Approaches to blackleg and clubroot management – Mixed successes in Canada

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Canola Council of Canada

52 BY 2025

KEEP IT COMING

Approaches to blackleg and clubroot management – Mixed successes in Canada

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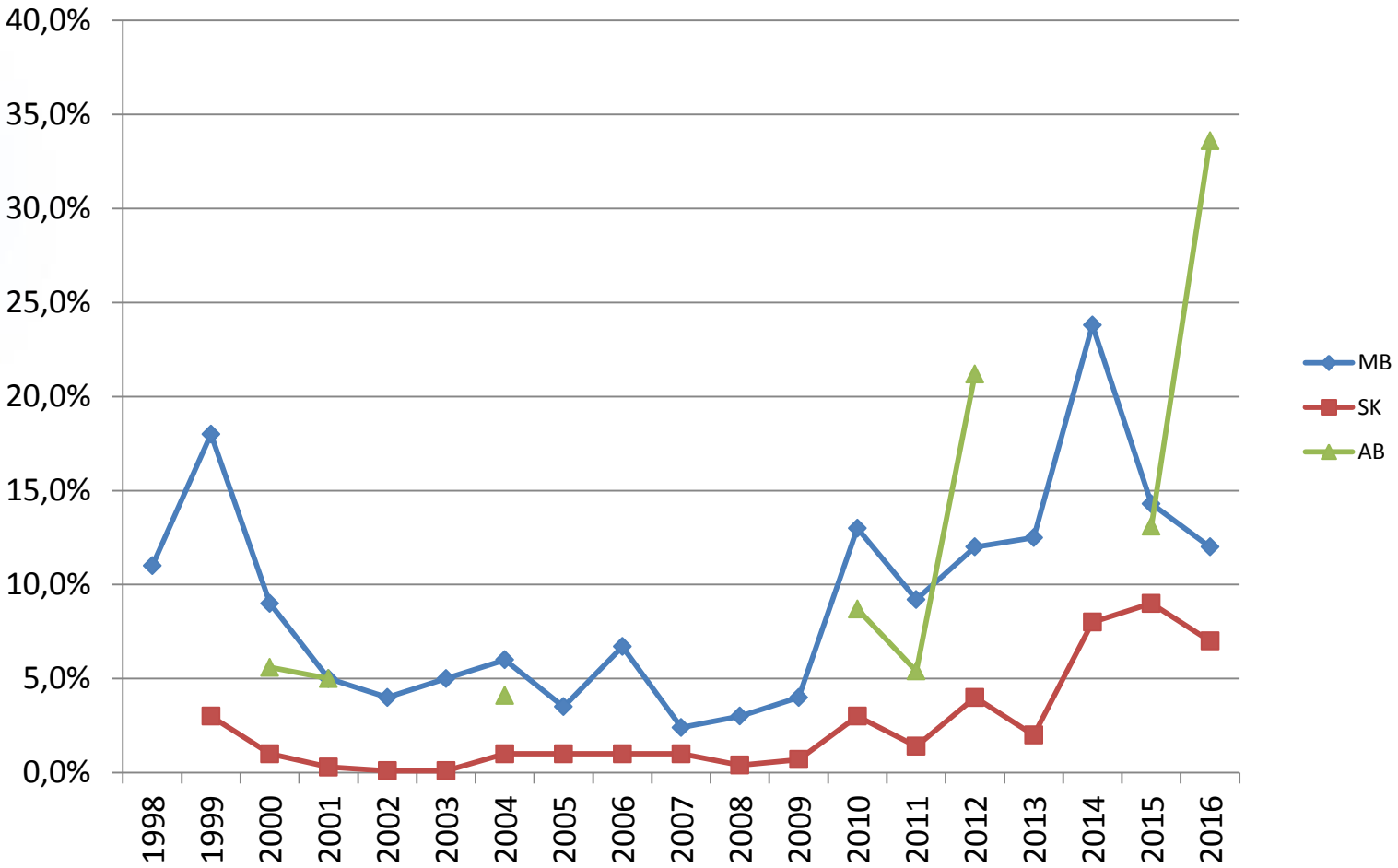
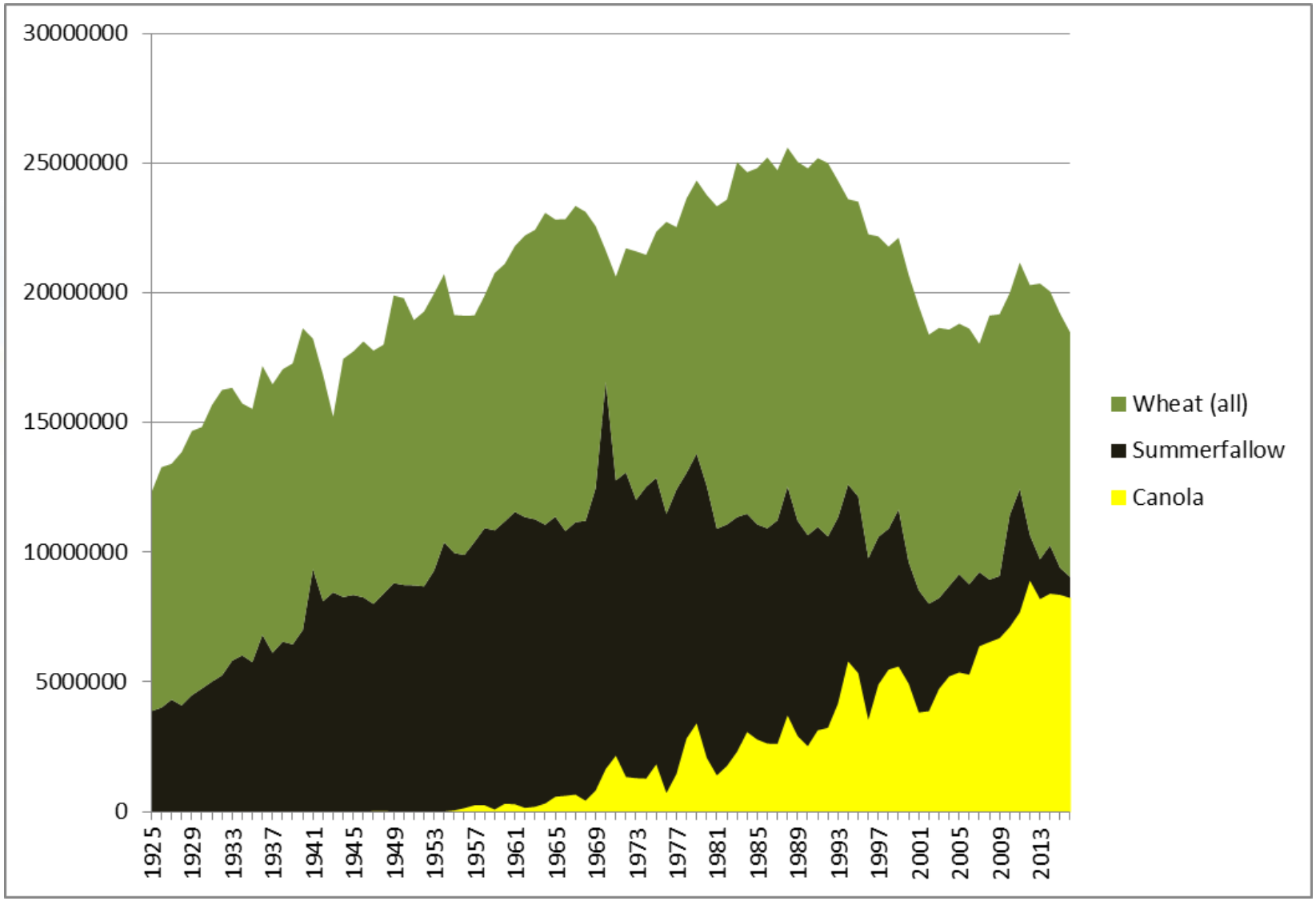
Blackleg (caused by *Leptosphaeria maculans*) and clubroot (caused by *Plasmodiophora brassicae*) are two of the most important diseases in Canada, reducing yield and profitability for canola (*Brassica napus*) growers. To manage these diseases successfully requires an integrated approach combining genetic resistance, cultural practices, and chemical applications. To ensure durability of resistance against both of these diseases in canola requires a complex, systematic approach and these will be reviewed. Cultural practices such as crop rotation, sanitation, and tillage will be examined in detail, along with various chemical approaches using fungicides and fumigation. Currently, there has been no single solution or practice that has been successful in the long term for managing blackleg and clubroot, therefore an integrated set of management techniques is needed. To be successful with these, an effective communication strategy is required to educate both canola growers and industry personnel.


Heavy production/rotation
Light production/rotation
Vanderhoof
Prince George
Grande Prairie
Red Deer
Lethbridge
Regina
Toronto
Hamilton
AB
Alberta
SK
Saskatchewan
MB
Manitoba

Blackleg Incidence in Canada's Prairie Provinces



Area of Canola, Wheat, and Fallow in Canada




Heavy production/rotation
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Vanderhoof
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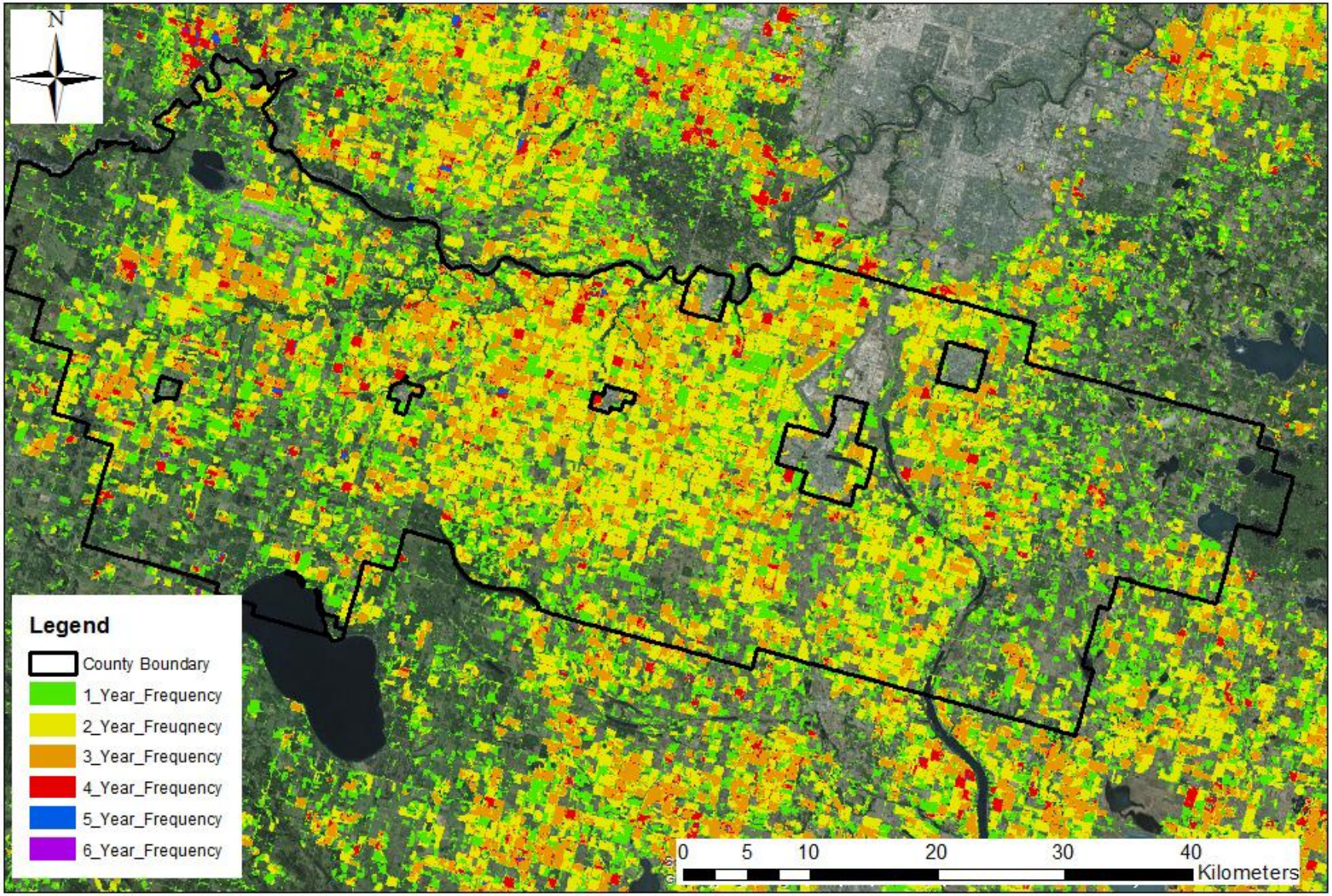
Canola Frequency in Leduc County AB (2009-2014)

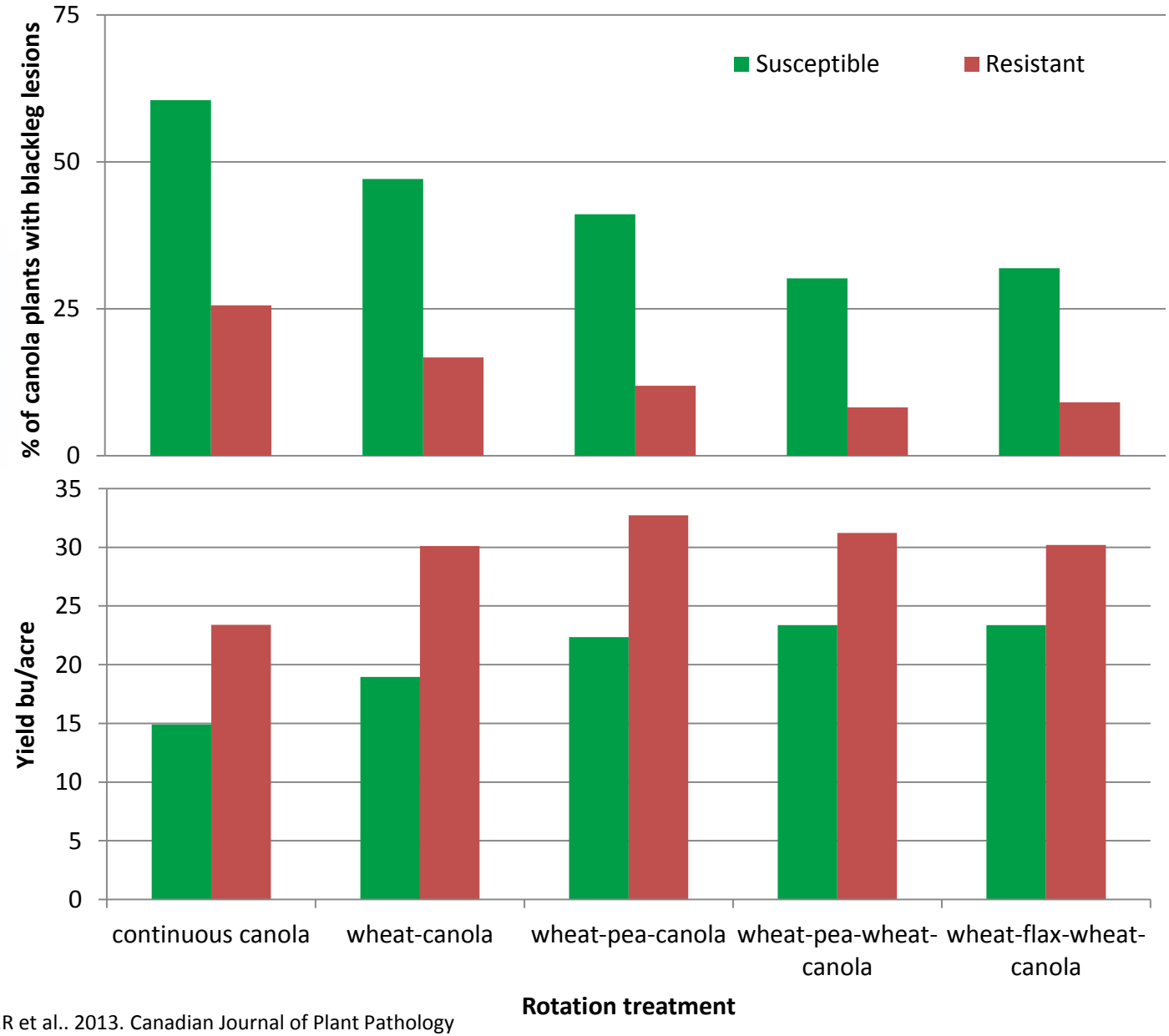
Derived from AAFC Annual Crop Inventory Maps



What works?

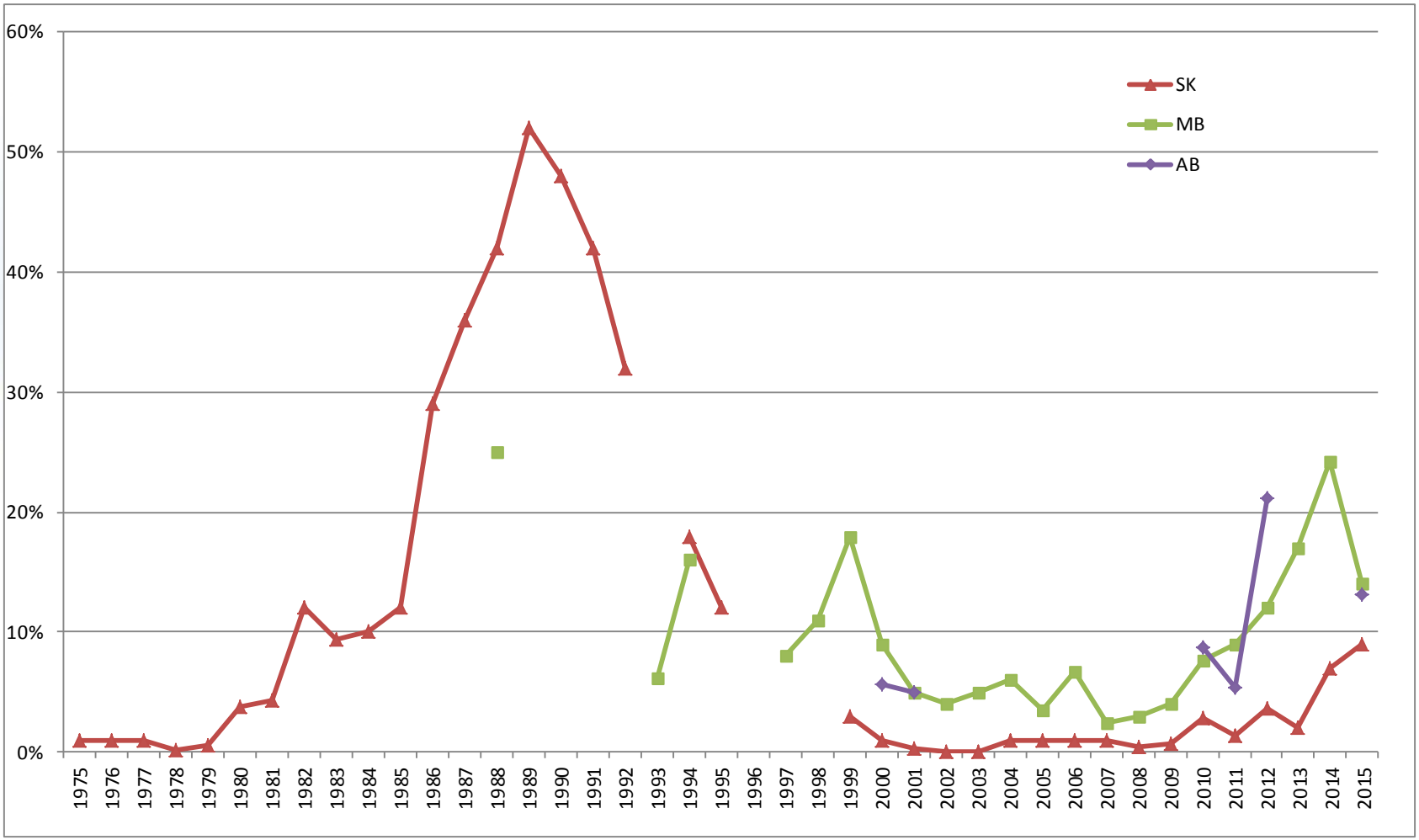
- Crop rotation and resistance

The impact of crop rotation on yield and blackleg disease incidence



Kutcher, H.R et al.. 2013. Canadian Journal of Plant Pathology

Blackleg Incidence in Prairie Provinces



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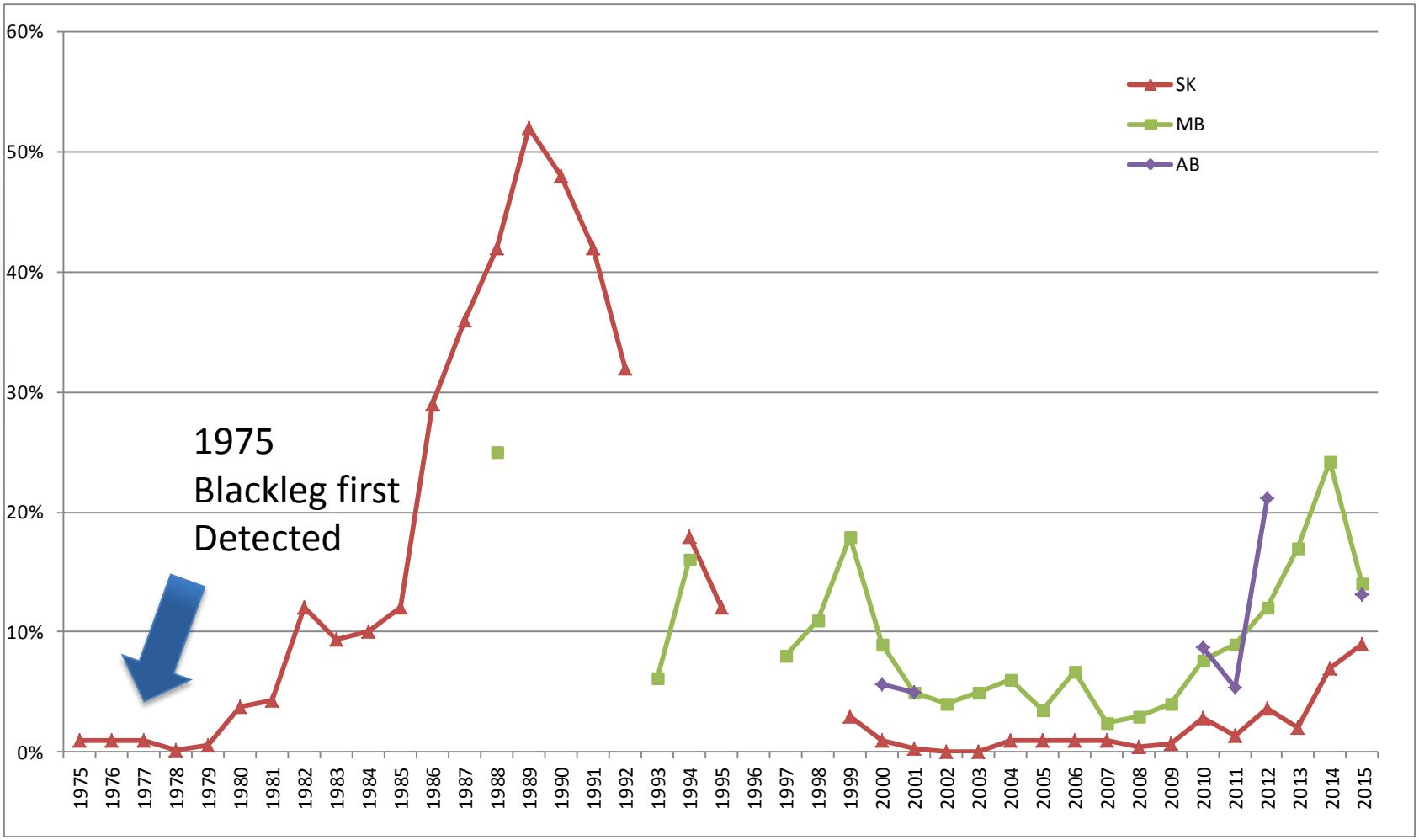

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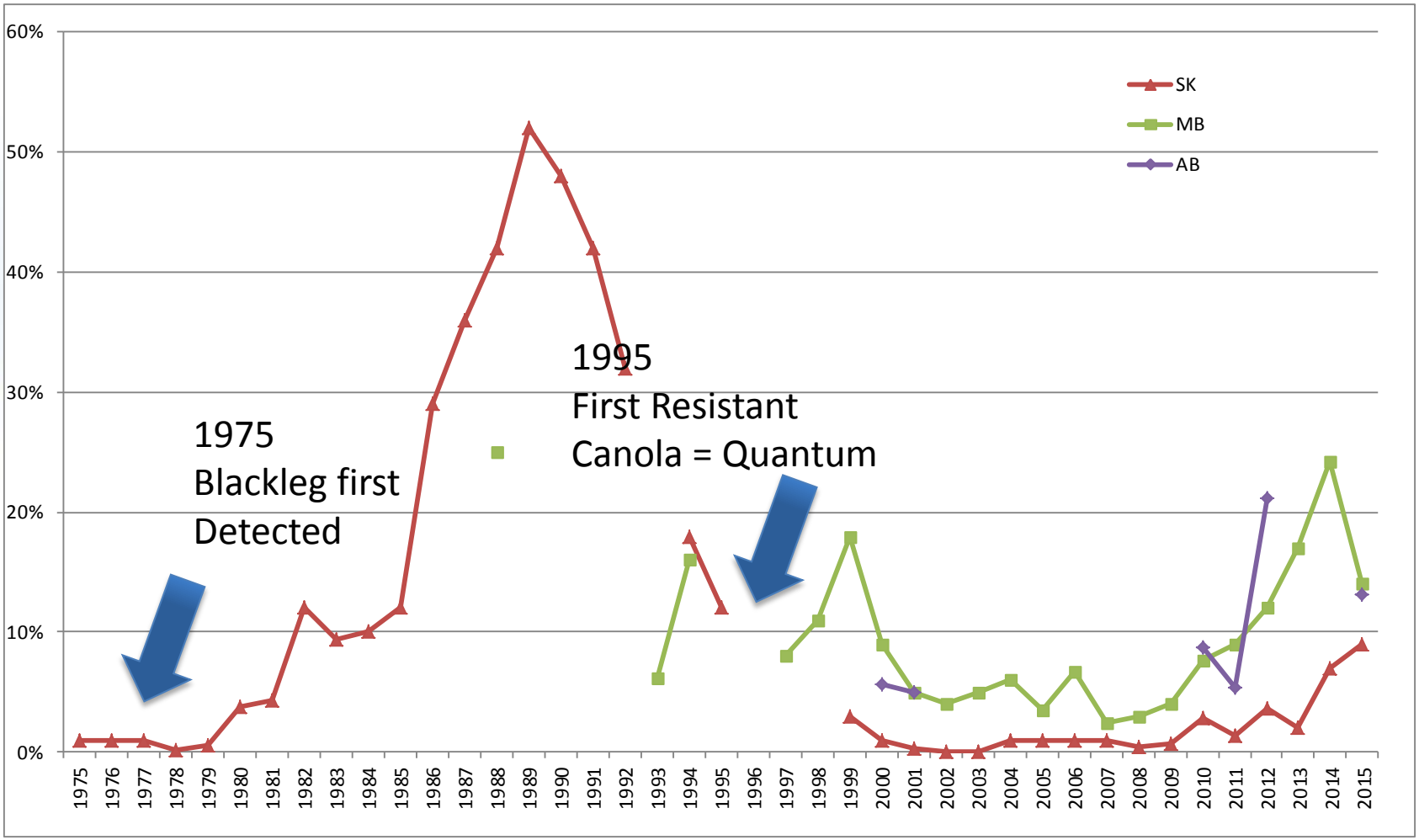
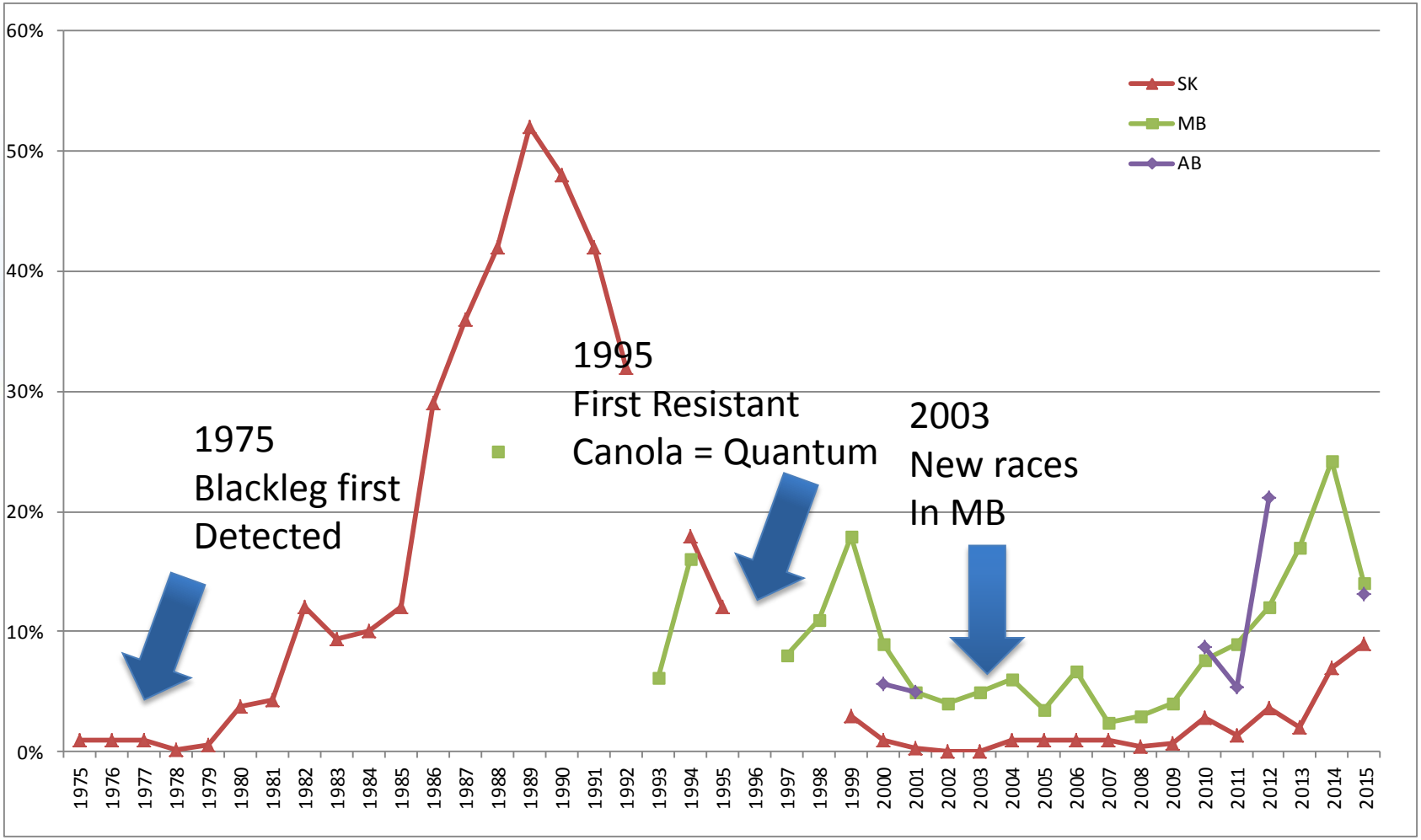


Blackleg Incidence in Prairie Provinces



What works?

- fungicide

Early fungicide treatment also reduced blackleg severity on R and MR cultivars, but did not increase the yield (7 site-years, 2011-2013)

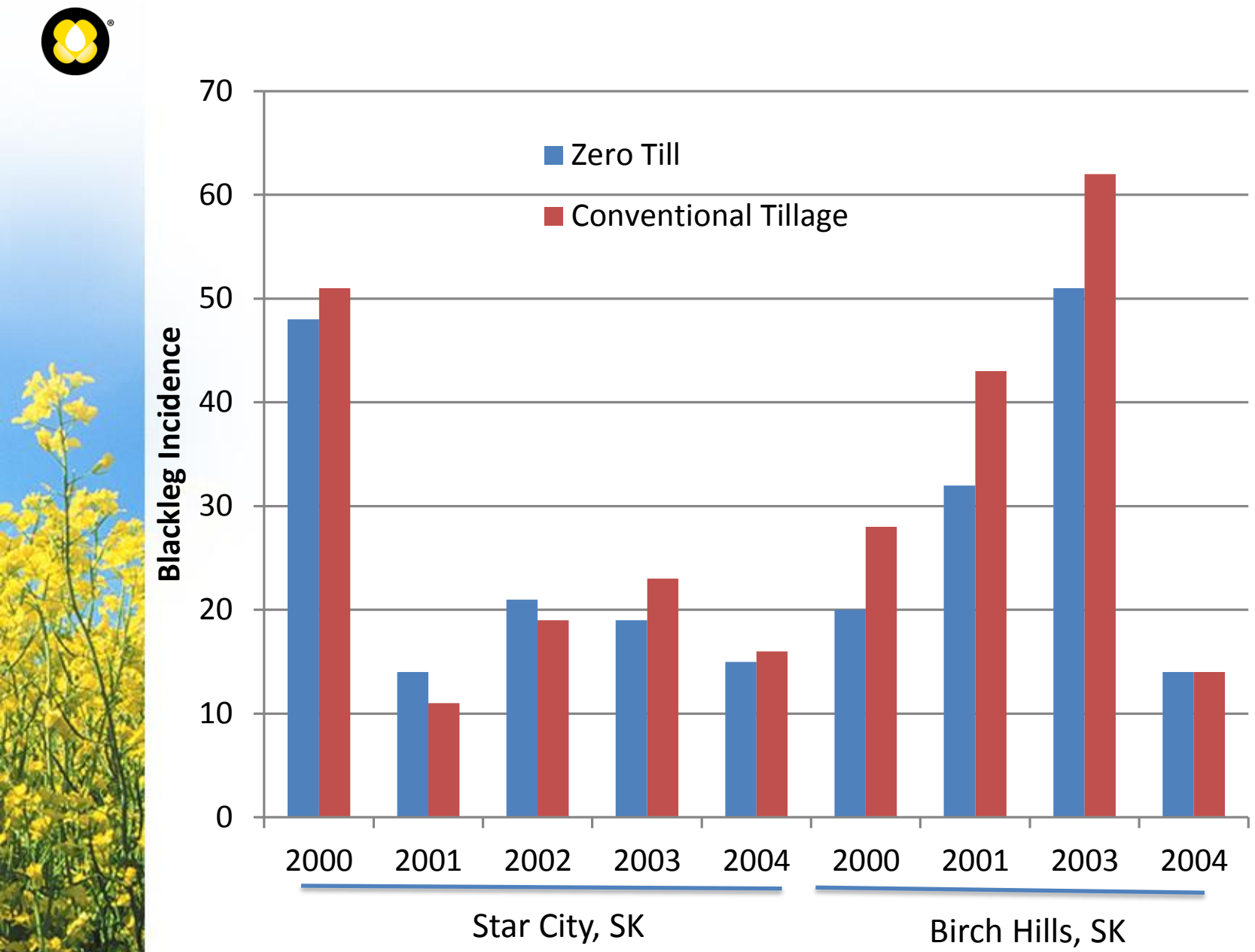
	Dis. severity (0-5)	Canola yield (bu/ac)
R cultivar (45H29)		
Non-treated control	1.3	54.1
Headline (2-4leaf)	0.8*	55.3
MR Cultivar (43E01)		
Non-treated control	2.0	37.8
Headline (2-4leaf)	1.1*	34.6

* Significant at P=0.05 (Dunnetts' test)

Peng et al., 2015

What does not work?

- Tillage



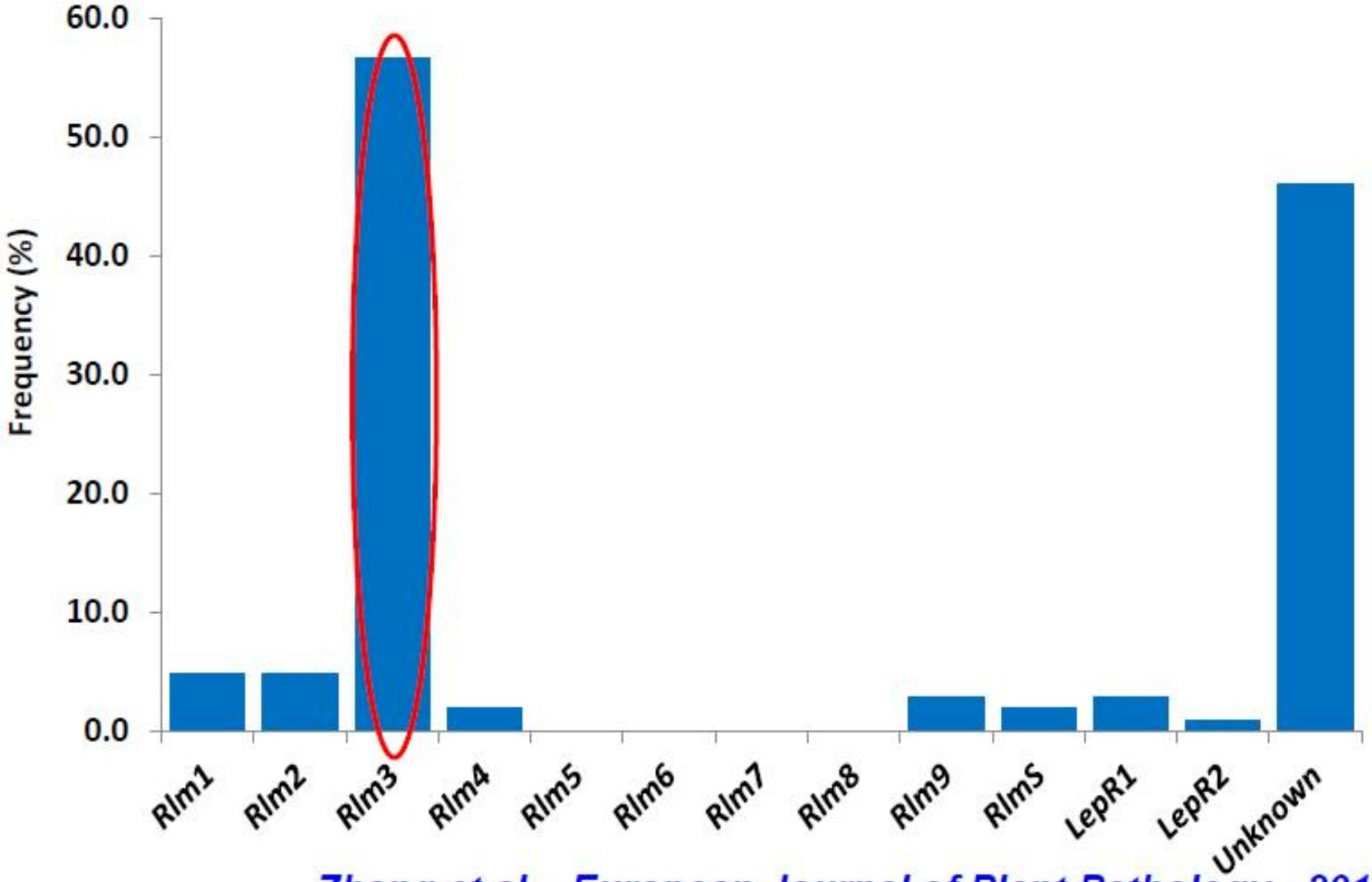
From Kutcher and Malhi, 2010

What does not work?

- Resistance

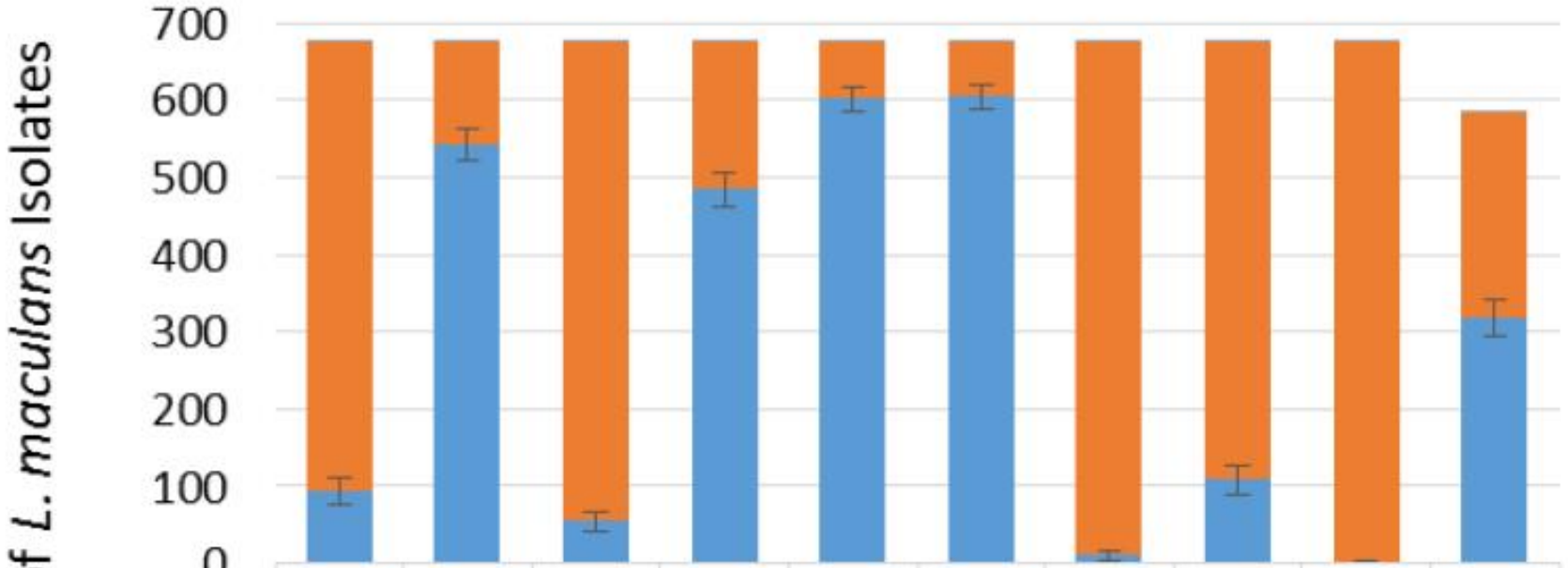
R genes in Canadian *Brassica napus* germplasm

High frequency of *Rlm3* in Canadian canola germplasm



Zhang et al – European Journal of Plant Pathology - 2015

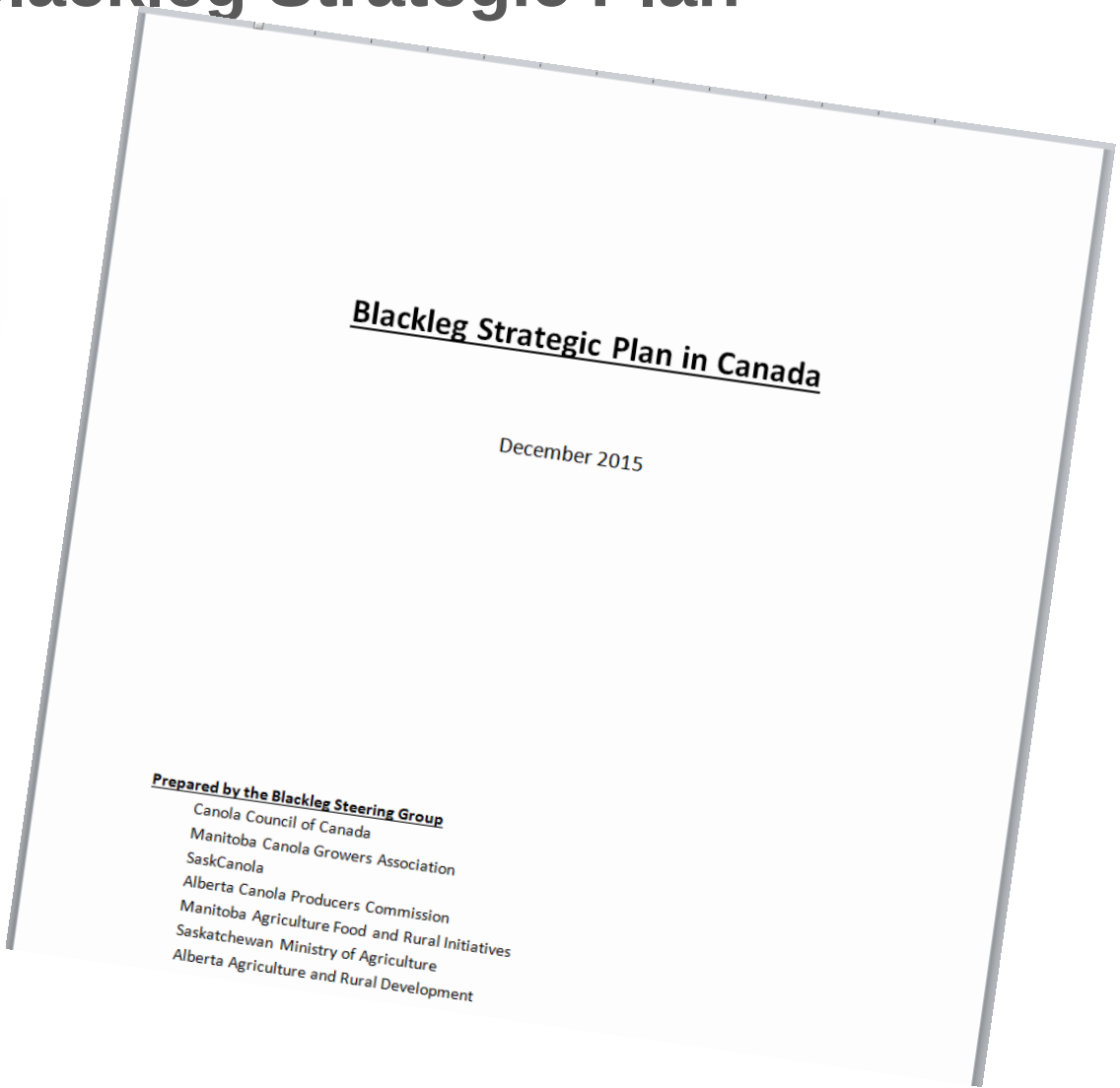
Prairie Population of Blackleg – 2010 and 2011



	1	2	3	4	6	7	9	LepR 1	LepR 2	S
Percent	13.65	80.56	8.01%	71.81	89.32	89.76	1.48%	16.02	0.15%	54.81
Virulent	582	131	620	190	72	69	664	566	673	263
Avirulent	92	543	54	484	602	605	10	108	1	319

Liban *et al*. 2016. Plant Pathology

Blackleg Strategic Plan



Risk factors for blackleg development

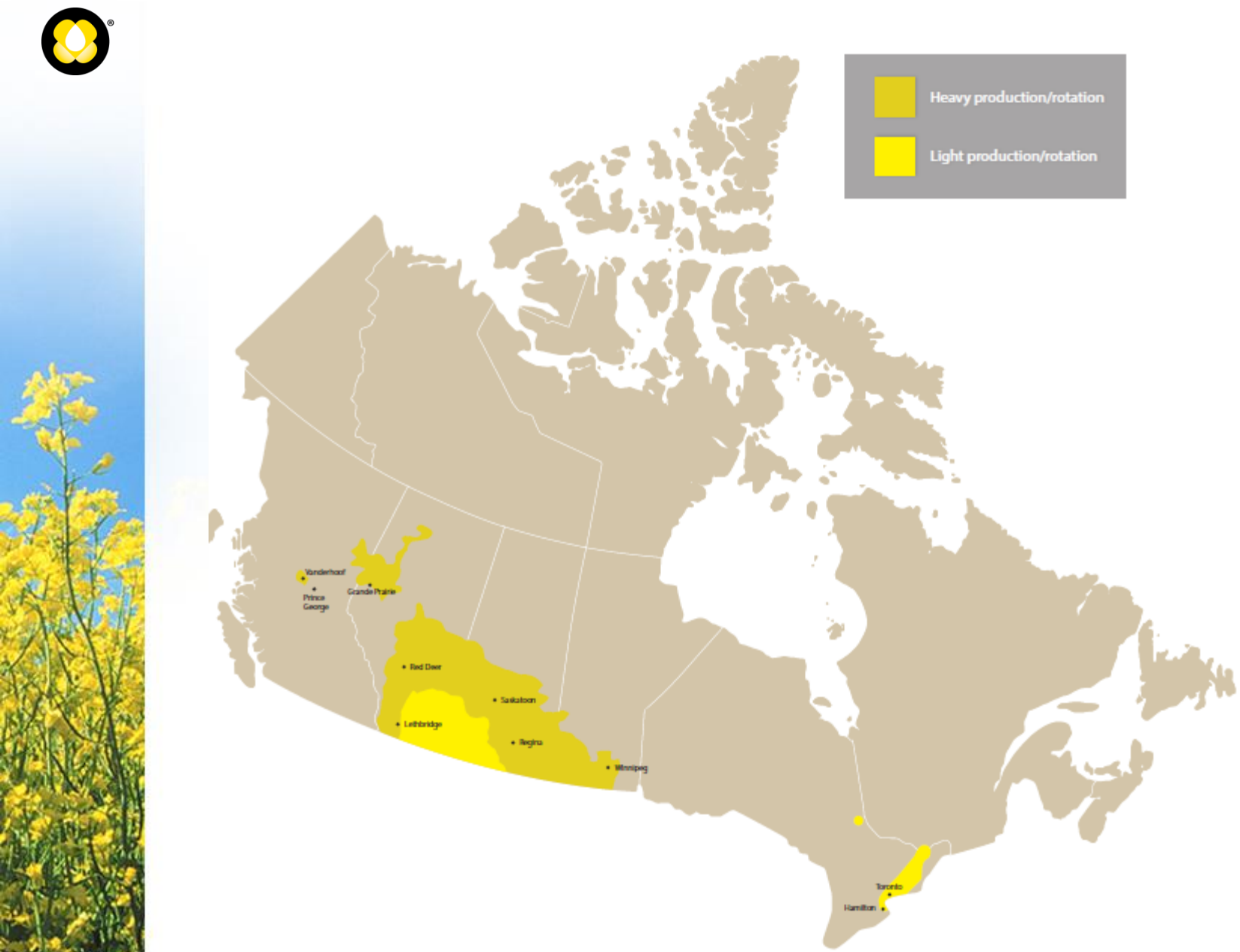
Activity	Low Risk	Moderate Risk	High Risk
Scouting	Scout for disease, beginning, middle, and end of season. No disease present.	Scout for disease only at end of season	No scouting. Pseudothecia on canola residue.
Canola in Rotation	3 year break or longer	2 year break	1 year or less
Blackleg Field Resistance Identification	Resistant	MR	MS or Susceptible
Blackleg Major Gene Resistance Rotation	Different major resistance gene from last used in field		Same major resistance gene as last used in field
Foliar Fungicide Use	Early prophylactic spray	Late prophylactic spray	None
Brassica Weed Control (canola volunteers)	No brassica weed issues in rotation	Brassica weed issues	Brassica weeds with blackleg infection

Canadian Blackleg R-gene ID system:

Group	Gene
A	Rlm1 or LepR3
B	Rlm2
C	Rlm3
D	LepR1
E_1	Rlm4
E_2	Rlm7
F	*Rlm9*
G	*RlmS*
H	*LepR2*
X	Unknown

Clubroot

Photo courtesy of A. VanBeers 2008


Heavy production/rotation
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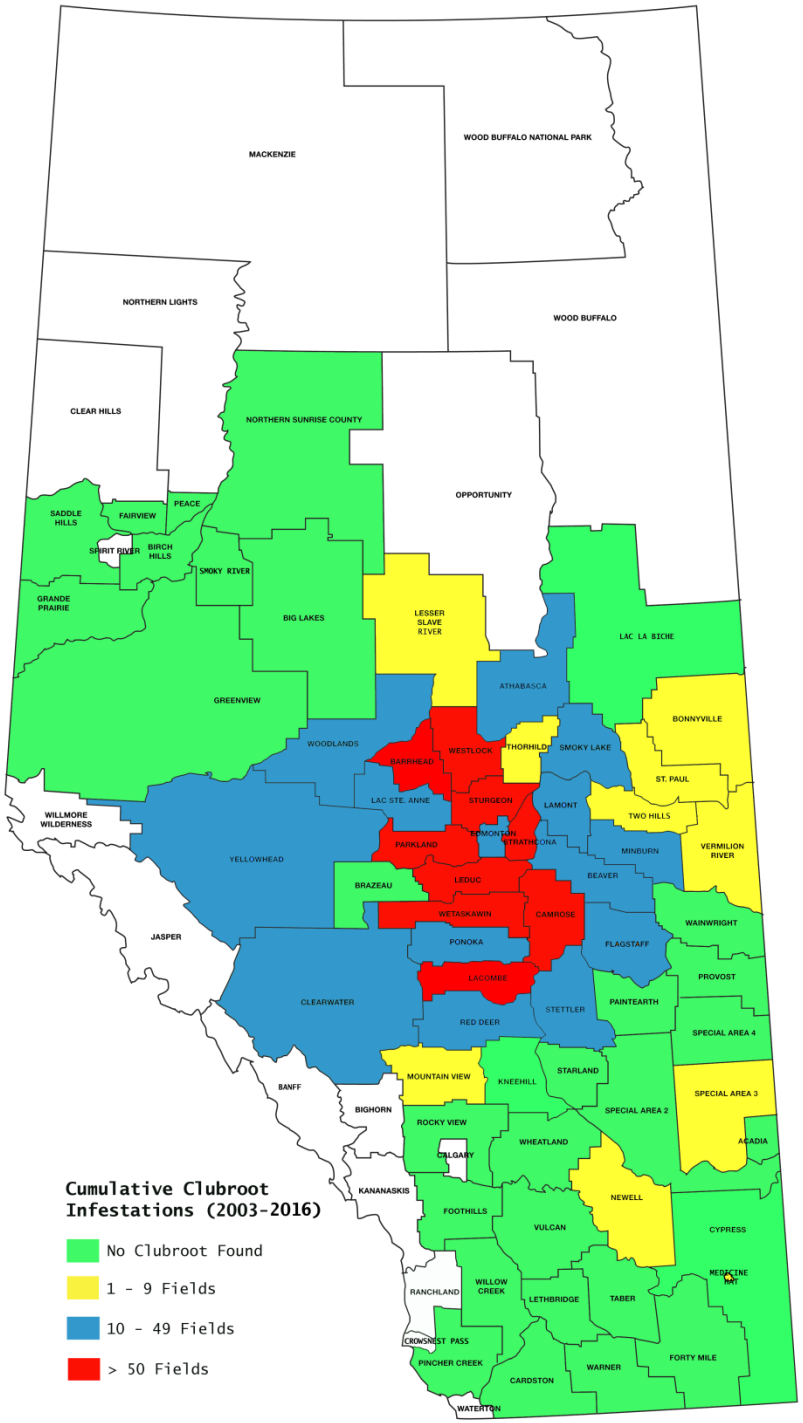
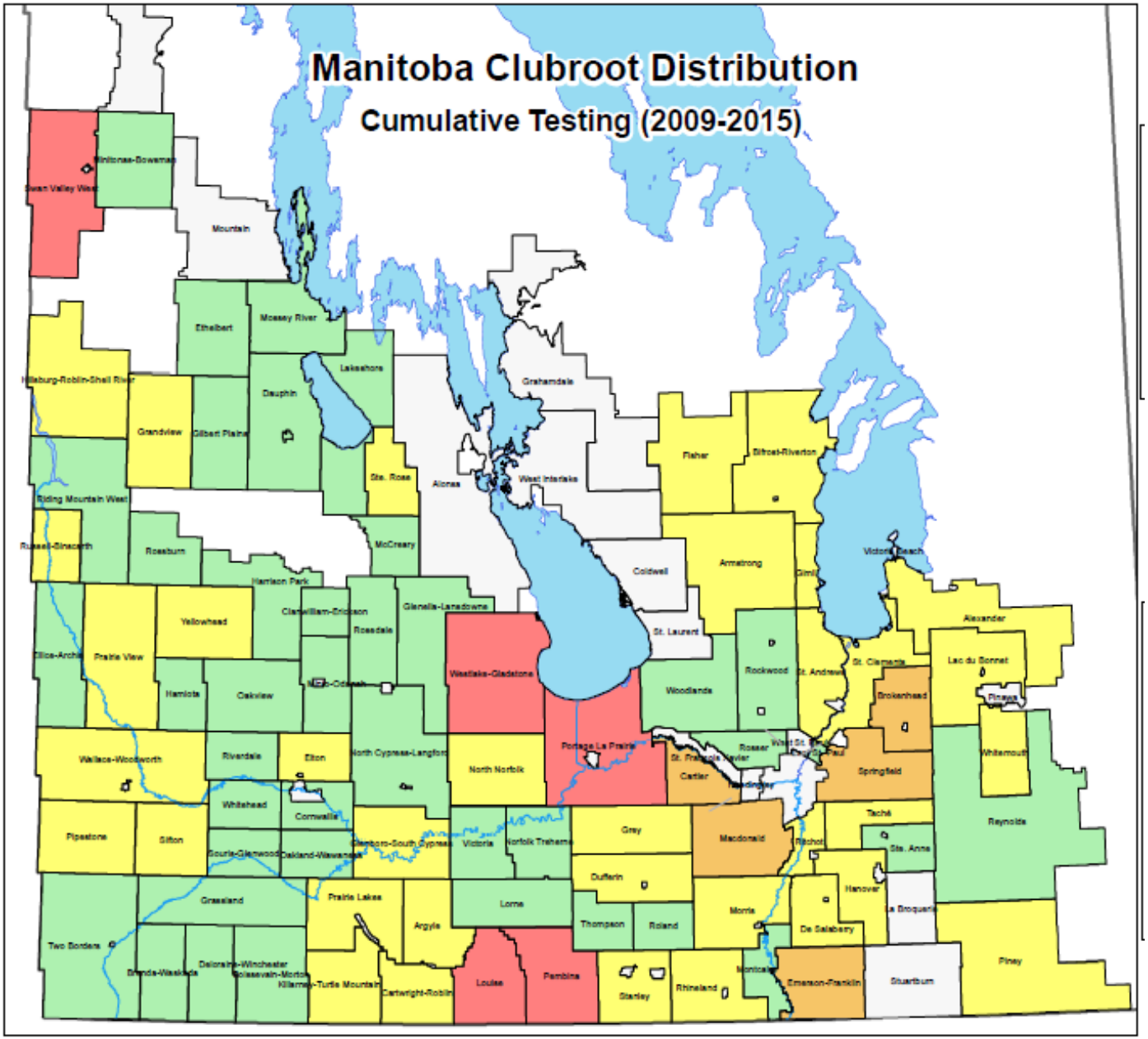
Cumulative Clubroot Infestations in Alberta




Manitoba Clubroot Distribution
Cumulative Testing (2009-2015)
Mountain
Ethelbert
Mossey River
Lakeshore
Dauphin
Grandview
Gilbert Plains
Ste. Rose
Alonas
Grahamdale
West Interlake
Fisher
Bifrost-Riverton
Riding Mountain West
Russell-Binscarth
Roseburn
McCreary
Harrison Park
Coldwell
Armstrong
Victoria Beach
Alexander
Yellowhead
Clanwilliam-Erickson
Roseisle
Glenella-Lansdowne
St. Laurent
Prairie View
Hamiota
Oakview
Westlake-Gladstone
Woodlands
Rockwood
St. Andrews
St. Clements
Lac du Bonnet
Brokenhead
Wallace-Woodworth
Rivers
Elton
North Cypress-Langford
North Norfolk
Portage La Prairie
Springfield
Whitemouth
Reynolds
Pipestone
Sifton
Whitehead
Cornwallis
Victoria
Norfolk Treherne
Gray
Macdonald
Taché
Ste. Anne
Dufferin
Grassland
Prairie Lakes
Argyle
Lorne
Thompson
Roland
Morris
Hanover
De Salaberry
La Broquerie
Two Borders
Louise
Pembina
Stanley
Rhineland
Emerson-Franklin
Stuartburn
Piney

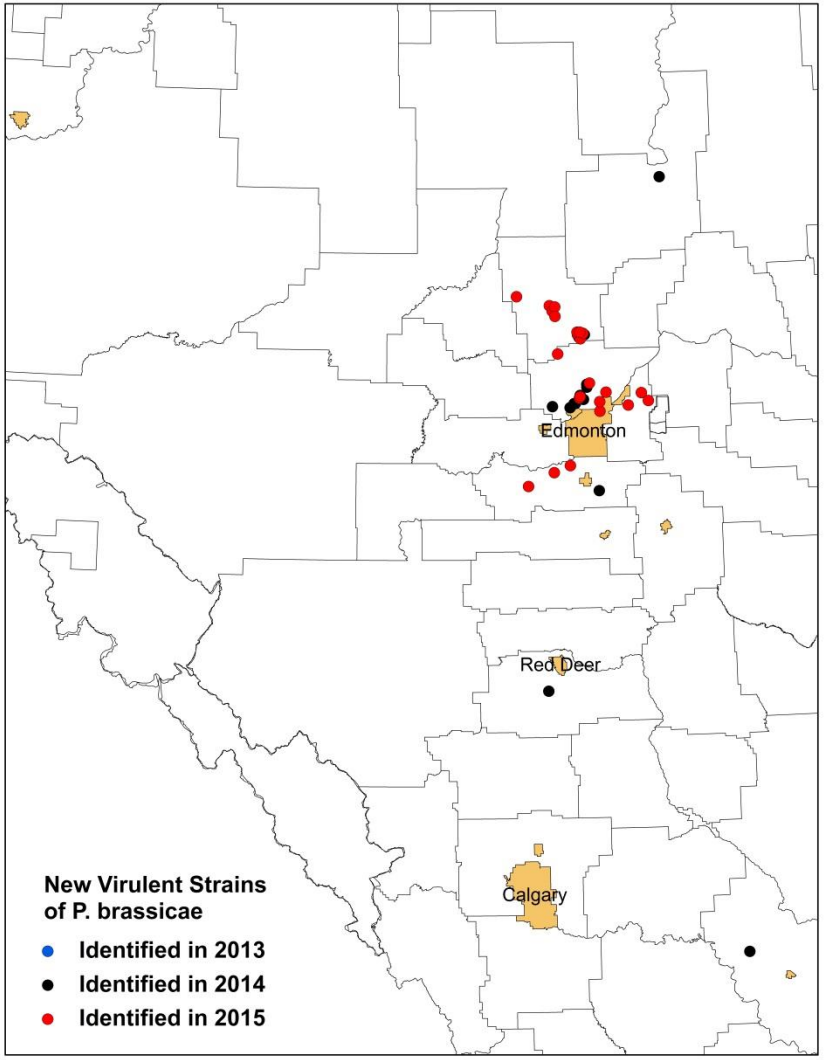
Why is clubroot spreading?

Resistance Erosion or Loss

- New strains capable of overcoming resistance confirmed in a total of 42 fields

Year	Number of New Fields
2013	2
2014	16
2015	24
Total (2013-15)	42

2016: About 30 suspect fields for testing



Strelkov et al.

New Canadian Clubroot Differential (CCD) set

Differential	Reaction										
ECD 02	-	-	-	-	-	-	-	-	-	-	-
ECD 05	+	+	+	+	+	+	+	+	+	+	+
ECD 06	+	+	+	+	+	-	-	+	+	-	-
ECD 08	+	+	+	+	+	+	+	+	+	+	-
ECD 09	+	+	+	+	+	-	-	+	+	-	-
ECD 10	-	-	-	-	-	-	-	-	-	-	-
ECD 11	-	+	-	-	-	-	-	-	-	-	-
ECD 13	+	+	+	+	-	+	-	+	-	-	-
Brutor	+	+	+	+	+	+	+	+	+	+	+
Laurentian	+	+	-	+	+	-	-	+	-	+	-
Mendel	+	+	+	-	-	-	-	-	-	-	-
Westar	+	+	+	+	+	+	+	+	+	+	+
45H29	+	+	+	+	+	+	+	-	-	+	+
Pathotype Designation											
CCD	A	B	C	D	E	F	G	H	I	J	K
Williams	3	2	6	3	8	6	5	3	5	8	6
Somé et al.	P2	P2	P2	P2	P2	P3	P3	P2	P2	P3	P3

Pathotype 5x

L-G1, G2, G3	D-G3
-	-
+	+
-	-
+	+
-	-
-	-
-	-
-	-
+	+
-	-
+	-
+	+
+	-
Pathotype	
L	M
5	5
P3	P3

What does work?

- Crop rotations
- Resistance
- Fumigation?
- Controlling brassica weeds
- Sanitation
- Using clean inputs
- Scouting for the disease

What does not work?

- Crop Rotations
- Tillage
- Fungicides
- Soil amendments
- Boron
- Liming soils
- Bait crops
- Resistance?

The Clubroot Solution

- Two approaches:
  - 1. For areas of low and/or no disease
    - Prevention strategies
    - Use resistance to prevent spore buildup
  - 2. For areas with high levels of disease
    - Very difficult situation
    - Long rotations
    - Resistance essential
      - and rotate resistance types
    - No tillage!
    - Patch management
      - Liming
      - Fumigation
      - Isolation/quarantine

The difficulty

- How do we communicate complex systems in an effective and simple manner?