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Fungicide usage is increasing: Don't forget to rotate fungicides.

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Canada 

Fungicide Usage on the Canadian Prairies

Prov.	Area (M ha)	Fungicide applied (%)				Increase (%)
		1996	2001	2006	2011	
AB	7.0	8	8	9	15	59%
SK	10.9	5	9	9	21	136%
MB	3.5	10	21	23	47	110%
Total	21.3	7	11	11	23	107%
ON	2.4	8	9	11	17	51%

Gossen's Guide to Disease Management

- Disease management activities should be almost complete **BEFORE** any crop is planted.
- Use the best genetics for the region.
 - high yield, suitable days to harvest, best disease resistance.
- Don't plant problems with the crop.
 - use seed with high germination and vigour, treated & inoculated, minimal diseases.
- Plan for a diverse crop rotation.
 - different crops are best, but different cvs. can be useful.
- Ensure isolation from last year's infected fields.
- Scout fields and apply a foliar fungicide if required.

Risks

- Most field crops are NOT at high risk of disease failures due to fungicide insensitivity.
 - Cultural methods (e.g., crop rotation) are adequate for disease reduction in many situations.
 - Fungicides used infrequently or managed with multi-site actives (older, but cheaper).
 - Many pathogens with no air-borne phase or low genetic diversity, so development and spread of insensitive isolates is slower.
- Fungicide insensitivity on the prairies
 - Sclerotinia - alfalfa, ascochyta - chickpea & pea

Strobilurin Insensitivity in *Ascochyta rabiei*

Risk of insensitivity to strobilurins was high:

- genetically diverse pathogen,
- air-borne sexual spores,
- several fungicide appl. / year,
- insensitivity in related fungi.

N.B. Resistance reported first in SK, but then AB and the USA.



Increase of Insensitive Isolates in SK

2004 – 2005

Headline	0 R, 53 S	100% S
Quadris	4 R, 49 S	92% S

2006

Headline	20 R, 17 S	50% S
Quadris	23 R, 14 S	32% S

Control failures

- 6 of 7 fields	0% S
- 1 field	100% S

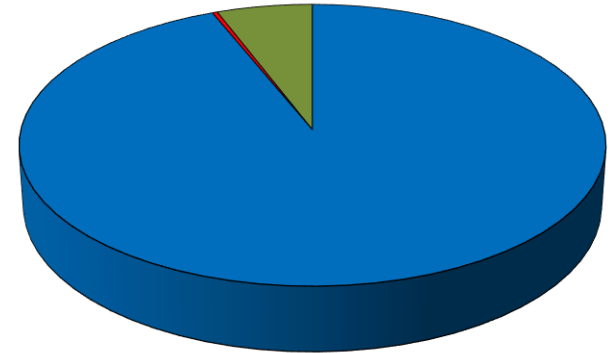
2007 132 R, 4 S 3% S

2008 74 R, 7 S 8% S

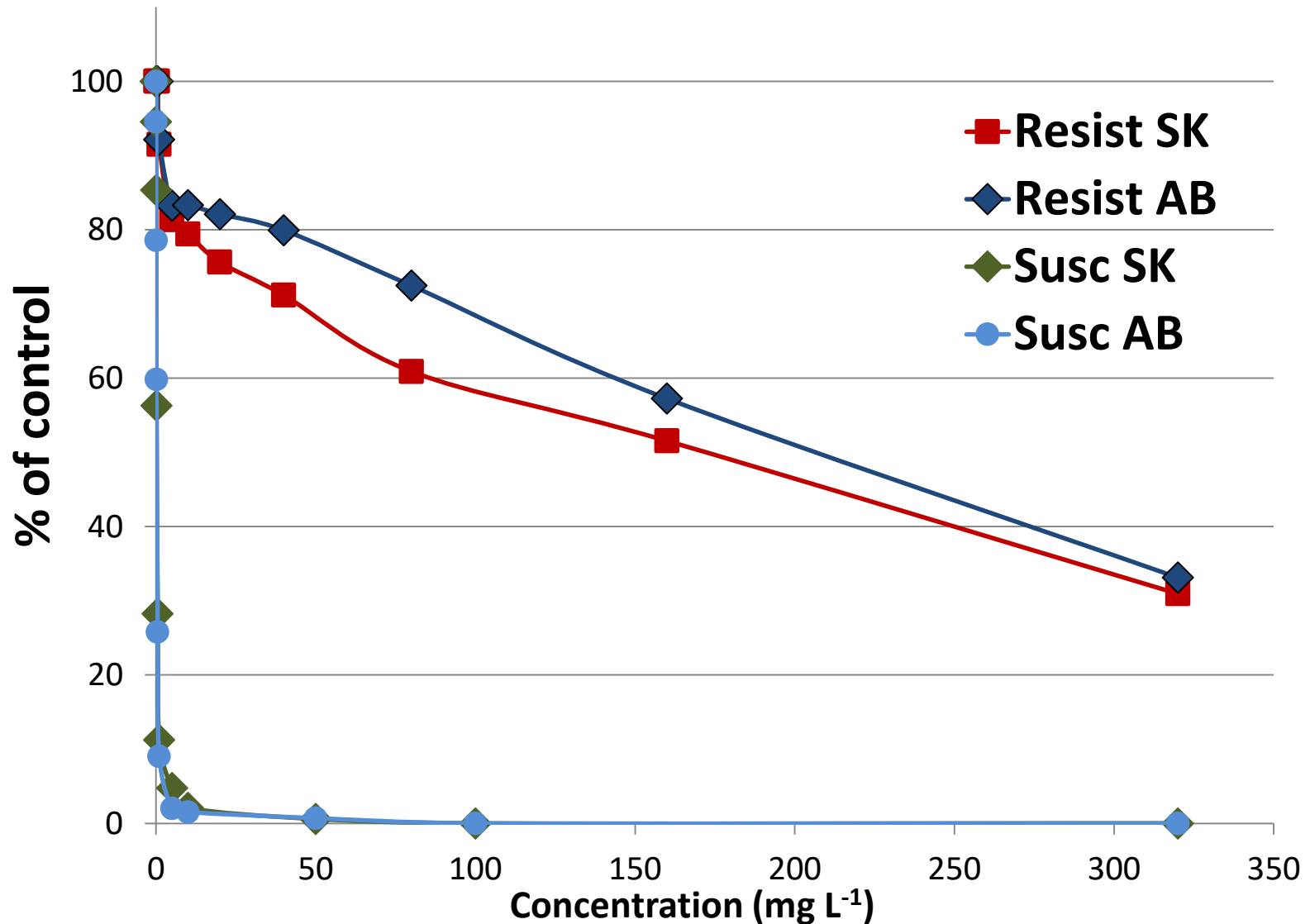
Inensitivity of *Mycosphaerella pinodes* from field pea to strobilurins

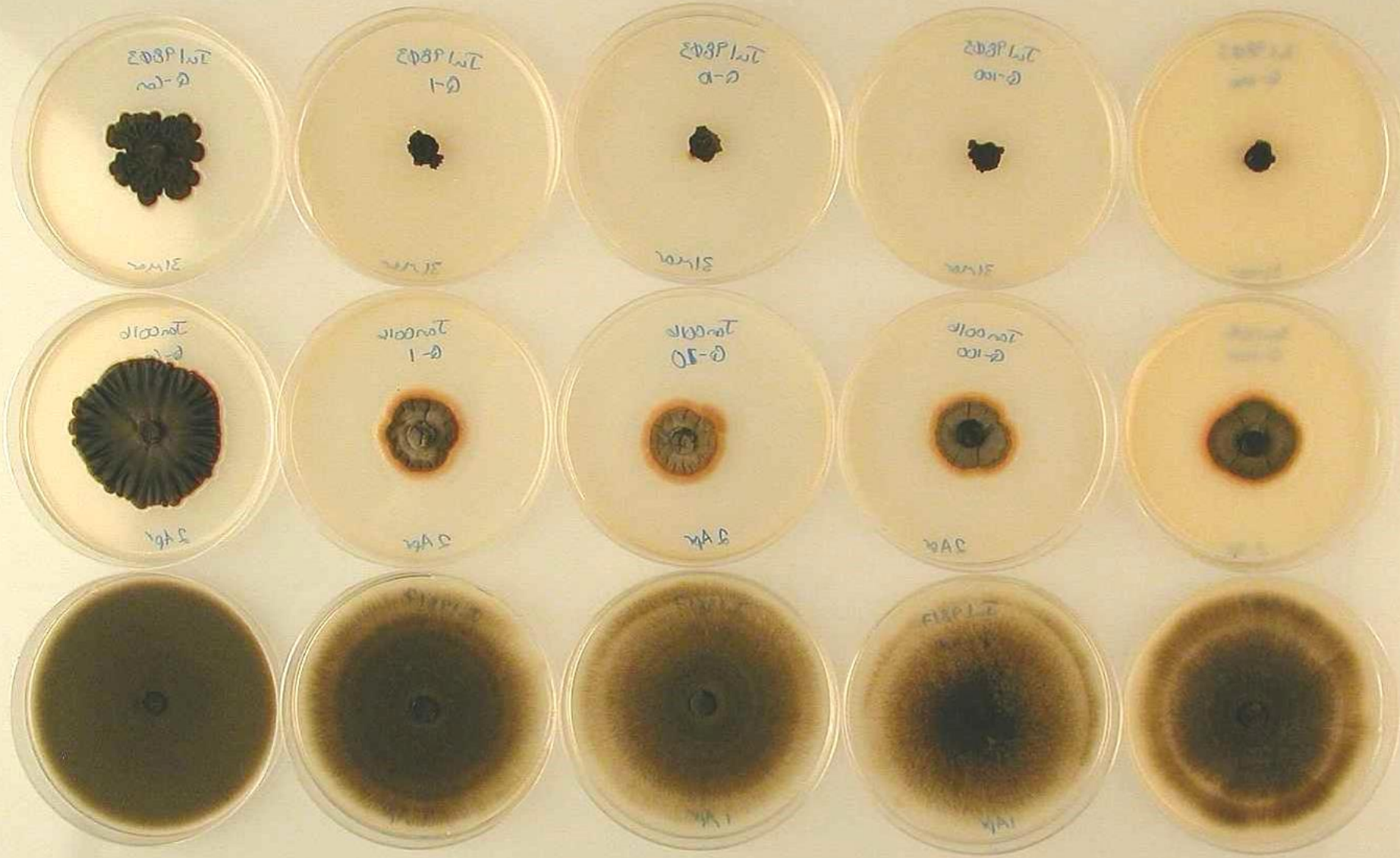
- ❑ Pathogen at high risk of loss of sensitivity to strobilurins.
- ❑ Baseline assessment conducted using isolates collected in SK, AB, ND & WA before 2003.
- ❑ Assessed > 300 isolates collected in 2010–2011.
- ❑ 8% of isolates from SK & AB insensitive, 0% from ND & WA.
- ❑ Populations in SK & AB at risk of loss of efficacy using strobilurins.

■ Sensitive
■ Intermediate
■ Insensitive



Reaction of *M. pinodes* isolates to strobilurins





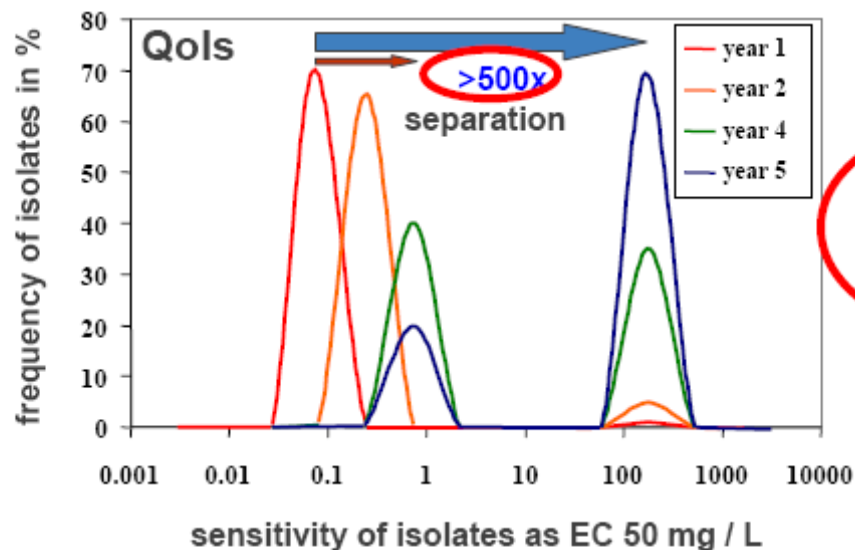
Background

- Initially, fungicides used persistent actives with multi-site modes of action, e.g., heavy metals, some older chemistries such as mancozeb.
- Shift to focus on reduced-risk actives (usually non-persistent, single-site modes of action).
- Good efficacy, but greater risk of insensitivity
- Reduced sensitivity usually detected first under high selection pressure.
- Viticulture, golf courses, orchards > hort crops > intensive field crops > extensive field crops

Fungicide resistance development: Selection models for Qol and DMI fungicides

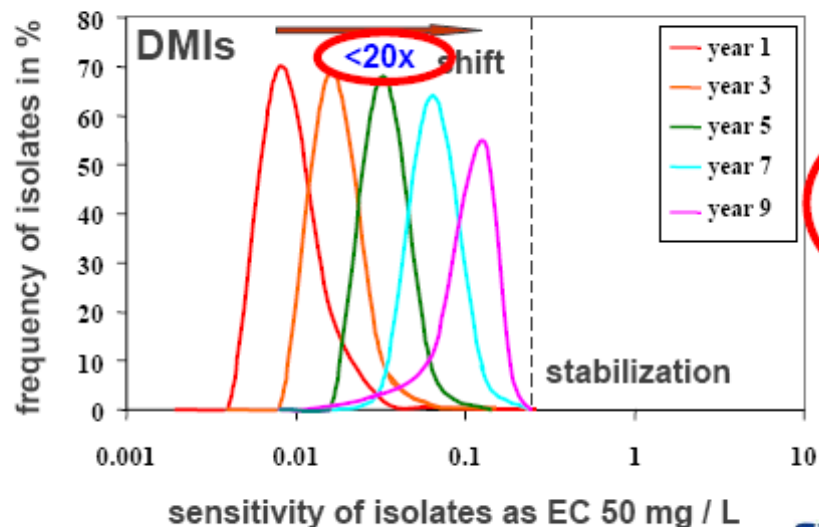


monogenic, single allelic
resistance at target site,
disruptive selection, **high
risk**

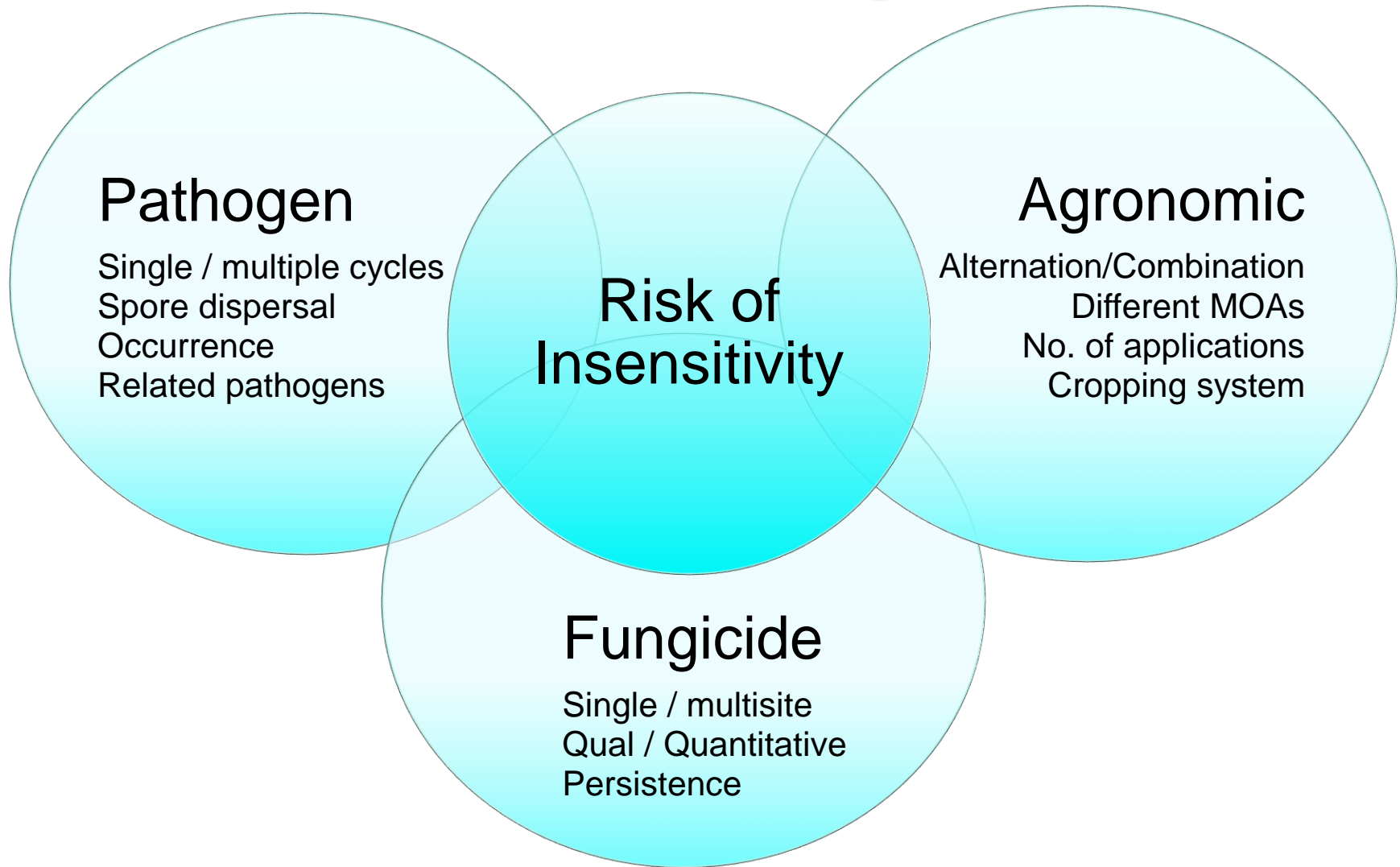


polygenic, multi allelic
resistance at target site,
continuous selection,
moderate risk

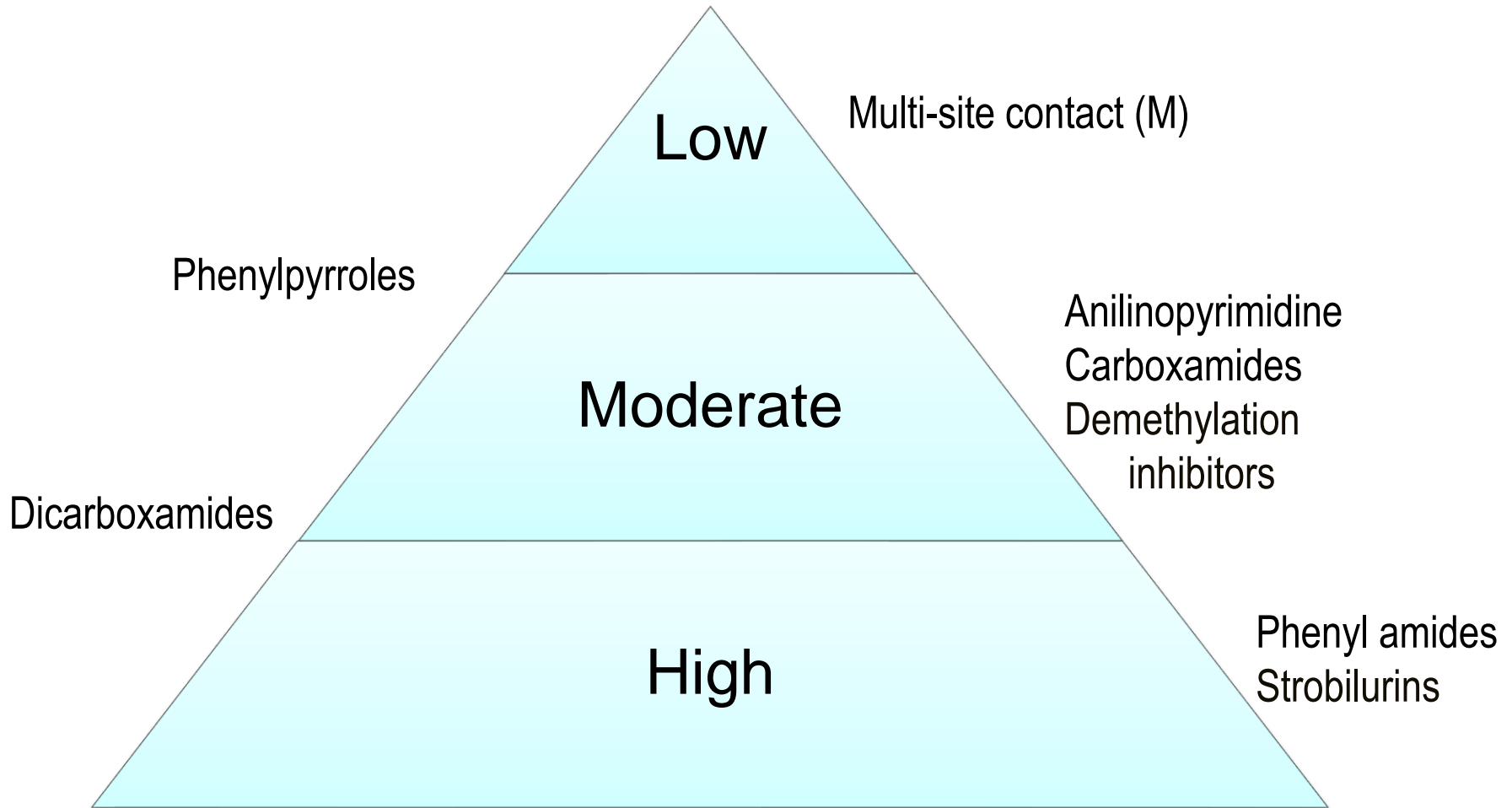
- Fitness cost
- Polygenic inheritance (dilution)



Factors Affecting Risk



Risk Based on Mode of Action



Source: Kristina Polziehn, BASF

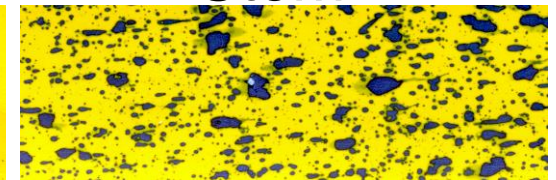
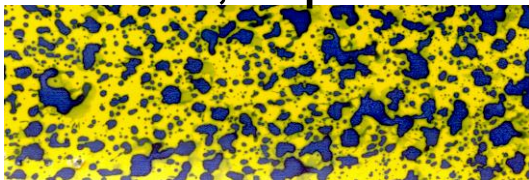


Leaf, top

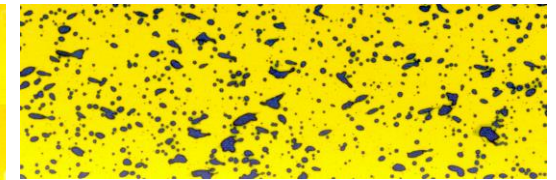
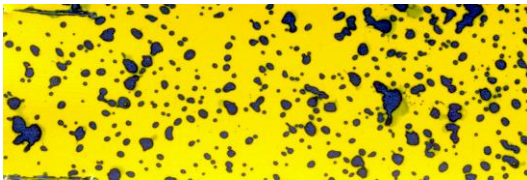
Leaf, underside

Stem

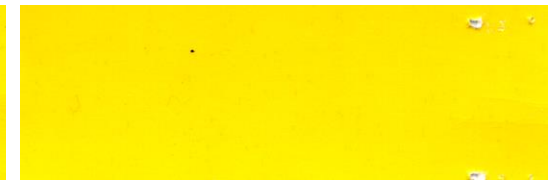
Top



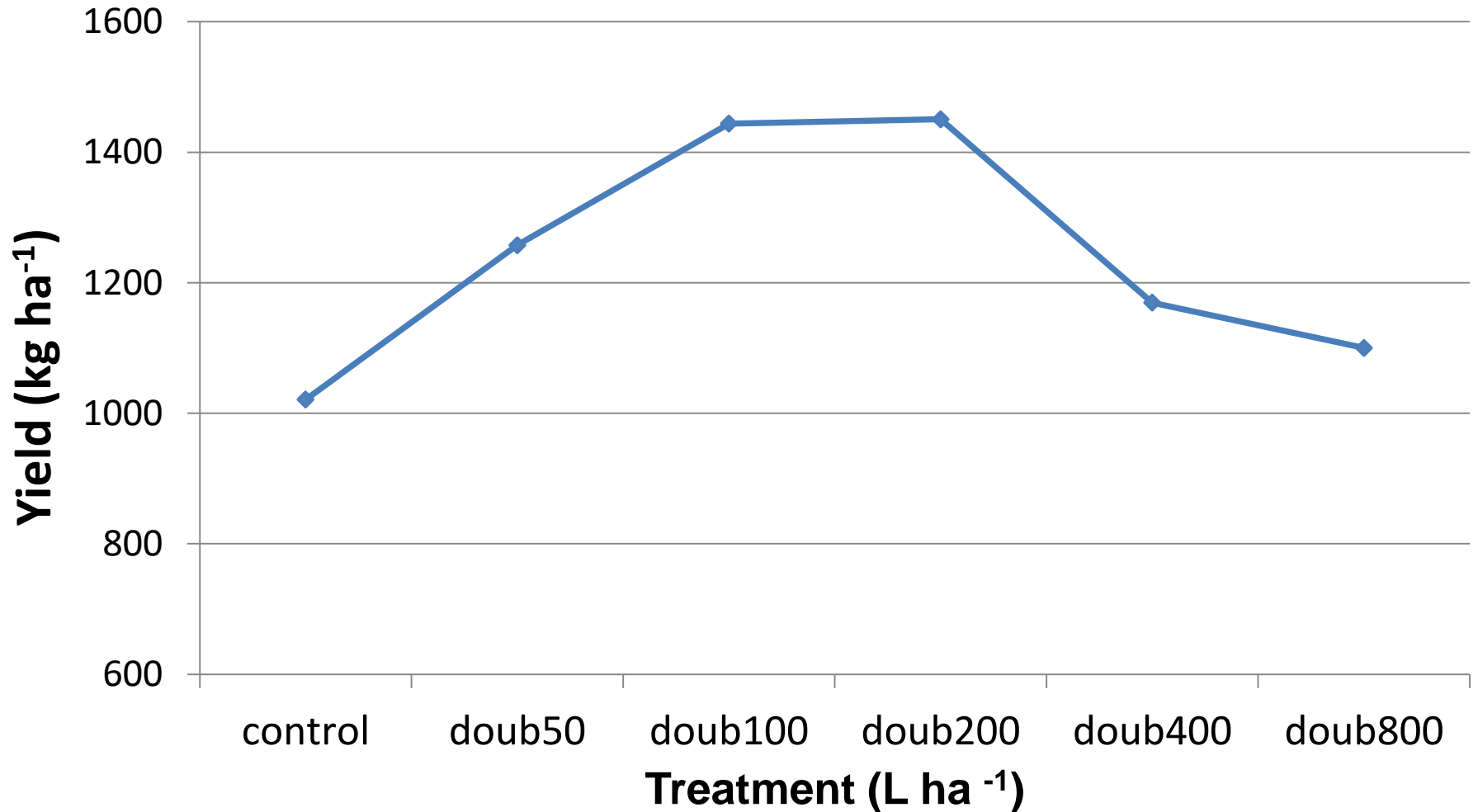
Middle



Bottom



Water Volume



Prevention is the best solution

- Actives will last longer if used less frequently. Limit number of applications and use IPM.
- Alternate fungicides with different MOA.
- Tank mix or select high risk products with a multi-site partner or an effective active with a different MOA, and apply label rates.
- Seed treatments generally not affected.
- Host-pathogen systems at risk: blackleg of canola, fusarium head blight of wheat, anthracnose and bacterial blight of bean, sclerotinia of many crops.



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