

EFFICACY OF FUNGICIDES TO CRANBERRY FRUIT ROT PATHOGENS

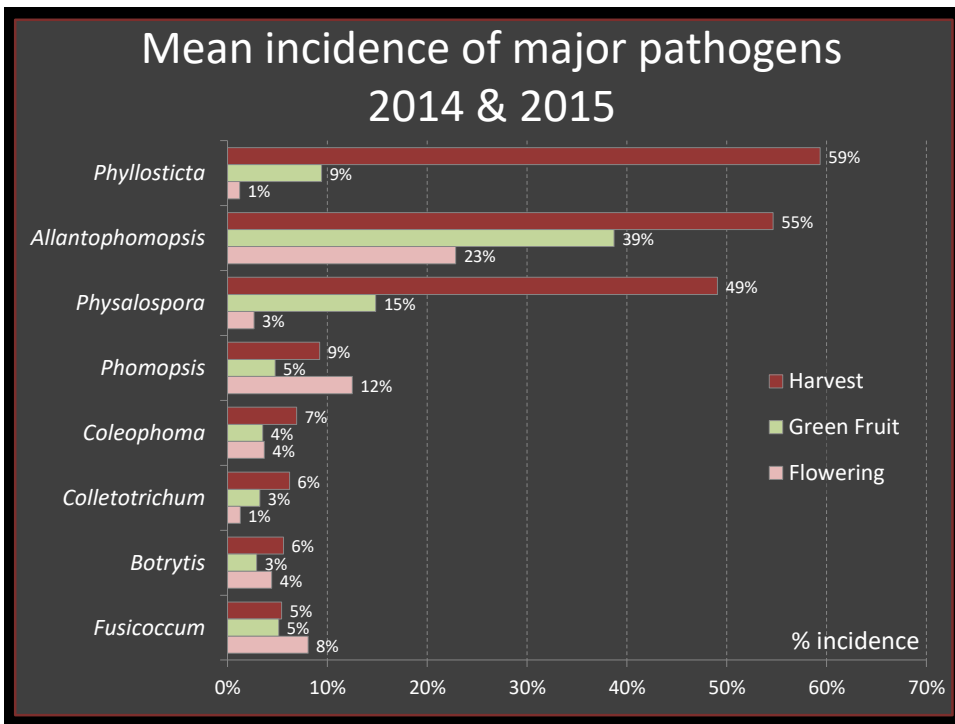
CRANBERRY CONGRESS - February 2018

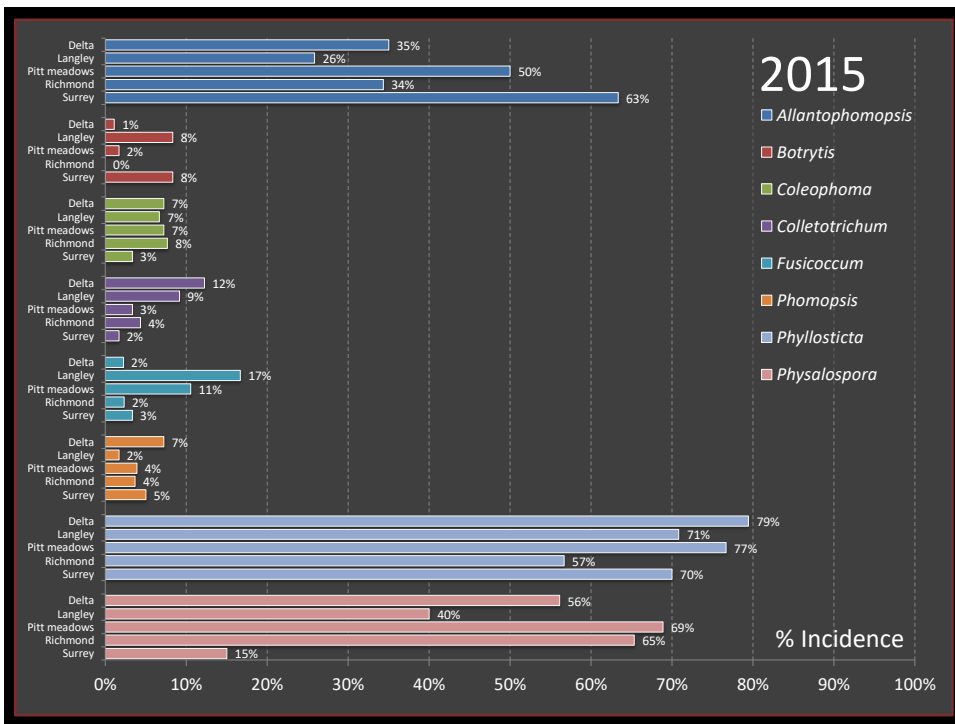
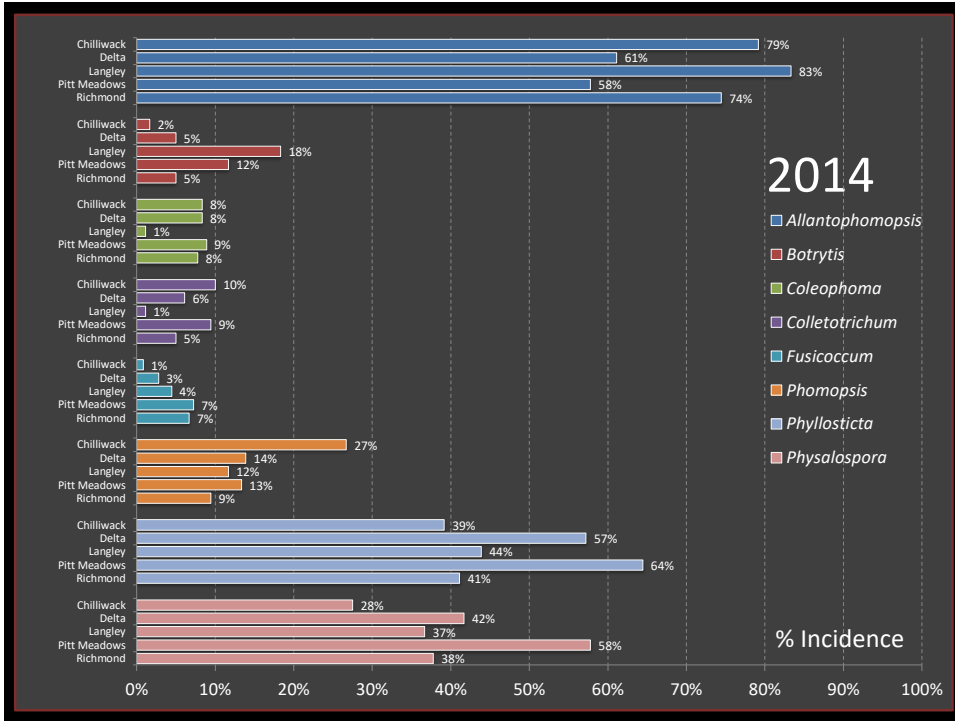
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Fruit rot pathogens...

1. Black rot	<i>Allantophomopsis</i> spp.: infection period - late summer to autumn (mostly storage rot)
2. End rot	<i>Fusicoccum putrefaciens</i> (<i>Godronia cassandrae</i>): infection period - early spring or autumn (cooler conditions)
3. Blotch rot	<i>Physalospora vaccinii</i> : infection period - entire season, particularly bloom to early fruit set
4. Early rot	<i>Phyllosticta vaccinii</i> : Infection period - bloom to summer
5. Bitter rot	<i>Colletotrichum</i> spp.: Infection period - bloom to early fruit-set (latent infection)
6. Ripe (white rot)	<i>Coleophoma empetri</i> : infection period - bloom & early fruit-set
7. Viscid rot	<i>Phomopsis vaccinii</i> : infection period - bud break to early fruit-set
8. Yellow rot	<i>Botrytis cinerea</i> : infection period - bloom to fruit-set





Study objective.....

Evaluate and identify registered & potential non-registered fungicides for efficacy against cranberry fruit rot pathogens

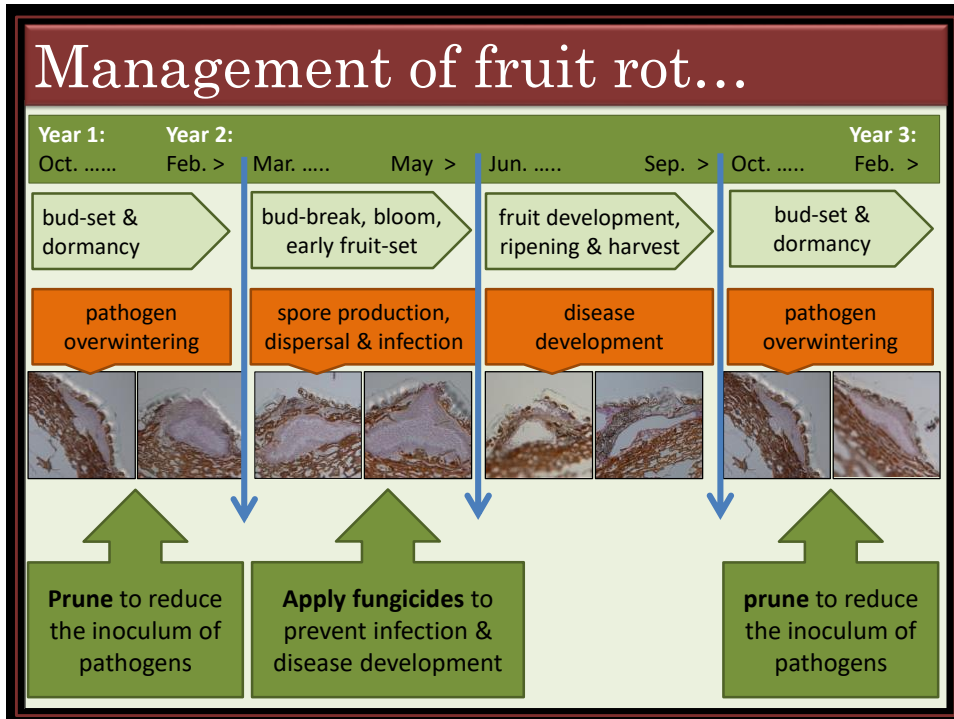
Why?

Cranberry fruit rot is caused by many different pathogens. Therefore, currently registered fungicides may not have the required efficacy to control all the fruit rot pathogens.

Therefore, it is necessary to identify potential new fungicides, belong to different FRAC groups, for further assessment in the field & initiate PMRA registration.

To achieve good fruit rot control...

- a. Identify the appropriate fungicide(s) for the target pathogen.
- b. Use fungicides at recommended concentrations
i.e. min. or max. rate / volume of water / hectare
- c. Apply fungicides preventatively, prior to release of spores and infection by fruit rot pathogens
- d. Maintain the longevity & effectiveness of fungicides to prevent resistance development by the pathogens.
- rotate amongst different chemistries (i.e. FRAC groups)
- e. Avoid delayed harvesting to minimize fruit rot



Screening of fungicides *in vitro* for their efficacy to inhibit the mycelial growth and spore germination of cranberry fruit rot pathogens

Efficacy of fungicides...

Methodology:

26 chemical- & 2 bio-fungicides were tested in the laboratory.

Fungicides were tested against 2 or 3 strains of each of 10 fruit rot pathogens.

Fungicides were tested *in vitro* for the efficacy to inhibit mycelial growth (curative effect) and spore germination (preventative effect) of fruit rot pathogens.

They were tested at minimum and maximum label rates in 500 mL water, and maximum rate in 200 mL water.

	Fruit rot	Pathogens	Isolate number	Field location
1	Black rot	<i>Allantophomopsis lycopodina</i> (dark strain)	15 CB 55	Pitt Meadows
2			15 CB 57	Surrey
3			15 CB 59	Surrey
4	Yellow rot	<i>Botrytis cinerea</i>	15 CB 29	Delta
5			15 CB 30	Langley
6			15 CB 31	Pitt Meadows
7	Ripe rot	<i>Coleophoma empetri</i>	15 CB 70	Richmond
8			15 CB 71	Delta
9			15 CB 72	Richmond
10	Bitter rot	<i>Colletotrichum acutatum</i>	15 CB 01	Richmond
11			15 CB 02	Langley
12			15 CB 03	Pitt Meadows
13		<i>Colletotrichum gloeosporioides</i>	15 CB 06	Richmond
14			15 CB 07	Langley
15			15 CB 08	Langley
16		<i>Glomerella cingulata</i>	15 CB 11	Delta
17			15 CB 12	Richmond
18			15 CB 13	Richmond
19	End rot	<i>Fusicoccum putrefaciens</i>	15 CB 39	Langley
20			15 CB 40	Richmond
21			15 CB 41	Delta
22	Viscid rot	<i>Phomopsis vaccinii</i>	07 CB 04	Richmond
23			15 CB 66	Delta
24			15 CB 67	Surrey
25	Early rot	<i>Phyllosticta elongata</i>	15 CB 60	Chilliwack
26			15 CB 61	Richmond
28			15 CB 62	Langley
29	Blotch rot	<i>Physalospora vaccinii</i> (dark strain)	15 CB 45	Langley
30			15 CB 47	Richmond
31		<i>Physalospora vaccinii</i> (light strain)	15 CB 49	Pitt Meadows
32			15 CB 50	Richmond

FRAC group	Active ingredient	Product Name	
M	chlorothalonil	Bravo 500	1
	copper sulphate	Copper 53 WP	2
	copper octanoate	Cueva	3
	copper oxychloride	Guardsman	4
	copper hydroxide	Kocide	5
	captan	Maestro 80 DF (Captan)	6
3	flutriafol	Fullback 125 SC	7
	triforine	Funginex DC	8
	fenbuconazole	Indar	9
	difenoconazole	Inspire	10
	prothioconazole	Proline 480 SC	11
	propiconazole	Tilt (Topas / Orbit)	12
7	pydiflumetofen	A19649B (Adepidyn)	13
	solatenol (benzovindiflupyr)	Aprovia	14
	penthiopyrad	Fontelis	15
	isofetamid	Kenja (Isfetamid 400 SC)	16
	fluxapyroxad	Sercadis (Xemium)	17
9	pyrimethanil	Scala	18
	cyprodinil	Vanguard	19
11	fluoxastrobin	Evito 480 SC	20
	trifloxystrobin	Flint 50 WG	21
	azoxystrobin	Quadris	22
12	fludioxonil	Medallion (Scholar)	23
17	fenhexamid	Elevate 50 WDG	24
19	Polyoxin D	OSO 5% SC	25
33	fosetyl-Al	Aliette	26
Biological	Reynoutria sachalinensis extract	Regalia Maxx	27
	Melaleuca alternifolia (tea-tree) extract	Timorex Gold	28

Inhibition of mycelial growth...

Methodology:

Assay plates were prepared with fungal growth medium, 1/4-strength PDA, amended with min. & max. rates of the fungicides.

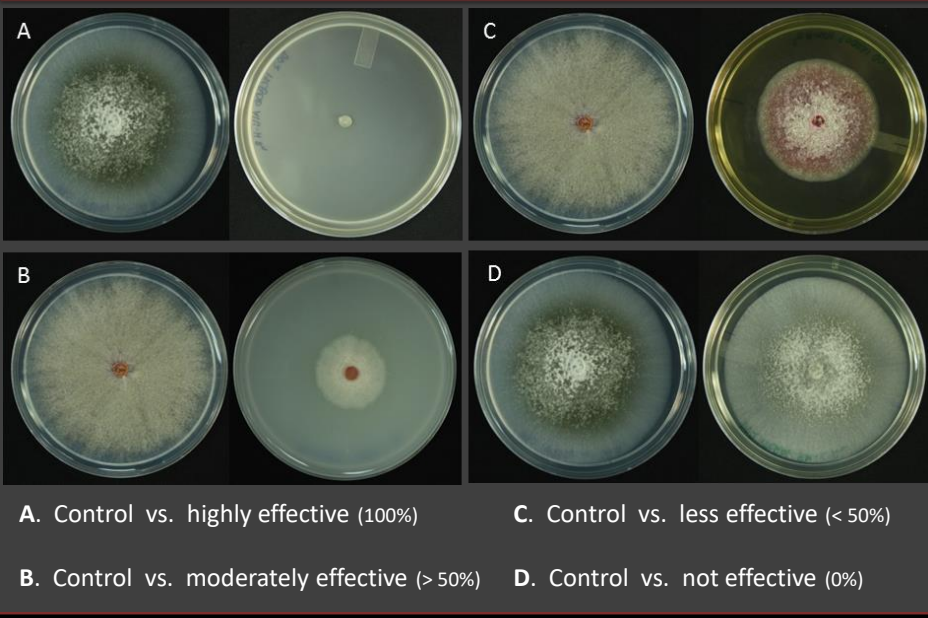
Assay plates without the fungicides were used as controls.

Two replicate assay plates were used for each fungal isolate.

Mycelial plug of the target pathogen was placed at the centre of the assay plates and incubated in the dark at 24°C.

At 5-7 day incubation, measurements of colony diameters of fungicide-amended and non-amended were measured and compared and percent reduction in mycelial growth by each fungicide was calculated from .

fungicide vs. mycelial growth..



Inhibition of spore germination...

Methodology:

Assay plates were prepared in 24-well microtiter plates with fungal growth medium, 1/4-strength PDA, amended with min. & max. rates (in 200 mL water) of the fungicides.

Assay plates without the fungicides were used as controls.

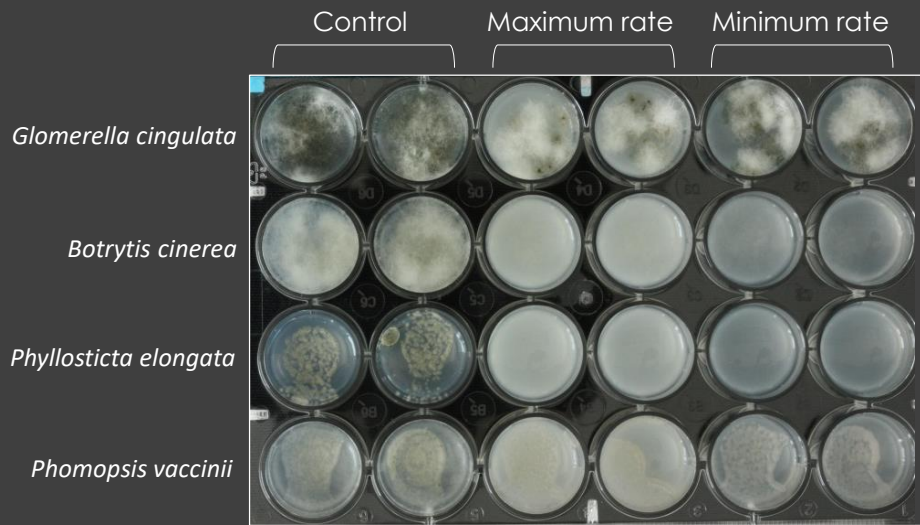
Two replicate assay plates were used for each fungal isolate.

Spores (conidia or ascospores) were harvested from mature cultures of the fungal pathogens and adjusted to a concentration of 1×10^4 cfu/mL

20 μ l spore suspension was placed onto the wells of the assay plates and incubated in the dark at 18°C for 5-7 days.

Each well was scored for presence or absence of fungal growth and compared with the growth on non-fungicide amended control s.

Fungicides vs. spore germination...



Results

M	Inhibition of mycelial growth (Scale: 1 – 10)																		Inhibition of spore germination (+ or -)											
	Bravo			Copper			Cueva			Guardsman			Kocide			Maestro			Bravo	Copper	Cueva	Guardsman	Kocide	Maestro						
	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 200L	Max 200L	Min 200L	Max 200L	Min 200L	Max 200L						
<i>Allantophomopsis lycopodina</i> (Black Rot)	9	8+	9+	10	10	10	10	9+	N/A	8+	9	10	10	10	10	10	10	10	+	+	+	+	-	+	-	-	+	+	+	+
<i>Botrytis cinerea</i> (Yellow rot)	7+	7+	9+	10	9+	7	10	10	N/A	6	6+	7+	8	8	6	8+	9	10	-	-	+	+	+	+	-	-	-	-	+	+
<i>Coleophoma empetri</i> (Ripe rot)	6+	6	10	10	10	10	10	10	N/A	10	8+	10	10	10	10	8+	6+	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<i>Colletotrichum acutatum</i> (Bitter rot)	8	8	8	10	10	10	10	10	N/A	8	8	10	10	10	10	8+	8+	10	+	+	+	+	+	+	-	-	-	+	+	+
<i>Colletotrichum gloeosporioides</i> (Bitter rot)	8	8	9+	10	10	10	10	10	N/A	8+	8+	10	9+	10	10	9	8+	10	+	+	+	+	+	+	-	+	+	+	+	+
<i>Fusicoccum putrefaciens</i> (End rot)	5+	3+	10	8+	10	9	8	9	N/A	3	3+	8	9	10	10	8	8	10	+	+	+	+	+	+	-	-	+	+	+	+
<i>Glomerella cingulata</i> (Bitter rot)	8+	8+	9+	10	10	10	10	10	N/A	8+	8+	10	8	9	10	9	9+	10	+	+	+	+	+	+	-	-	-	+	-	+
<i>Phomopsis vaccinii</i> (Viscid rot)	9	9	9+	10	10	10	10	10	N/A	8+	8+	8	10	10	10	9+	9	10	+	+	+	+	+	+	-	-	+	+	+	+
<i>Phyllosticta elongata</i> (Early rot)	8+	8	10	10	10	10	10	10	N/A	10	10	8+	10	10	10	10	10	10	+	+	+	+	-	+	-	-	+	+	+	+
<i>Physalospora vaccinii</i> (Blotch rot)	8+	8+	10	10	10	10	10	10	N/A	10	10	10	10	10	10	10	10	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

3	Inhibition of mycelial growth (Scale: 1 – 10)																		Inhibition of spore germination (+ or -)											
	Fullback			Funginex			Indar			Inspire			Proline			Tilt			Fullback	Funginex	Indar	Inspire	Proline	Tilt						
	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 200L	Max 200L	Min 200L	Max 200L	Min 200L	Max 200L	Min 200L	Max 200L				
<i>Allantophomopsis lycopodina</i> (Black Rot)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	+	+	+	+	+	+	+	+	+	+	+	
<i>Botrytis cinerea</i> (Yellow rot)	10	10	9	10	9+	10	9+	9	10	9+	9	9+	9+	10	10	9+	9+	10	-	-	+	+	-	+	+	+	-	+	-	-
<i>Coleophoma empetri</i> (Ripe rot)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
<i>Colletotrichum acutatum</i> (Bitter rot)	9	9+	10	10	10	10	10	8+	8+	9	9	10	10	10	10	10	10	10	+	+	+	+	-	-	+	+	+	+	+	+
<i>Colletotrichum gloeosporioides</i> (Bitter rot)	10	10	10	10	10	10	7+	7+	7+	9	9+	10	10	10	10	10	10	10	+	+	+	+	-	-	+	+	+	+	+	+
<i>Fusicoccum putrefaciens</i> (End rot)	10	10	10	9	10	10	10	10	10	7+	10	10	10	10	10	10	10	10	+	+	+	+	+	+	+	+	+	+	+	+
<i>Glomerella cingulata</i> (Bitter rot)	10	10	10	10	10	10	6	6	5+	9+	10	10	10	10	10	10	10	10	+	+	+	+	-	-	+	+	+	+	+	+
<i>Phomopsis vaccinii</i> (Viscid rot)	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	+	+	+	+	-	-	+	+	-	+	+	+
<i>Phyllosticta elongata</i> (Early rot)	10	10	10	10	10	10	9	9+	10	10	9+	10	10	10	10	8+	10	10	+	+	+	+	-	+	+	+	-	+	+	+
<i>Physalospora vaccinii</i> (Blotch rot)	10	10	10	10	10	10	7+	7+	10	10	10	10	10	10	10	10	10	10	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

7	Inhibition of mycelial growth (Scale 1 – 10)															Inhibition of spore germination (+ or -)									
	Adepidyn			Aprovia			Fontelis			Kenja			Sercadis			Adepidyn		Aprovia		Fontelis		Kenja		Sercadis	
	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 200L	Max 200L	Min 200L	Max 200L	Min 200L	Max 200L	Min 200L	Max 200L		
<i>Allantophomopsis lycopodina</i> (Black Rot)	4+	4	4+	9	10	10	3+	3+	7	3+	2+	6	2+	3+	8	-	-	+	+	-	-	-	-	-	
<i>Botrytis cinerea</i> (Yellow rot)	6	7	6	9+	9+	10	4	5+	5+	5	5+	6+	6	6	8	-	-	+	+	-	-	-	-	-	
<i>Coleophoma empetri</i> (Ripe rot)	6+	4+	3+	10	10	10	2+	3+	2+	1+	2	1	3	3	4	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
<i>Colletotrichum acutatum</i> (Bitter rot)	4	4	3+	8+	9	10	7	7	8+	1+	1+	2+	0	0	3	-	-	+	+	-	-	-	-	-	
<i>Colletotrichum gloeosporioides</i> (Bitter rot)	3	3+	2+	8+	8+	10	7	7	6+	1	1+	1+	2+	3	2+	-	-	+	+	+	+	-	-	-	
<i>Fusicoccum putrefaciens</i> (End rot)	5	5	7+	10	10	10	2+	3	6	3	2	6	1+	1	6+	-	-	+	+	-	-	-	-	-	
<i>Glomerella cingulata</i> (Bitter rot)	5+	4+	4	9	10	10	9+	9+	8	4	4+	4	4+	4+	4	-	-	+	+	-	-	-	-	-	
<i>Phomopsis vaccinii</i> (Viscid rot)	5+	6	5+	10	9+	10	4	4	5	4	4	4	5	4+	5+	-	-	+	+	-	-	-	-	-	
<i>Phyllosticta elongata</i> (Early rot)	8	10	7+	10	10	10	7+	7+	8	7	7	8	6+	7+	8	+	+	+	+	+	+	-	+	-	
<i>Physalospora vaccinii</i> (Blotch rot)	4+	4	6	10	10	10	3+	3	4+	3	2+	3+	2+	2+	5	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	

9	Inhibition of mycelial growth (Scale: 1 - 10)						Inhibition of spore germination (+ or -)			
	Scala			Vanguard			Scala		Vanguard	
	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 200L	Max 200L	Min 200L	Max 200L
<i>Allantophomopsis lycopodina</i> (Black Rot)	8+	9	9+	8+	9	10	+	+	+	+
<i>Botrytis cinerea</i> (Yellow rot)	9+	10	9	9	9	9	+	+	-	-
<i>Coleophoma empetri</i> (Ripe rot)	10	10	8	6	6	10	N/A	N/A	N/A	N/A
<i>Colletotrichum acutatum</i> (Bitter rot)	6+	7	5+	4+	5	5+	-	-	-	-
<i>Colletotrichum gloeosporioides</i> (Bitter rot)	7+	7+	6+	5	5+	4+	-	-	-	-
<i>Fusicoccum putrefaciens</i> (End rot)	10	10	8	8+	8+	10	+	+	+	+
<i>Glomerella cingulata</i> (Bitter rot)	8	8+	7+	7	6+	7+	+	+	-	-
<i>Phomopsis vaccinii</i> (Viscid rot)	9	9+	8	8	7	8	-	-	-	-
<i>Phyllosticta elongata</i> (Early rot)	10	10	9+	9+	9+	10	+	+	+	+
<i>Physalospora vaccinii</i> (Blotch rot)	10	10	10	9+	10	10	N/A	N/A	N/A	N/A

11	Inhibition of mycelial growth (Scale: 1 – 10)									Inhibition of spore germination (+ or -)					
	Evito			Flint			Quadris			Evito		Flint		Quadris	
	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 200L	Max 200L	Min 200L	Max 200L	Min 200L	Max 200L
<i>Allantophomopsis lycopodina</i> (Black Rot)	1+	1+	2+	2+	2+	9+	5	7+	5	-	-	+	+	-	-
<i>Botrytis cinerea</i> (Yellow rot)	0	0	2	1	1+	9	3+	4	5+	-	-	-	-	-	-
<i>Coleophoma empetri</i> (Ripe rot)	2	2+	3+	3+	4	8	2	2+	4	N/A	N/A	N/A	N/A	N/A	N/A
<i>Colletotrichum acutatum</i> (Bitter rot)	1+	1	3+	1	1+	5+	4+	4	3+	-	-	-	-	-	-
<i>Colletotrichum gloeosporioides</i> (Bitter rot)	4+	4	6	5+	5	6+	7+	7	7	-	-	-	-	-	-
<i>Fusicoccum putrefaciens</i> (End rot)	3+	2+	4	2+	2+	8	3+	4	5	-	-	-	-	-	-
<i>Glomerella cingulata</i> (Bitter rot)	2	2+	4+	2+	2+	7+	4+	5	4	-	-	-	-	-	-
<i>Phomopsis vaccinii</i> (Viscid rot)	2+	3	4	1+	2	8	2+	2+	2+	-	-	-	-	-	-
<i>Phyllosticta elongata</i> (Early rot)	6	6	8+	4+	5+	9+	6	6+	8+	-	-	-	-	-	-
<i>Phyalospora vaccinii</i> (Blotch rot)	4+	4+	8+	4	4+	10	6+	8	8+	N/A	N/A	N/A	N/A	N/A	N/A

12	Inhibition of mycelial growth (Scale: 1 - 10)			Inhibition of spore germination (+ or -)	
	Medallion			Medallion	
	Min 500L	Max 500L	Max 200L	Min 200L	Max 200L
<i>Allantophomopsis lycopodina</i> (Black Rot)	7+	7+	8	+	+
<i>Botrytis cinerea</i> (Yellow rot)	8	9+	8	-	-
<i>Coleophoma empetri</i> (Ripe rot)	4+	5+	4+	N/A	N/A
<i>Colletotrichum acutatum</i> (Bitter rot)	7+	9	9	-	-
<i>Colletotrichum gloeosporioides</i> (Bitter rot)	8	7+	8	-	-
<i>Fusicoccum putrefaciens</i> (End rot)	8+	8+	8+	-	-
<i>Glomerella cingulata</i> (Bitter rot)	8	7	9	-	-
<i>Phomopsis vaccinii</i> (Viscid rot)	8	8	8	-	-
<i>Phyllosticta elongata</i> (Early rot)	9+	9+	10	+	+
<i>Phyalospora vaccinii</i> (Blotch rot)	9	10	10	N/A	N/A

17	Inhibition of mycelial growth (Scale 1 - 10)			Inhibition of spore germination (+ or -)	
	Elevate			Elevate	
	Min 500L	Max 500L	Max 200L	Min 200L	Max 200L
<i>Allantophomopsis lycopodina</i> (Black Rot)	8+	9	10	-	-
<i>Botrytis cinerea</i> (Yellow rot)	7+	7+	6	-	+
<i>Coleophoma empetri</i> (Ripe rot)	5	6	7	N/A	N/A
<i>Colletotrichum acutatum</i> (Bitter rot)	3	3	4	-	-
<i>Colletotrichum gloeosporioides</i> (Bitter rot)	3+	4+	4	-	-
<i>Fusicoccum putrefaciens</i> (End rot)	10	10	10	-	-
<i>Glomerella cingulata</i> (Bitter rot)	4+	5+	6+	-	-
<i>Phomopsis vaccinii</i> (Viscid rot)	5	6	7	-	-
<i>Phyllosticta elongata</i> (Early rot)	7	7+	8+	-	-
<i>Physalospora vaccinii</i> (Blotch rot)	3+	5	10	N/A	N/A

19	Inhibition of mycelial growth (Scale: 1 - 10)			Inhibition of spore germination (+ or -)	
	OSO (Polyoxin D)			OSO (Polyoxin D)	
	Min 500L	Max 500L	Max 200L	Min 200L	Max 200L
<i>Allantophomopsis lycopodina</i> (Black Rot)	5	5	7	-	-
<i>Botrytis cinerea</i> (Yellow rot)	9	9	9+	-	-
<i>Coleophoma empetri</i> (Ripe rot)	2+	2+	2	N/A	N/A
<i>Colletotrichum acutatum</i> (Bitter rot)	6+	7	8	-	-
<i>Colletotrichum gloeosporioides</i> (Bitter rot)	4+	5	8	-	-
<i>Fusicoccum putrefaciens</i> (End rot)	6+	10	8+	-	-
<i>Glomerella cingulata</i> (Bitter rot)	4+	3+	5+	-	-
<i>Phomopsis vaccinii</i> (Viscid rot)	2+	4+	6	-	-
<i>Phyllosticta elongata</i> (Early rot)	8+	9	10	-	-
<i>Physalospora vaccinii</i> (Blotch rot)	6+	6+	8+	N/A	N/A

33	Inhibition of mycelial growth (Scale: 1 - 10)			Inhibition of spore germination (+ or -)	
	Alette			Alette	
	Min 500L	Max 500L	Max 200L	Min 200L	Max 200L
<i>Allantophomopsis lycopodina</i> (Black Rot)	10	10	10	-	+
<i>Botrytis cinerea</i> (Yellow rot)	10	10	10	+	+
<i>Coleophoma empetri</i> (Ripe rot)	10	10	10	N/A	N/A
<i>Colletotrichum acutatum</i> (Bitter rot)	10	10	10	+	+
<i>Colletotrichum gloeosporioides</i> (Bitter rot)	10	10	10	+	+
<i>Fusicoccum putrefaciens</i> (End rot)	10	10	10	+	+
<i>Glomerella cingulata</i> (Bitter rot)	10	10	10	+	+
<i>Phomopsis vaccinii</i> (Viscid rot)	10	10	10	+	+
<i>Phyllosticta elongata</i> (Early rot)	10	10	10	+	+
<i>Physalospora vaccinii</i> (Blotch rot)	10	10	10	N/A	N/A

Bio	Inhibition of mycelial growth (Scale 1 - 10)						Inhibition of mycelial growth (+ or -)			
	Regalia			Timorex			Regalia		Timorex	
	Min 500L	Max 500L	Max 200L	Min 500L	Max 500L	Max 200L	Min 200L	Max 200L	Min 200L	Max 200L
<i>Allantophomopsis lycopodina</i> (Black Rot)	3+	5+	N/A	0	1	8+	-	-	-	-
<i>Botrytis cinerea</i> (Yellow rot)	2+	6+	N/A	0+	1+	10	-	-	-	-
<i>Coleophoma empetri</i> (Ripe rot)	0	0+	N/A	1	1+	8+	N/A	N/A	N/A	N/A
<i>Colletotrichum acutatum</i> (Bitter rot)	1+	4	N/A	3	4	6+	-	-	+	+
<i>Colletotrichum gloeosporioides</i> (Bitter rot)	0	3	N/A	3	4	7	-	-	+	+
<i>Fusicoccum putrefaciens</i> (End rot)	1+	6	N/A	2	3+	10	-	-	+	+
<i>Glomerella cingulata</i> (Bitter rot)	1+	4	N/A	4	5	8+	-	+	-	+
<i>Phomopsis vaccinii</i> (Viscid rot)	6	7	N/A	4+	5+	8+	-	-	+	+
<i>Phyllosticta elongata</i> (Early rot)	5	6+	N/A	5	6+	10	-	-	+	+
<i>Physalospora vaccinii</i> (Blotch rot)	4	6+	N/A	3	4+	10	N/A	N/A	N/A	N/A

Future directions...

Evaluate fungicides for efficacy to control fruit rot pathogens in the field and identify the most potential fungicides.

Explore avenues for PMRA registration process

Fine-tune most effective fungicide spray program that would minimize fruit rot incidence,

- i.e. - selection of effective fungicides
- timing, rotation
- frequency of application
- assessment of effectiveness

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