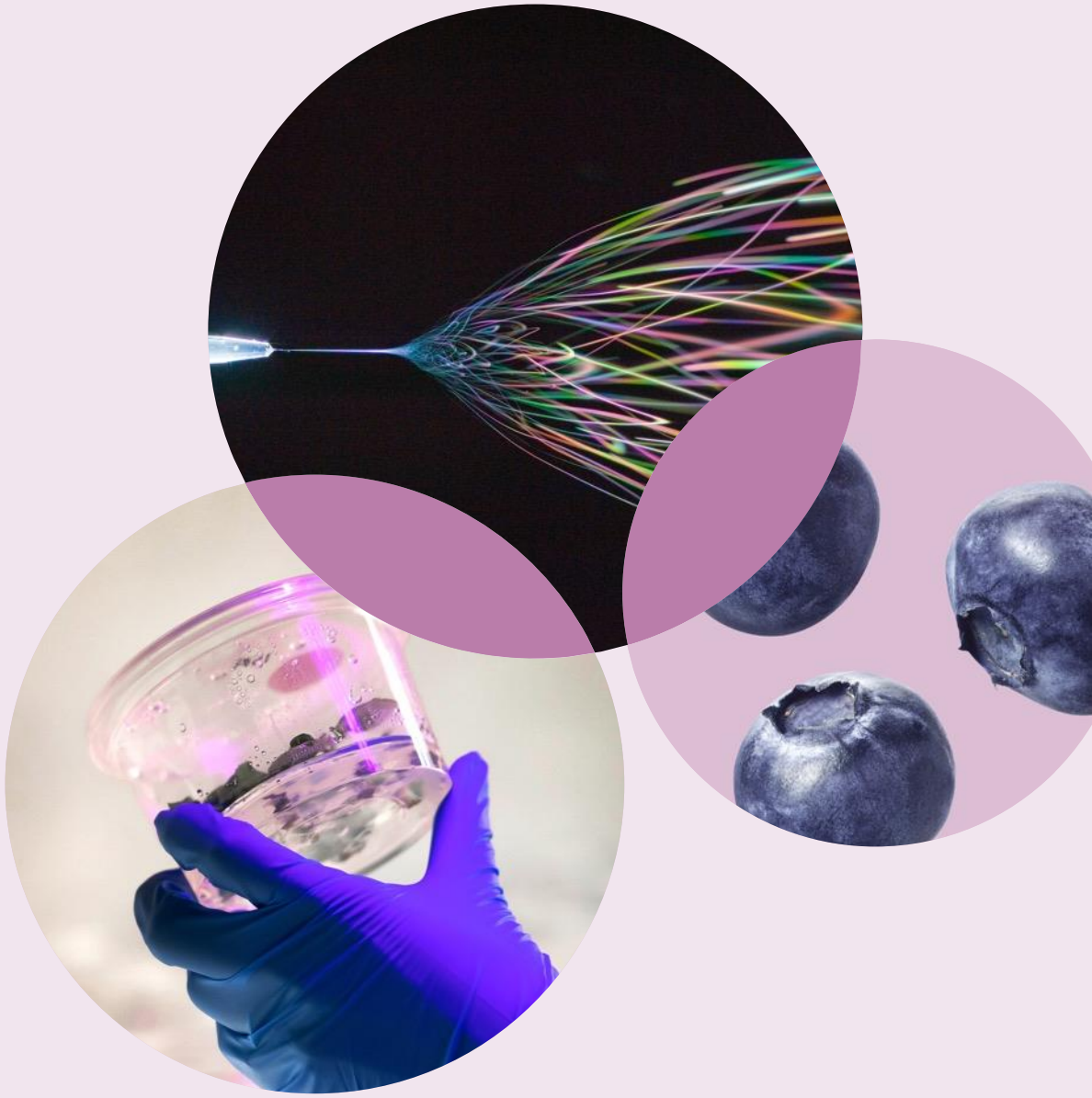
Plant & Food Research
Rangahau Ahumāra Kai

Blueberry *Botrytis*



Presented by Monika Walter

On behalf of Shahjahan Kabir, Peter Wright, Maryam Alavi, Annie Reid, Teiarere Stephens

March 2024

Botrytis cinerea (B.c.) causal agent of grey mould

- It is a necrotroph
- An opportunistic pathogen
- In green tissue, it needs a wound
- Green fruit shows resistance, ripe fruit does not

- There is an abundance of necrotic corollas
- There is an abundance of aborted flowers

Photo: 16 June 2023

Experiments

Three experiments

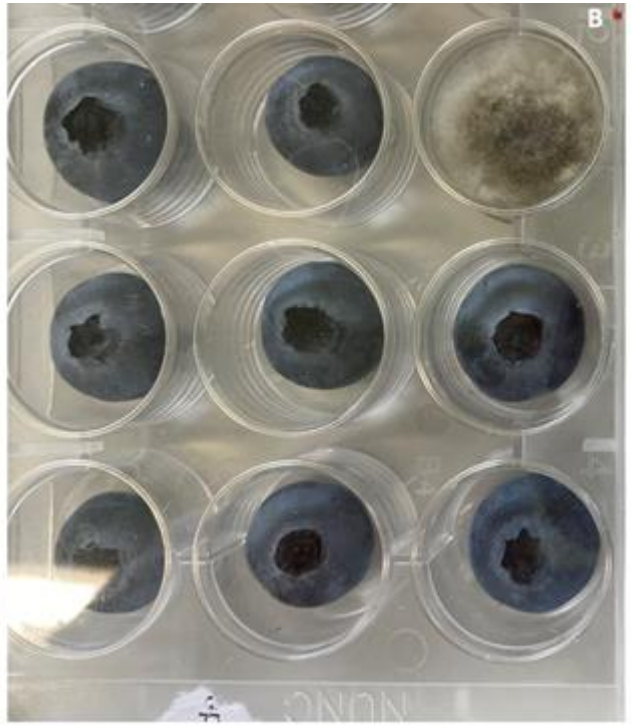
1. **Inoculum removal**
2. Spray trial
3. Berry collapse

- 50 m length was swept weekly starting 26 July

Photo David Holmes

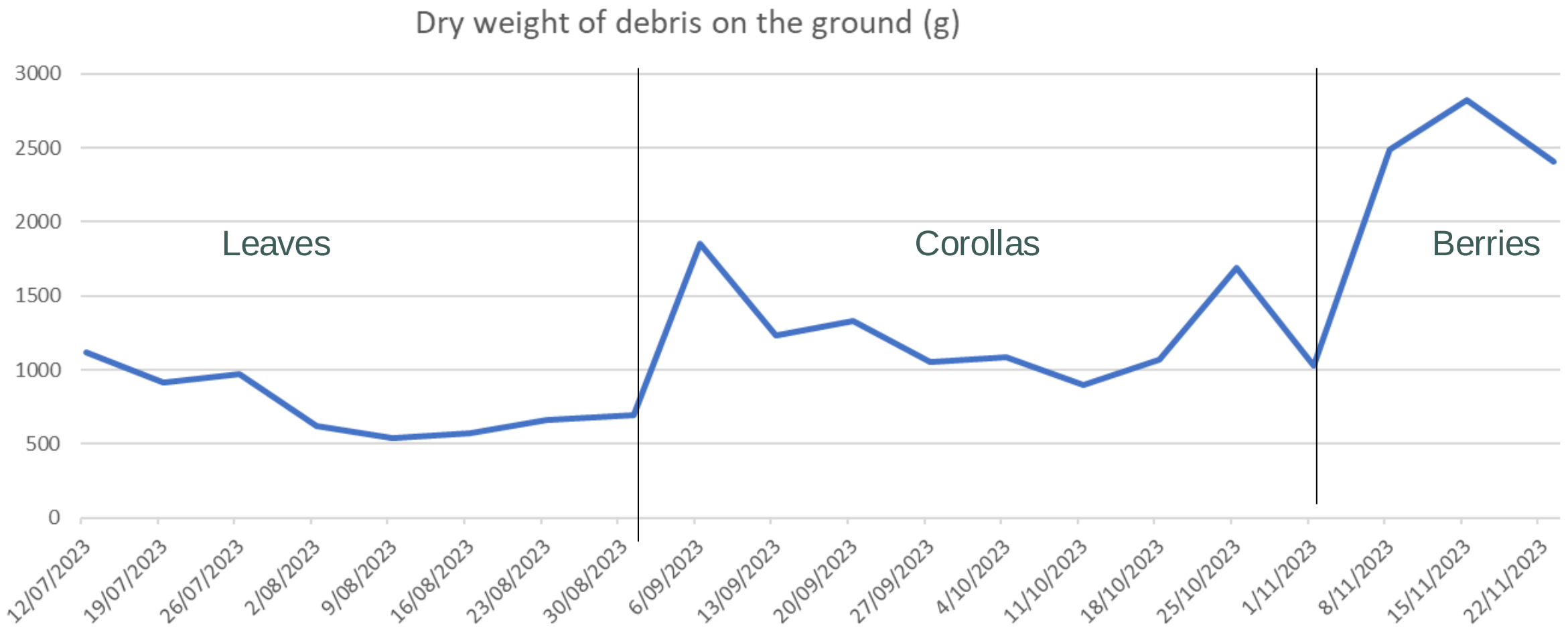
Inoculum removal

- Incubation of corollas, aborted flowers, green berries (surface sterilised), and ripe berries
- Debris dry weights
- Corolla:aborted flower ratios counted



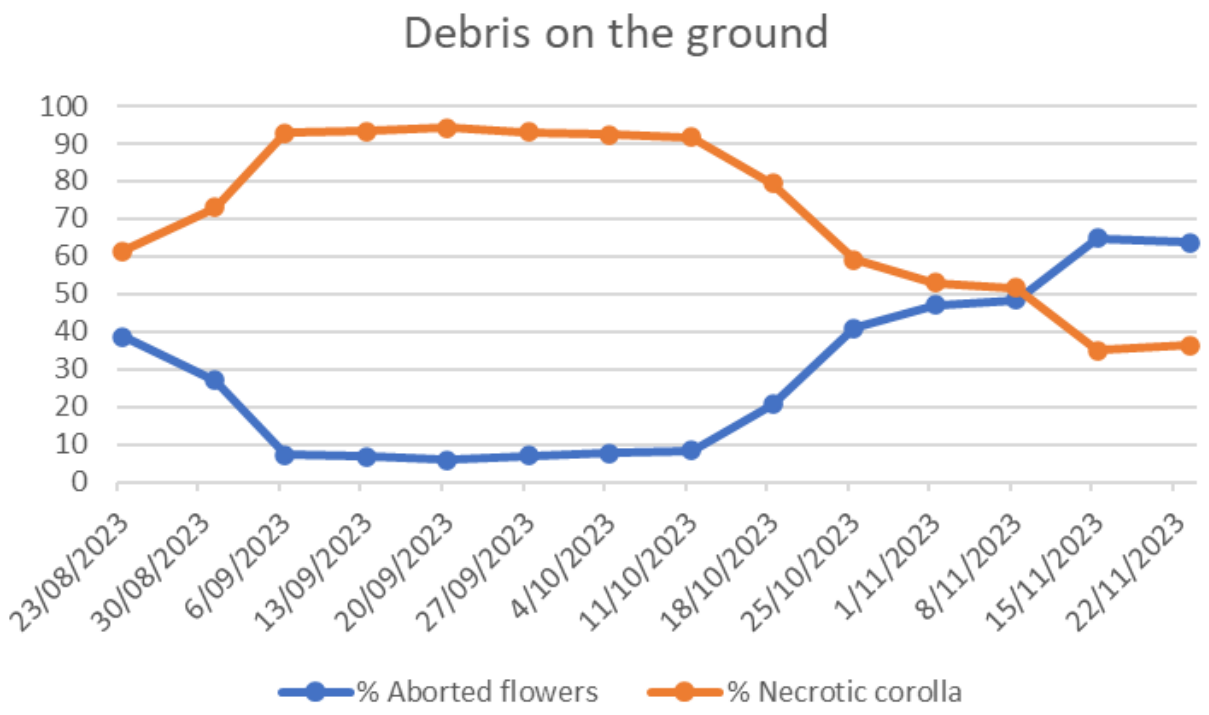
Inoculum removal

- Debris dry weights



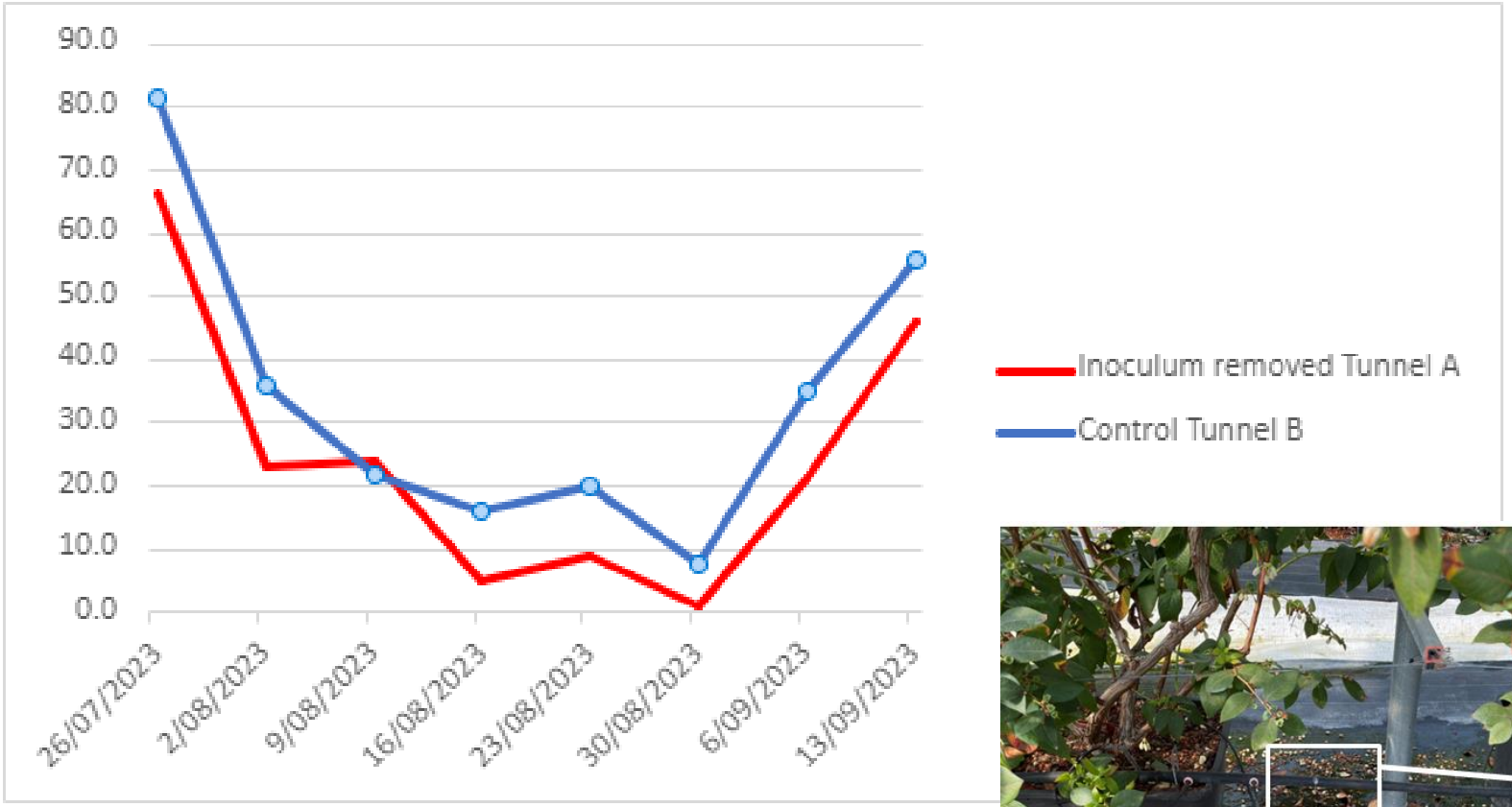
Inoculum removal

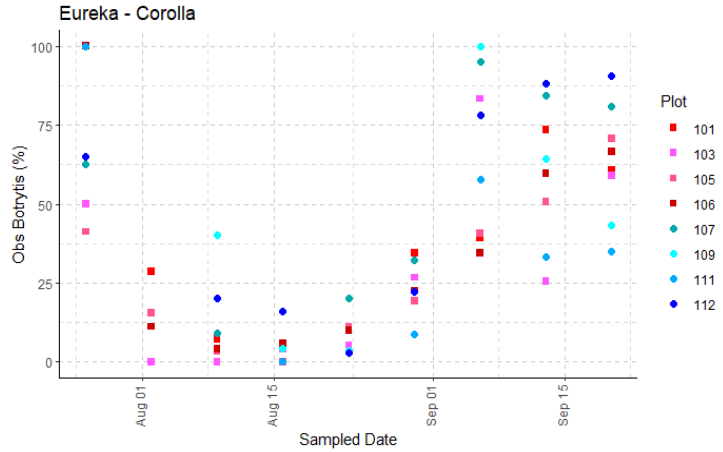
- Corolla:aborted flower ratios counted



Inoculum removal

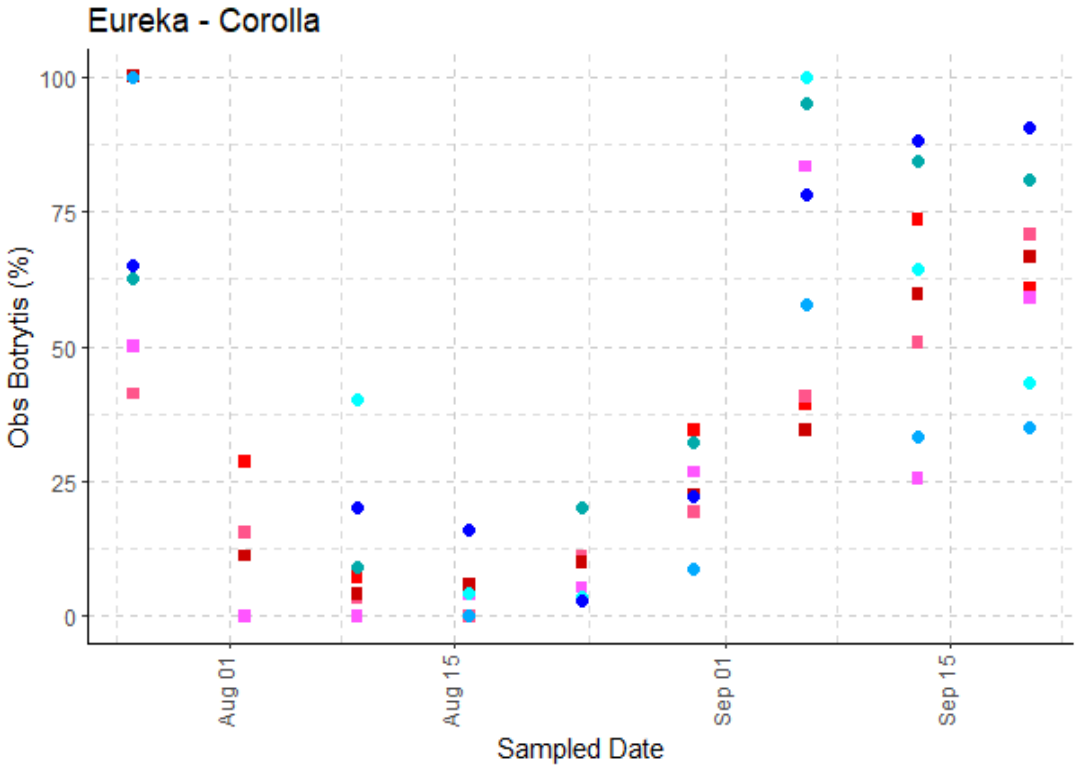
- Corolla colonisation (%) by *Botrytis cinerea* after 5 days incubation

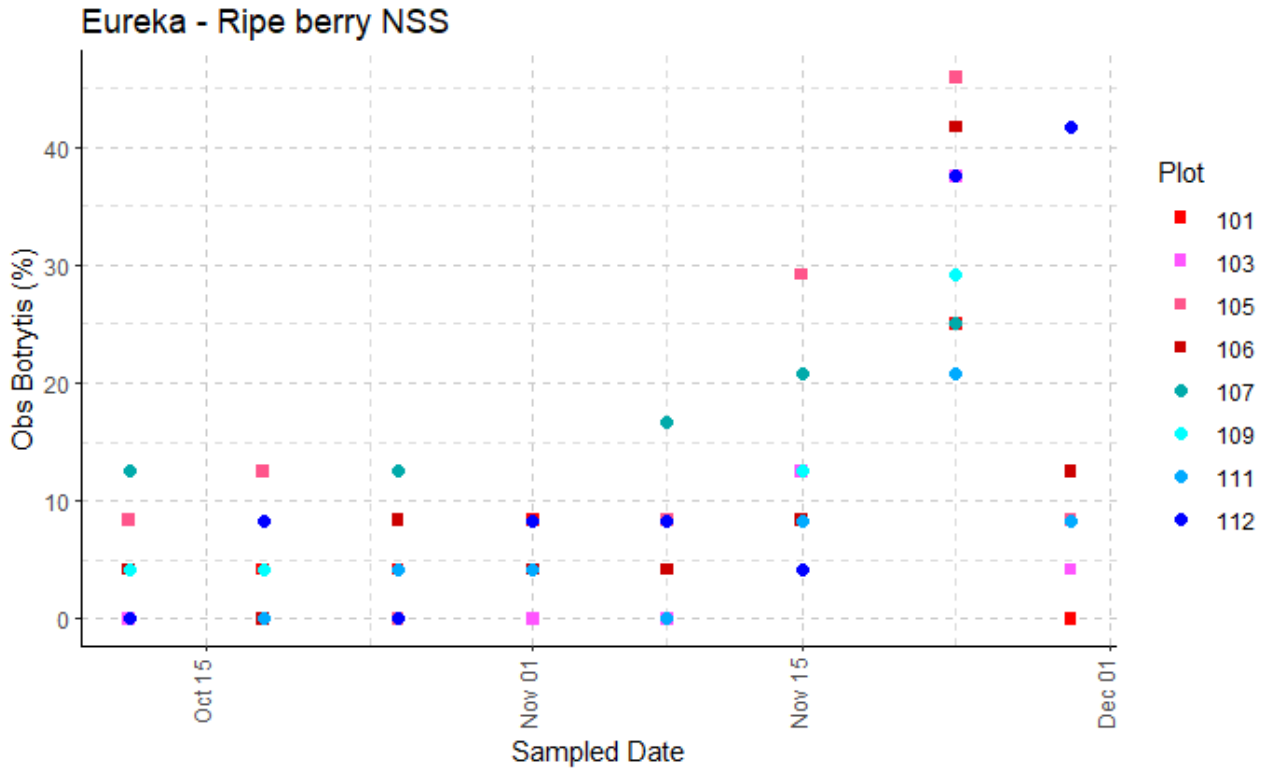




Inoculum removal

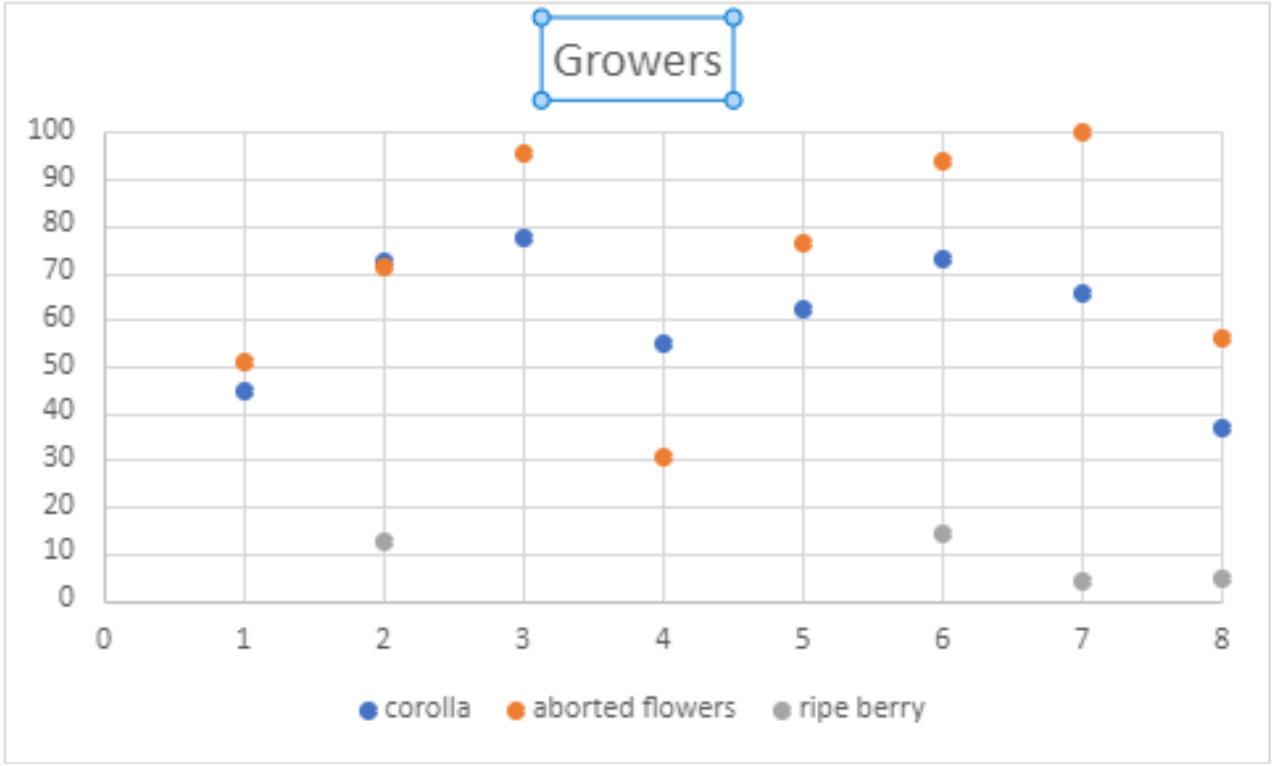
- Corolla colonisation (%) might be predictive of ripe berry infections
- Removing inoculum broke the link between corolla and ripe berry infection

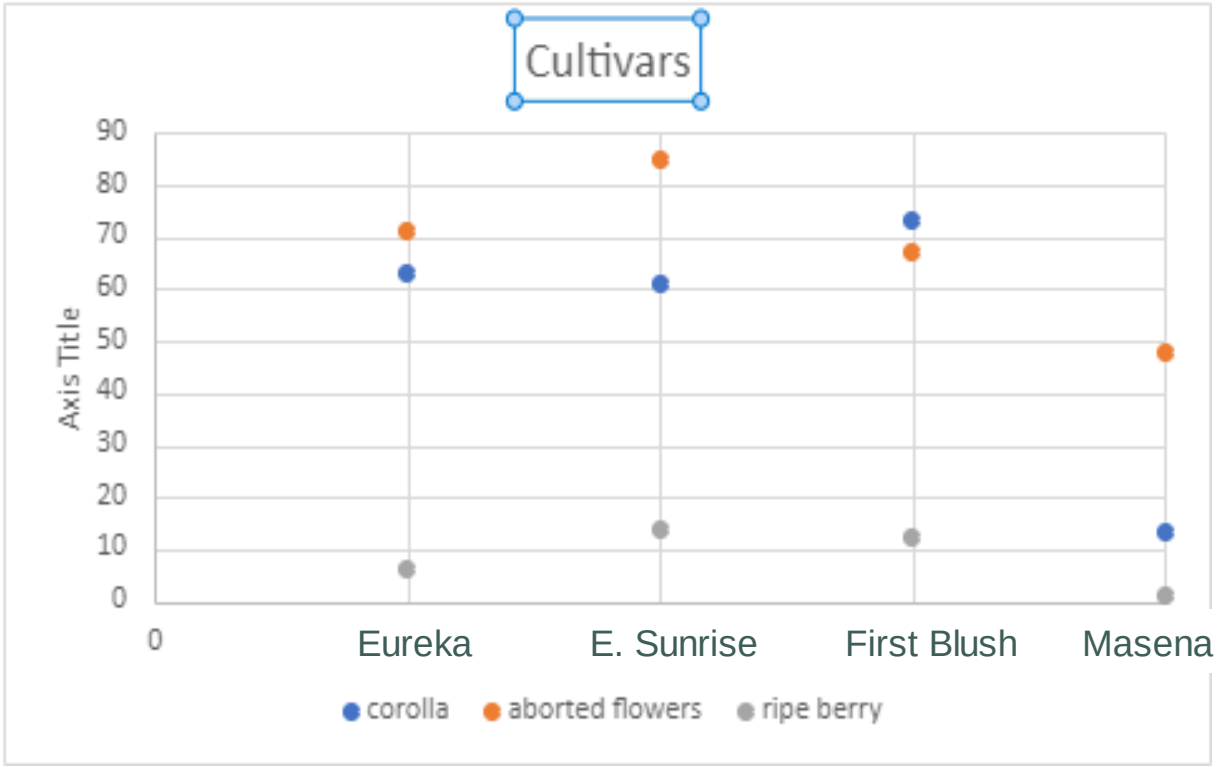




Observational data

- *Botrytis cinerea* colonisation (%) on tissues collected from 8 grower properties and four cultivars





Inoculum control – key findings

- Corolla infections increase over time, so do green berry and ripe berry infections (but at a lower rate @ 5x less)
- Corolla-ripe berry infection relationship
- Wet patches from irrigation/fertigation run-off contribute to increased *Botrytis* sporulation
- Flower abortion was prevalent - *The highest count of symptomatic tissues/plant (in the canopy) was 975 (25 Oct 2023). Average max Tunnel A was 47 and Tunnel B 525, first count 13 Sep both stated at 3-5/plant*
- Sweeping causes spore clouds (inverted leaf blower) for vacuum might be more user and plant friendly
- Humidity in the tunnels is high and therefore conducive to *Botrytis* development – use of fans ….?
- 'Low' ripe berry infections compared to previous seasons

- Sanitation, wetness management and humidity control are key tools in disease management and reducing spore production potential

Experiments

Three experiments

1. Inoculum removal
2. **Spray trial**
3. Berry collapse

- 8 treatments: product and application frequency

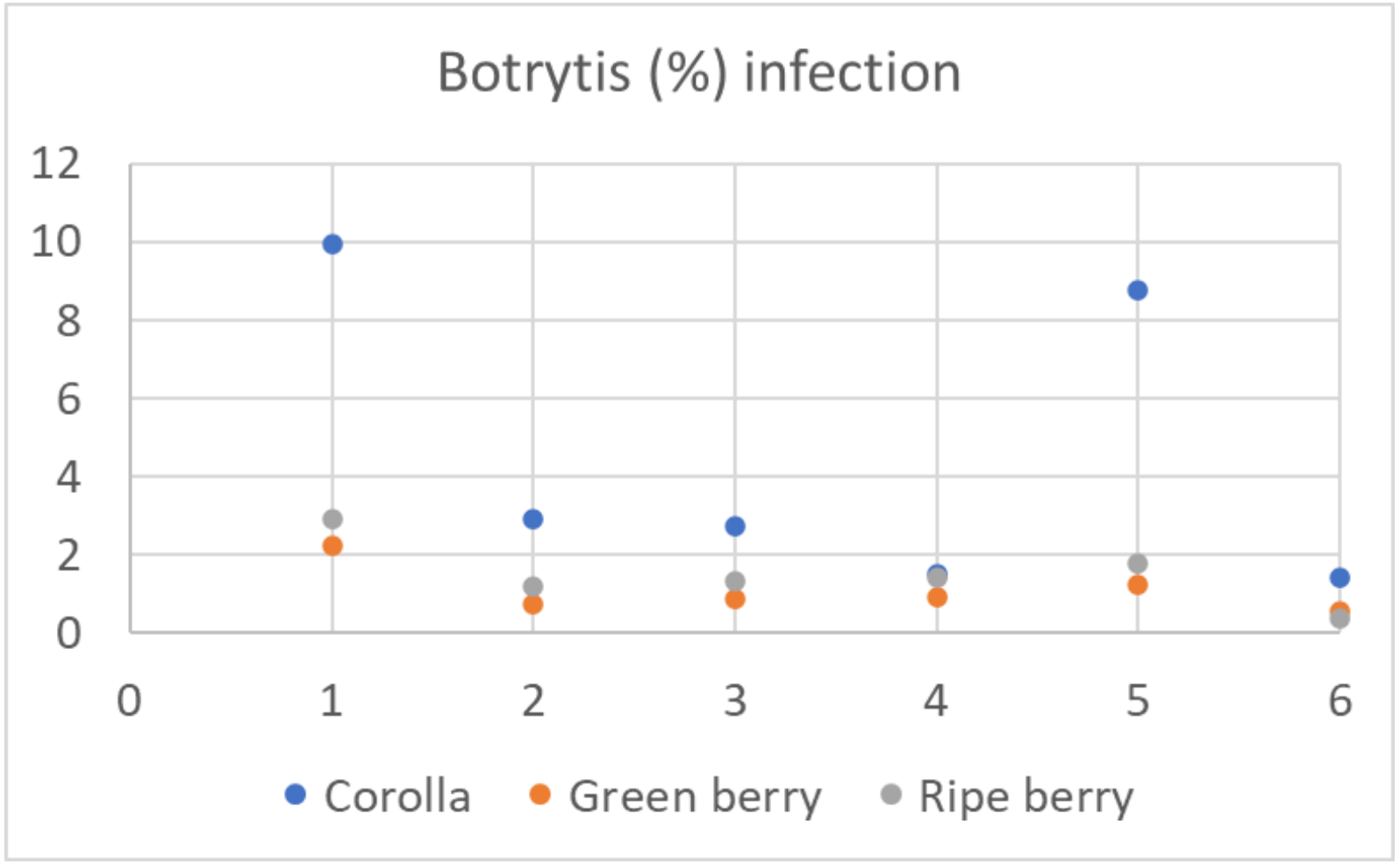
Photo David Holmes

Spray Trial Treatments

	Sampling Timing	Corollas (25 Jul – 11 Sep)							Green berries (11 Sep – 23 Oct)						Ripe (blue) berries (6 Nov – 11 Dec)			
	Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
	Application date	25-Jul	1-Aug	8-Aug	15-Aug	23-Aug	29-Aug	5-Sep	12 Sep	19-Sep	26-Sep	3-Oct	10-Oct	17-Oct	24-Oct	31-Oct	7-Nov	14-Nov
TRT#																		
1	Unsprayed	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
2	Unsprayed (2)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3	14 day, grower standard	P	-	S	-	P	-	S	-	E	-	E	-	E	-	C	-	C
4	7 day, grower standard (2x Switch)	P	C	S	C	P	C	S	C	E	C	E	C	E	C	C	C	C
5	7 day, grower standard (1x Switch)	P	C	-	C	P	C	S	C	E	C	E	C	E	C	C	C	C
6	7 day, Kenja	P	C	K	C	P	C	S	C	E	C	E	C	E	C	C	C	C
7	7 day, Armour-Zen	P	C	AZ	AZ	AZ	AZ	AZ	AZ	AZ	AZ	AZ	AZ	AZ	AZ	AZ	AZ	AZ
8	3-4 day, grower standard	P, C	C, C	S, C	C, C	P,-	C, C	S, C	C, C	E, C	C,-	E, C	C, C	E, C	C, C	C, C	C, C	C, C

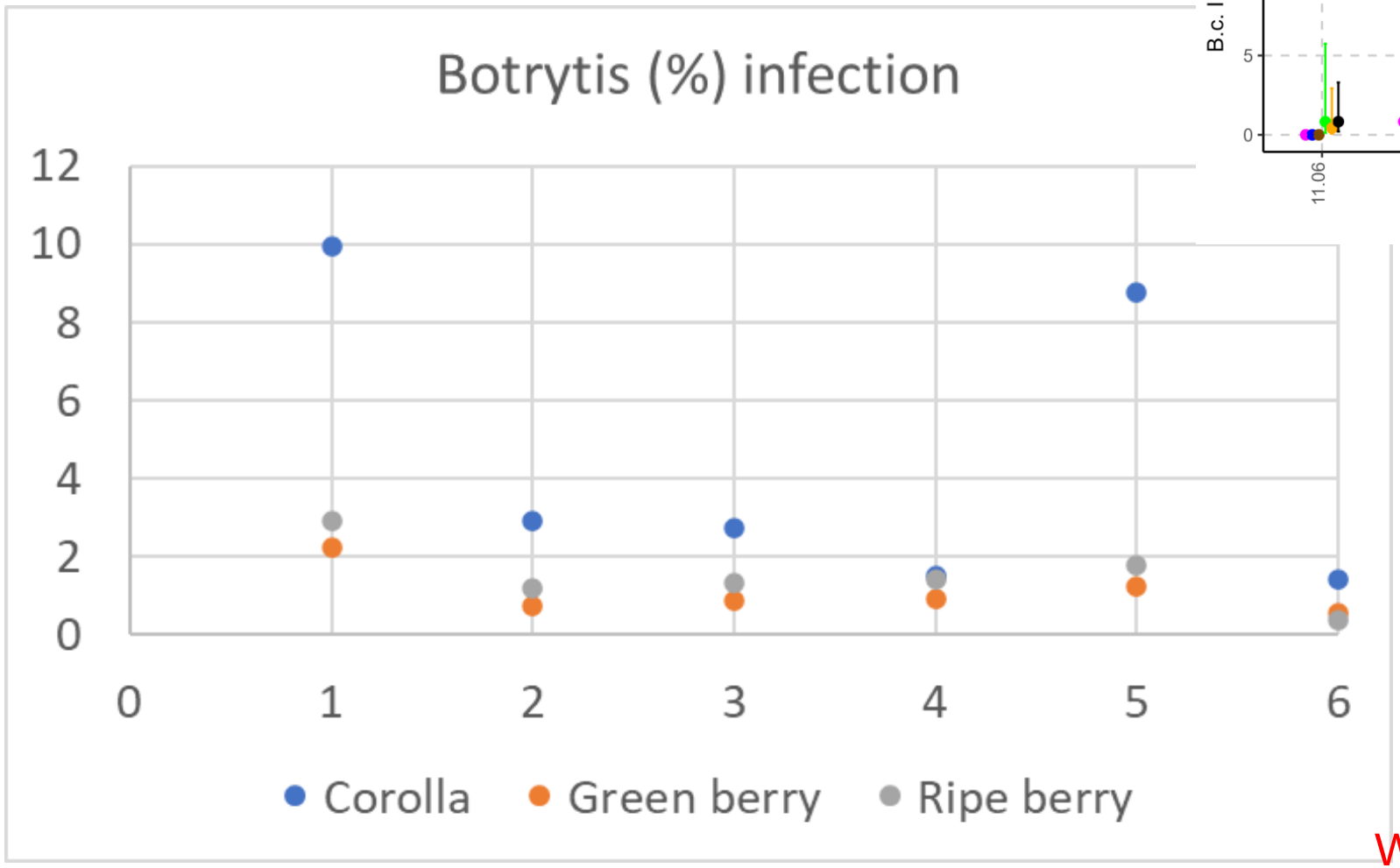
P=Pristine® (BASF), C=Captan 600 Flo® (Nufarm), S=Switch® (Syngenta New Zealand), K=Kenja® (UPL), E=Esteem® (Arxada New Zealand), AZ= Armour-Zen® (Botryzen).

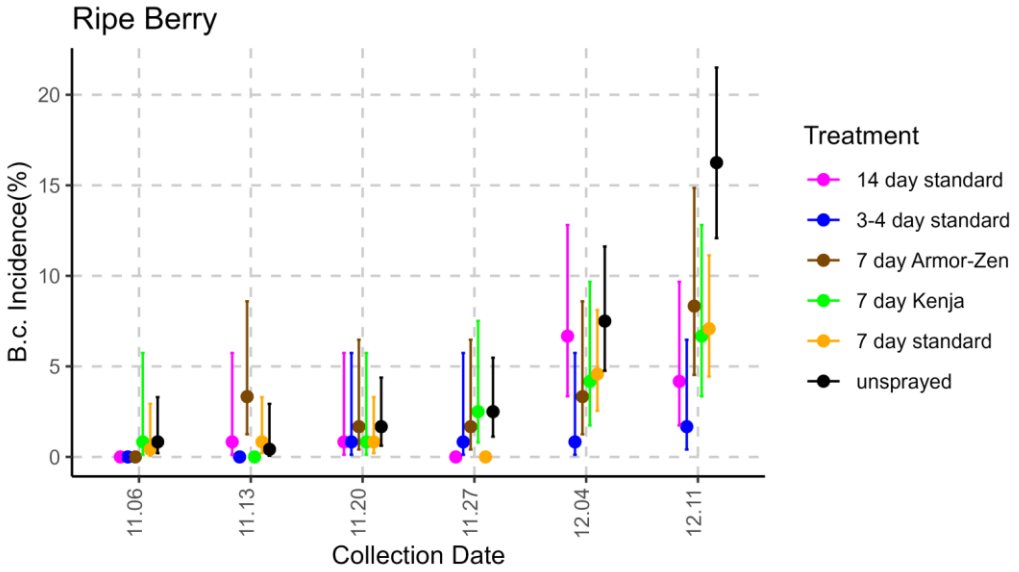
Spray trial - *Botrytis cinerea* tissue infections



1 = unsprayed
2 = 14 day standard
3 = 7 day standard
4 = 7 day Kenja
5 = 7 day Armour-Zen
6 = 3-4 day standard

Spray trial
Botrytis cinerea tissue infections





1 = unsprayed
2 = 14 day standard
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4 = 7 day Kenja
5 = 7 day Armour-Zen
6 = 3-4 day standard

Why do we have low Botrytis?

Spray trial – key findings

- Low *Botrytis* infections in ‘Masena’
- Ripe berry infections increased in all treatments during harvest 6 Nov to 11 Dec, the least in the 3-4 day interval spraying
- Green berry infections provided a good baseline for predicting minimum ripe berry infections

- In a low-risk year and a low risk cultivar - a 14 day spray interval could be adequate
- In a low risk year and a high risk cultivar - would a 7 day spray intervals be adequate for *Botrytis* management?
- In a high risk year and a high risk cultivar - how many sprays would be needed?
- What does an integrated disease management programme look like?

Experiments

Three experiments

1. Inoculum removal
2. Spray trial
3. **Berry collapse**

- Yieldia packhouse separating into premium, River run, and reject fruit

Photo Annie Reid

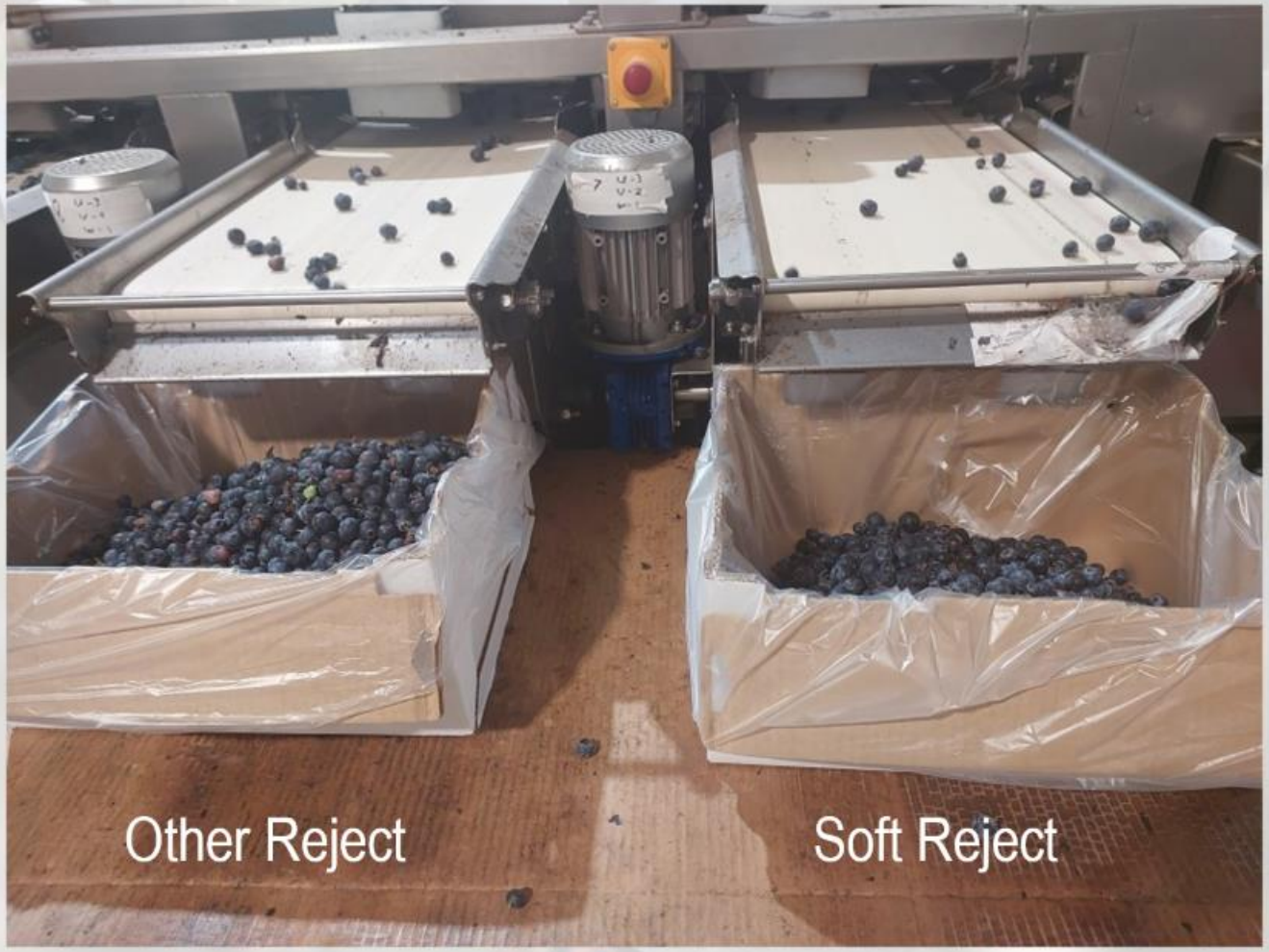
Berry Collapse – Orchard Sample Collection

Grower	Variety	Date Sampled		
1	Sunrise	11/11/2023		
1	Eureka	11/11/2023	17/11/2023	23/11/2023
1	Masena	11/11/2023	17/11/2023	23/11/2023
2	Eureka	11/11/2023	17/11/2023	23/11/2023
2	Masena	11/11/2023	17/11/2023	23/11/2023

Berry Collapse – Packhouse Sample Collection

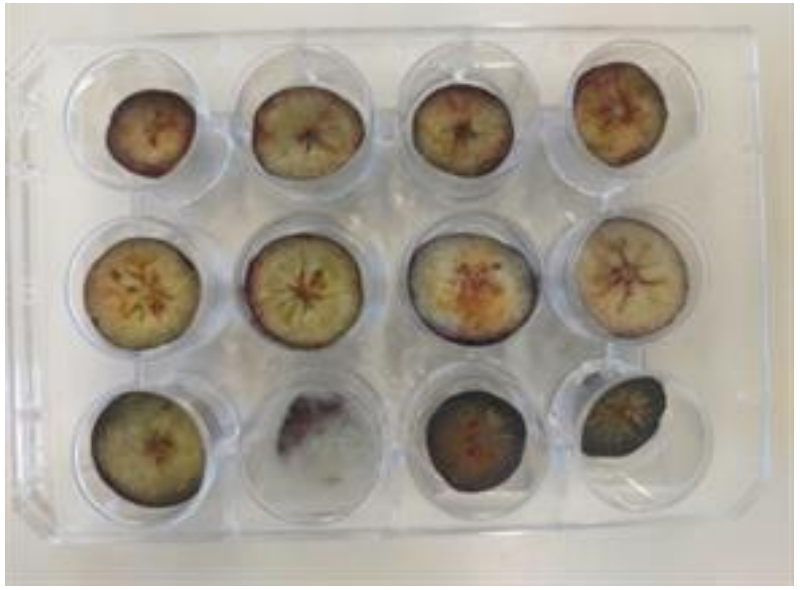
Grower	Class	Variety	Arrived At Yeildia	Processed at Yeildia
2	General Reject	Masena	*	21/11/2023
1	Other Reject	Mixed	20/11/2023	22/11/2023
			23/11/2023	24/11/2023
			24/11/2023	27/11/2023
			4/12/2023	5/12/2023
1	Soft Reject	Mixed	20/11/2023	22/11/2023
			23/11/2023	24/11/2023
			24/11/2023	27/11/2023
			4/12/2023	5/12/2023
1	River Run	Mixed	20/11/2023	22/11/2023
			24/11/2023	27/11/2023
			4/12/2023	5/12/2023
1	Premium	Mixed	20/11/2023	22/11/2023
			24/11/2023	27/11/2023
			4/12/2023	5/12/2023

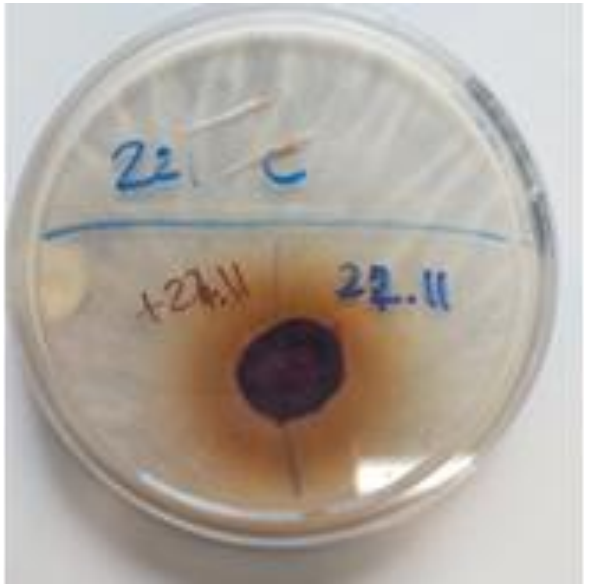
* Date unknown



Berry collapse – what we did

- Collect fruit
- Sort into four berry types: pink, regular/ripe, soft and collapsed berries
- Brix, firmness and interior browning
- Surface sterilise (SS) and not surface sterilised (NSS)
- Incubate each berry type, SS, in a titre plate, on agar and on a tray to study *Botrytis* colonisation
- Incubate regular type, NSS, on a tray for *Botrytis* disease expression





Berry collapse – what we found

	Berry type	B.c. % Titre	B.c. % Agar	B.c. % SS	B.c. % NSS	Browning score
Yieldia	Pink	0	0-25	10	11	1.1
	Regular	0-56	0-50	14-35	2-13	1.5
	Soft	1-25	1-50	34	33	2.0
	Collapsed	33-100	100	56	95	3.8
Orchard	Pink	1-9	0	-	-	1.0
	Regular	2-5	4-9	2-11	8-29	1.5
	Soft	4-20	12-22	-	-	1.8
	Collapsed	50-100	25-100	-	-	3.5

Eureka Sunrise > Eureka > Masena (10, 5, 1 for SS; 29, 22, 8 for NSS)

Berry collapse – key findings

- Lowest *Botrytis* infections in ‘Masena’
- Highest *Botrytis* infection in collapsed fruit followed by soft, River run, regular, premium and pink/unripe fruit.
- Not all collapsed berries developed *Botrytis*
- Not all ‘brown’ fruit developed *Botrytis*
- Surface sterilisation increased post harvest shelf life (less *Botrytis* than NSS berries)
- Spore surface contamination is a large contributor to berry rot

- Berry damage during harvest/post harvest handling, plus surface contamination and spore re-distribution, lack of quick chilling all contribute to speed of berry rots
- Other rots found included *Aspergillus, Penicillium, Rhizopus, Phoma* and yeasts
- Collapsed fruit is not solely caused by pathogens

Recommendations

- Remove/vacuum your corollas and aborted flowers from plants and ground
- Avoid wetness on the ground
- Control humidity via fans or ventilation
- I don’t believe we can spray our way out of high risk years and high risk cultivars
- Ensure good spray coverage
- Look out for other rots
- The time from picking to cooling should be 30 min or less
- Avoid unnecessary fruit handling
- Avoid temperature fluctuations
- Avoid overripe fruit
- Understand latent infections (arising from flowering) vs spore contamination at harvest
- I feel, integrated disease management guidelines for under cover blueberries would be beneficial, including decision support systems. Guidelines should account for regional and cultivar differences

Acknowledgements

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