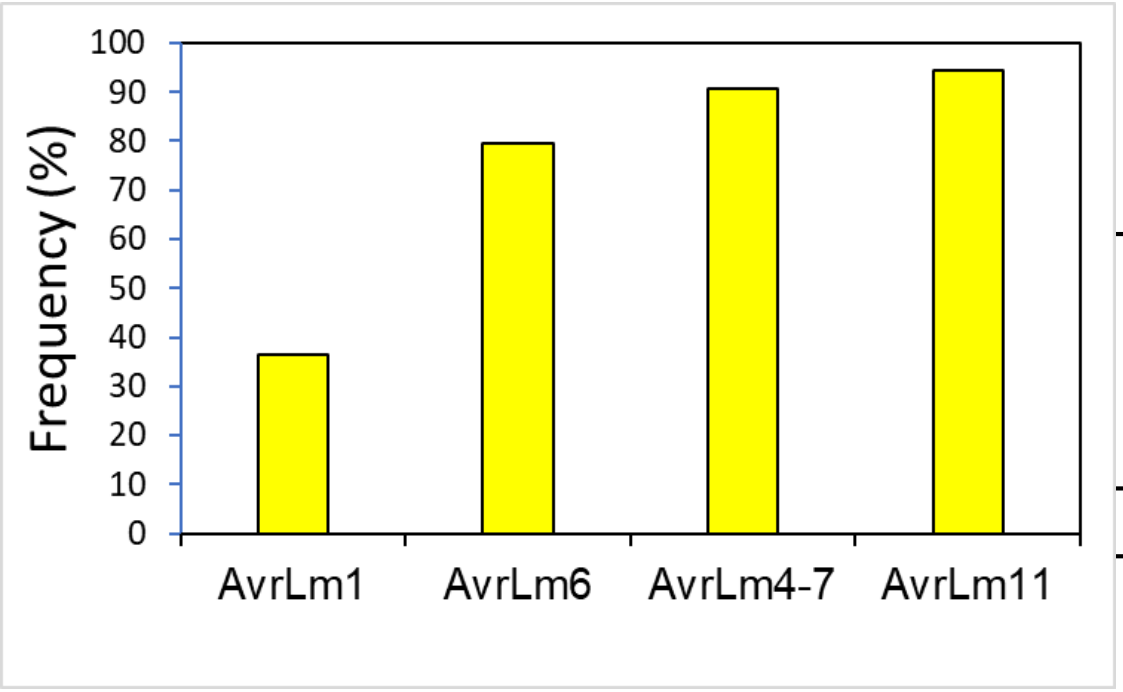
What does this mean?

Resistance genes could be inferred

	Resistance gene present (Rlm1)	*Resistance gene absent (rlm1)*
avirulence gene present (AvrLm1)		
avirulence gene absent (avrLm1)		

L. maculans avirulence gene prevalence

Frequencies based on PCR assays



12 races[1] among 164 isolates ('07-'17)

Races	Prevalence (%)
Av4,6,7,11	34
Av1,4,6,7,11	32
Av4,7,11	18

[1] Not tested for *AvrLm 2, 3, 5, 8, 9* and *AvrLepR1-3*

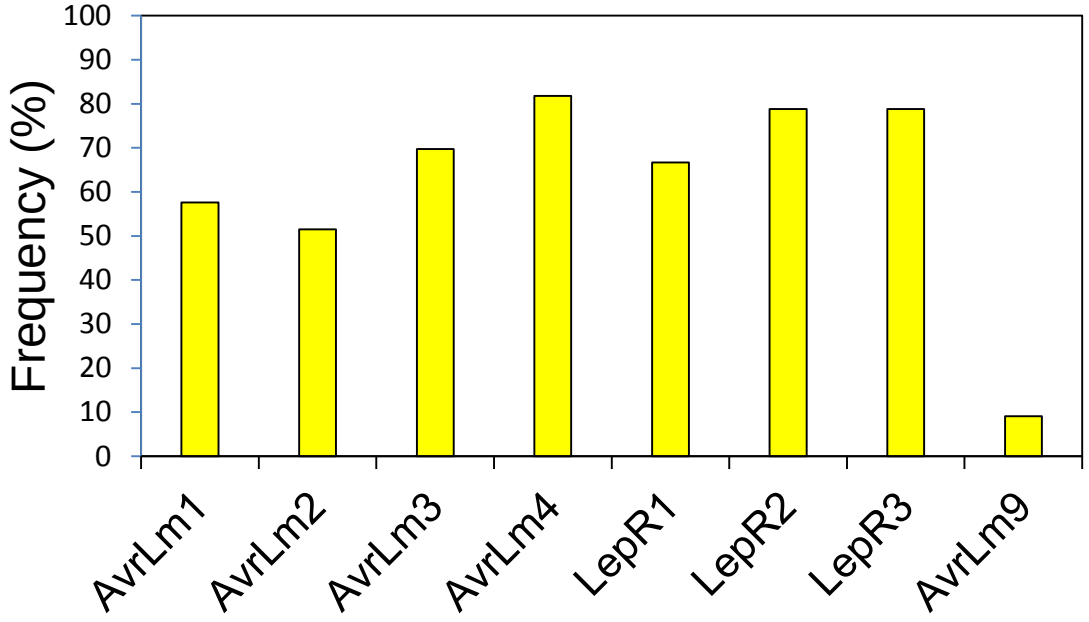
4 races[1] among 12 isolates in 2004

Races	Prevalence (%)
Av1,2,3,6,9	67
Av2,4,6,7,9	17
Av1,2,4,6,7	8

[1] Not tested for *AvrLm5, 8,* and *AvrLepR1-3*

L. maculans avirulence gene prevalence

Frequencies based on GHSE inoculations



24 races[1] among 30 isolates in 2016

Races	Prevalence (%)
Av1,3,4-Lep1,2,3	13
Av1,2,3,4-Lep1,2,3	10
Av2,3,4-Lep1,2,3	7
Av1,2,3,4,9-Lep1,2,3 (MN)	100

[1] Not tested for *AvrLm 5, 6, 7,* and *8*

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Blackleg

- Cultivars with resistance genes *Rlm6*, *Rlm7* or *Rlm11* could provide effective protection
- Resistance genes *Rlm4, LepR2* and *LepR3* may be useful in certain areas
- Variability in prevalence of avirulence genes may support idea of labeling hybrids for rotation

Clubroot

- Discovered in Alberta in 2005
- Saskatchewan in 2011
- Manitoba in 2012
- Cavalier County in 2013

Clubroot

- Soil-borne (acidic pH)
- High reproduction capability
- Biotypes produced

- Resistant hybrids available
- Not present in MN (n=7)

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