

# Managing Apple Fruit Rots in Ohio

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2020 OHIO PRODUCE NETWORK

JANUARY 22 2020

# SUMMER FRUIT ROTS

- Bitter Rot
- White Rot
- Black Rot
- Brown Rot



# Bitter Rot

- *Colletotrichum* species complex

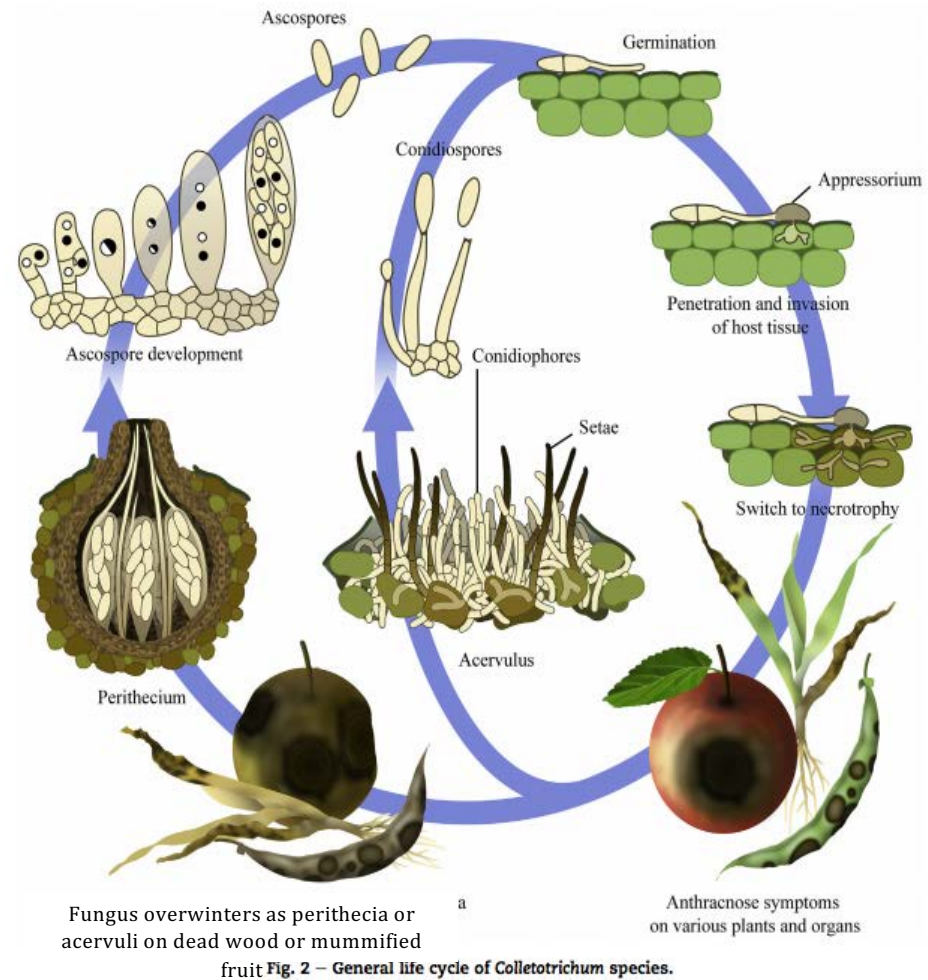
- *C. gloeosporioides* (Cg)
- *C. acutatum* (Ca)

- Ohio has isolates of *C. siamense* and *C. chrysophilum* (Cg complex)



Optimal conditions for infection:

- Rainfall
- High temperature (80-90F)
- High humidity (80-100%)



# White Rot (Bot Rot)

- *Botryosphaeria dothidea*
- Canker



# White Rot (Bot Rot)

- *Botryosphaeria dothidea*
- Canker



cv. Honey Crisp (2019)

# Black Rot

- *Botryosphaeria obtusa*
- Leaf spot (frogeye leaf spot)
- Canker



# Black Rot

- *Botryosphaeria obtusa*
- Leaf spot (frogeye leaf spot)
- Canker

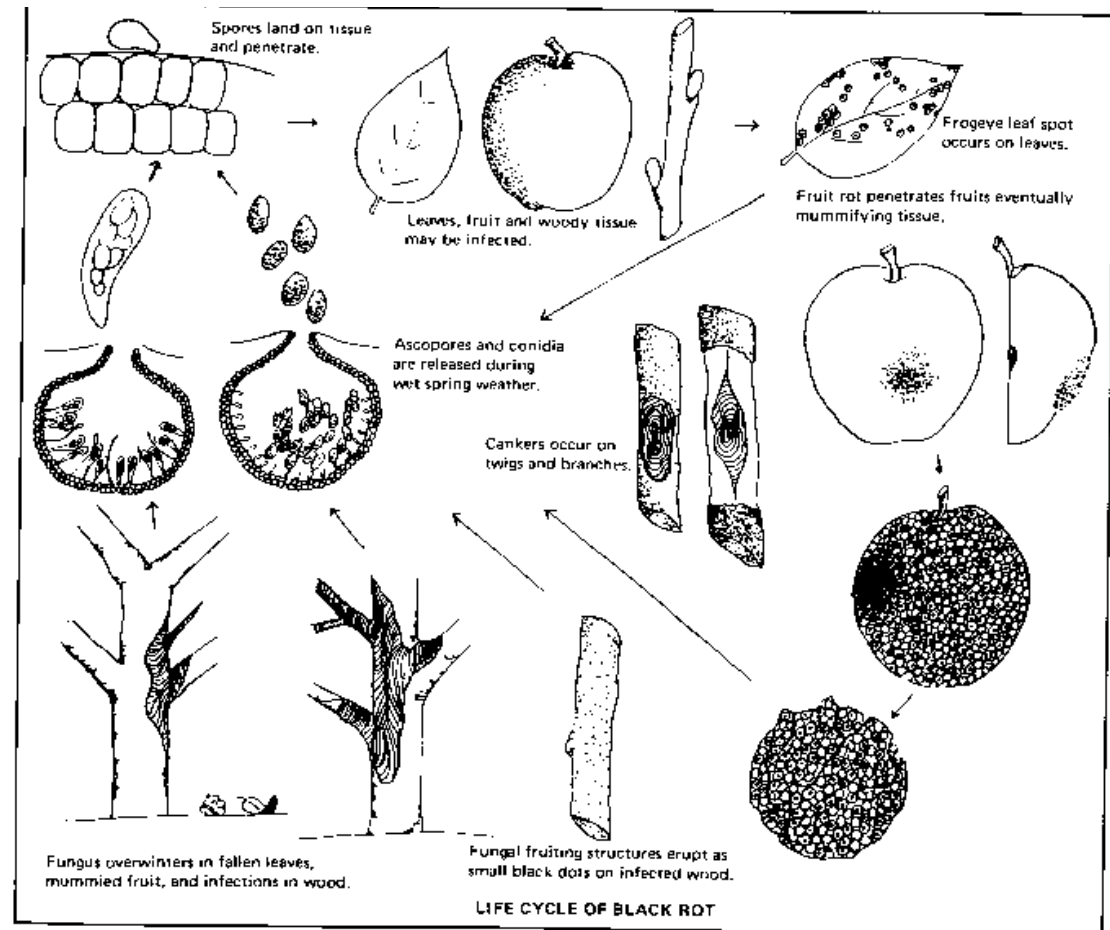


Optimal conditions for **Black Rot** infections:

- Moderate temperature (68-75 F)
- Leaf wetness for 9 hours or more

Optimal conditions for **White Rot** infections:

- High temperature (80-90 F)
- Leaf wetness for 5 hours or more



# Brown Rot

- *Monilinia fructicola*
- *Monilinia fructigena*

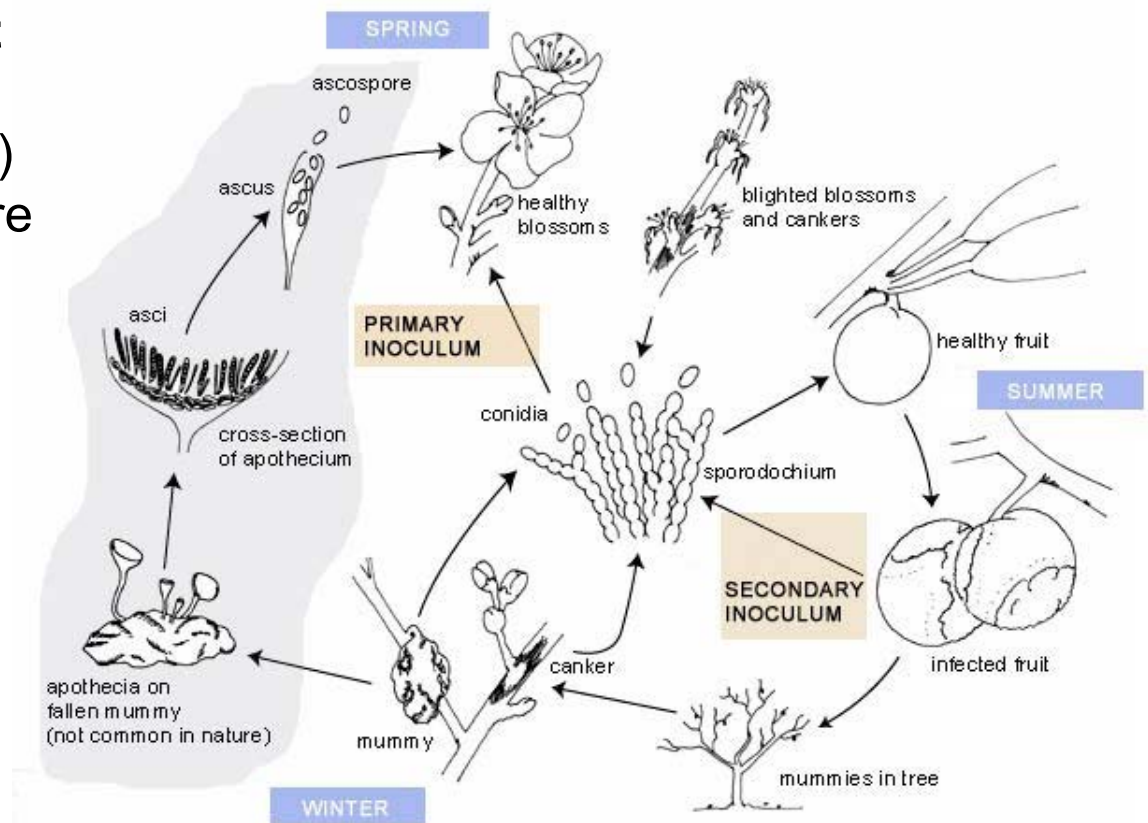


Brown rot on Apple 'Coronation', early September.  
Alan Buckingham



## Optimal conditions for **Brown Rot** infections:

- Moderate temperature (68-77 F)
- Leaf wetness for 3 hours or more



*Drawing courtesy Vickie Brewster*

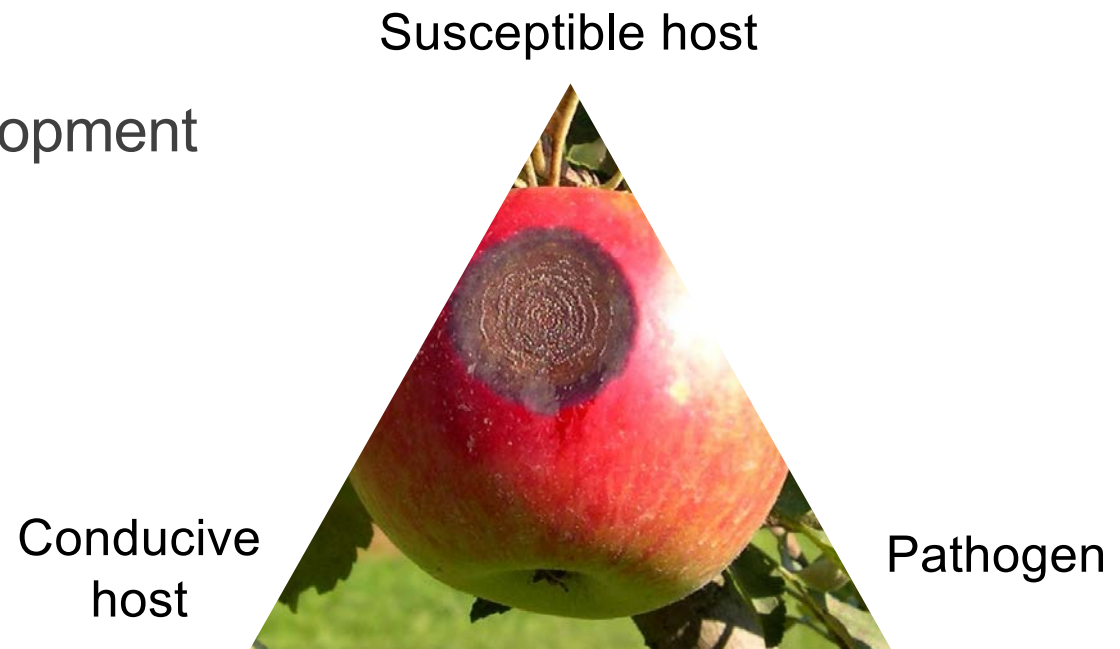
# Key Characteristics of Fruit Rot Diseases

Characteristic	Bitter Rot	White Rot	Black Rot	Brown Rot
Requires a wound to penetrate fruit skin	X	✓	✓	✓
Leaf spots	X	X	✓	X
Cankers on apple wood	X	✓	✓	✓
Overwinter on mummies	✓	✓	✓	✓
Overwinter on dead wood	✓	✓	✓	X
Overwinter on dead leaves	X	X	✓	X

# Fruit Rot Incidence Increasing in Midwest and Northeastern United States

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- Changing climate
- Fungicide resistance development
- New varieties/orchard management



# Fungicide Sensitivity Testing for Bitter Rot in Pennsylvania

FRAC	Fungicide target	Active ingredients	Notes	
1	$\beta$ -tubulin assembly	Thiophanate-methyl —	Resistance present 🗨️	• Topsin
7	Succinate Dehydrogenase Inhibitors (SDHIs)	<b>Benzovindiflupyr</b> 👍 Fluxapyroxad 🗨️ Fluopyram 🗨️	Mostly insensitive Mostly insensitive	• Sercadis, Merivon, Luna products
9	Methionine biosynthesis inhibitors	Pyrimethanil 🗨️ Cyprodinil 🗨️	Mostly insensitive Mostly insensitive	• Luna Tranquility, Inspire Super
11	Inhibition of cytochrome-b at Qol site	<b>Pyraclostrobin</b> 👍 Trifloxystrobin 🗨️ Kresoxim-methyl 🗨️	Resistance present 🗨️ Mostly insensitive Mostly insensitive	• Cabrio, Pristine, Merivon, Flint Extra, Sovran
12	Osmotic signal transduction	<b>Fludioxonil</b> * 👍	*Post-harvest for apples	
29	Uncoupler of oxi. Phos.	Fluazinam* 👍	*Low dose field trials 🗨️	

Table courtesy of P. Martin and K. Peter, 2020

# Production and Variety Changes

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- Up to 50% more apples per acre in high density plantings
- New varieties being developed with varying characteristics



# Susceptibility of Apple Fruit to Fungal Fruit Rot Diseases

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- Evaluated 12 to 14 varieties against four pathogens
- Measured Brix and skin thickness (2019)



Wounded +  
Inoculated

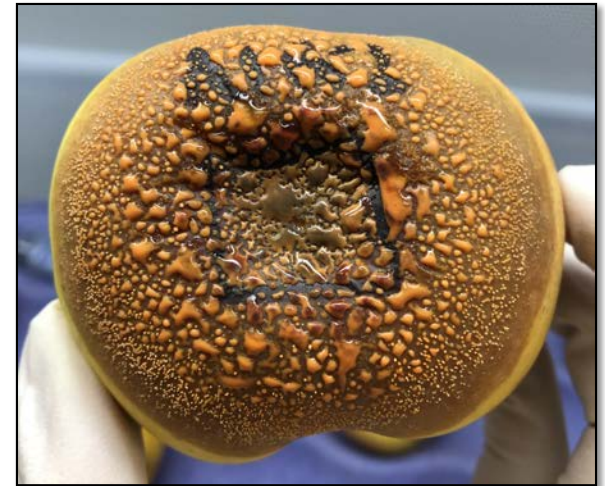
Non-wounded +  
Inoculated

Wounded

Non-treated  
Control

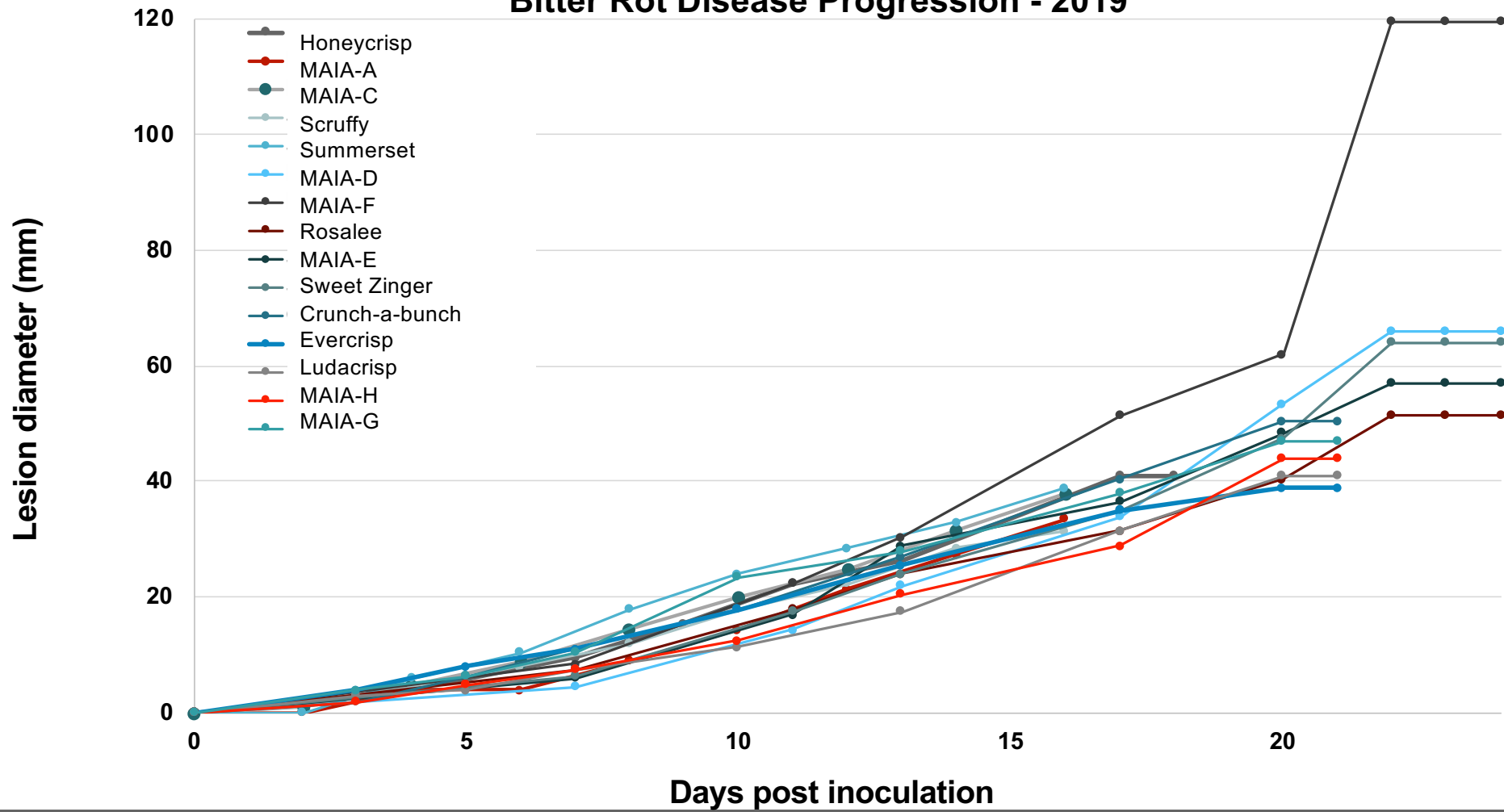
# Bitter Rot Lesion Progression

Variety	Percent Fruit Infected	Ave Temp Range (F)
Honeycrisp	6.43	67.5 to 70 F
MAIA-B	6.59	
MAIA-A	5.05	67 to 71 F
Scruffy	4.64	
MAIA-C	5.26	
Summerset	6.78	
Ludacrisp	7.74	68.5 to 72.8
MAIA-H	8.47	
Evercrisp	5.63	
Crunch-a-bunch	12.53	
MAIA-G	7.36	
MAIA-D	18.39	61.8 to 72.5
Rosalee	12.29	
Sweet Zinger	25.80	
MAIA-E	17.91	
MAIA-F	89.12	



- Optimal temperature 80-90F

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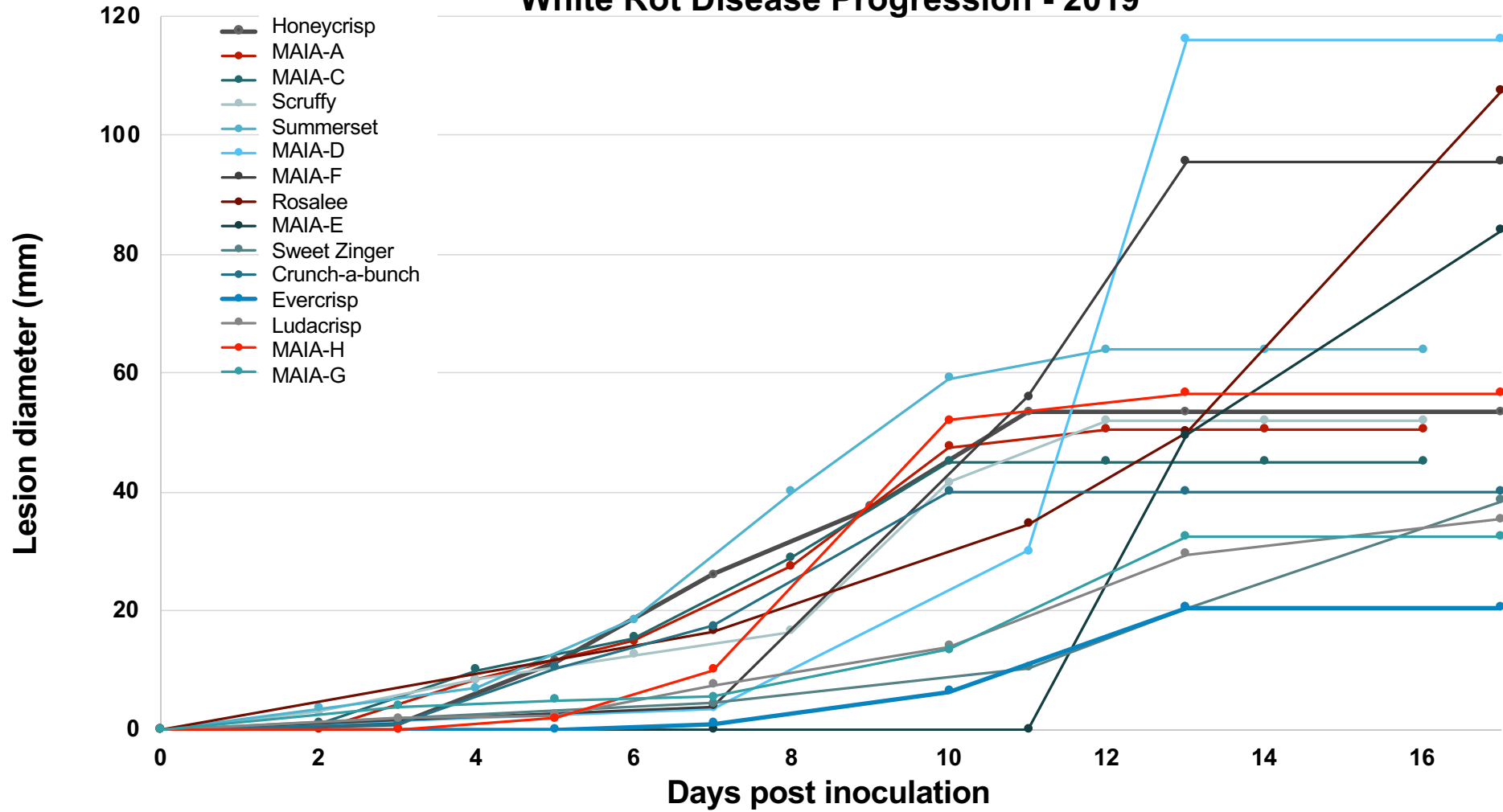


# White Rot Lesion Progression

Variety	Proportion of Fruit Size	Ave Temp Range (F)
MAIA-B	13.07	67.5 to 70 F
Honeycrisp	14.62	
Summerset	16.65	67 to 71 F
MAIA-C	10.00	
MAIA-A	12.91	
Scruffy	14.11	
Evercrisp	2.62	68.5 to 72.8
MAIA-G	4.94	
Ludacrisp	7.28	
Crunch-a-bunch	7.73	
MAIA-H	15.28	
Sweet Zinger	13.09	61.8 to 72.5
MAIA-E	48.19	
MAIA-F	61.85	
Rosalee	77.99	
MAIA-D	93.21	



- Optimal temperature 80-90 F



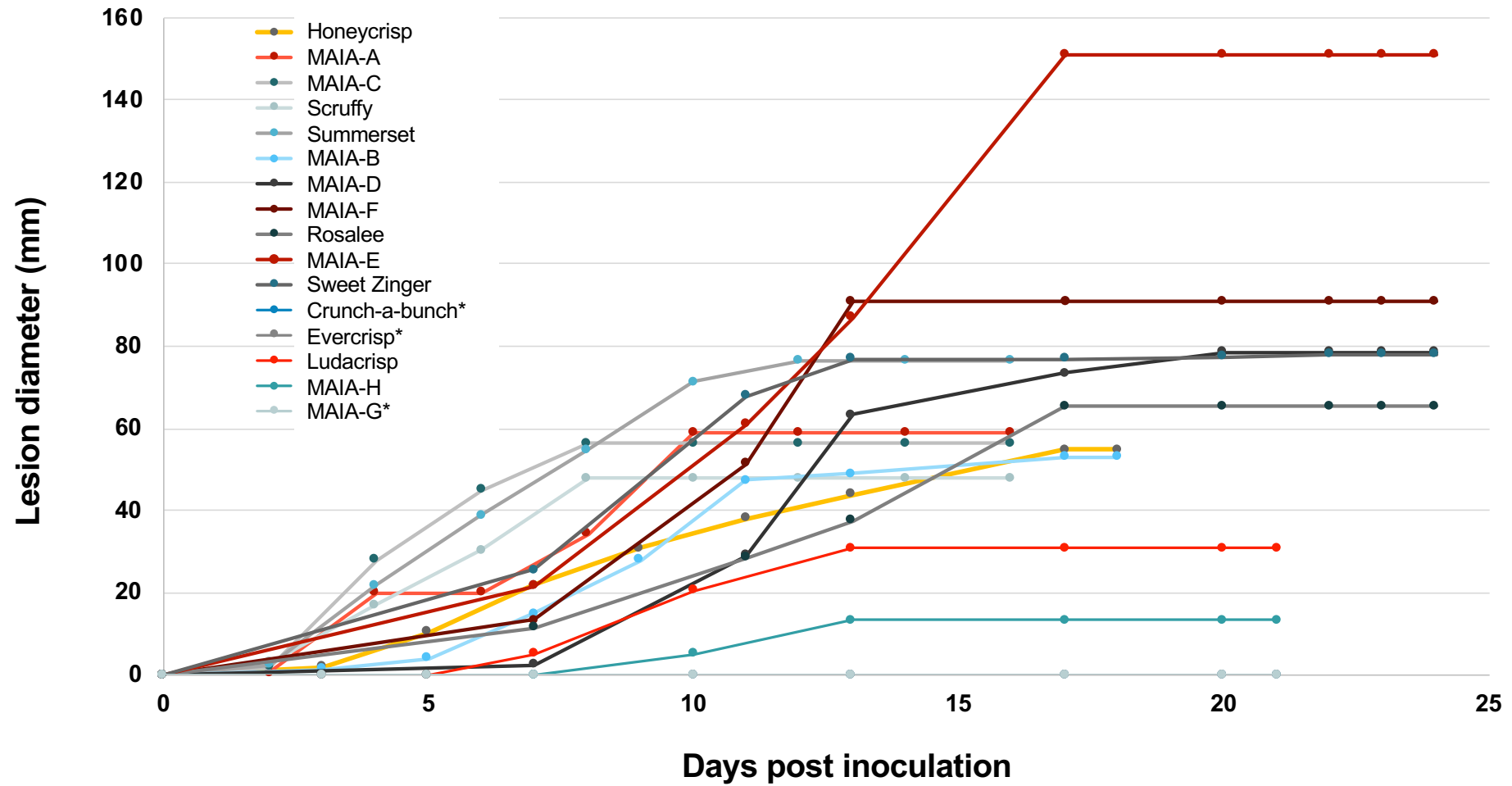
# Brown Rot Lesion Progression

Variety	Proportion of Fruit Size	Ave Temp Range (F)
MAIA-B	14.62	67.5 to 70 F
Honeycrisp	12.79	
Summerset	21.06	67 to 71 F
MAIA-C	18.90	
MAIA-A	15.92	
Scruffy	12.42	
Evercrisp	0.0	68.5 to 72.8
MAIA-G	0.0	
Ludacrisp	10.29	
Crunch-a-bunch	0.0	
MAIA-H	3.30	
Sweet Zinger	50.84	61.8 to 72.5
MAIA-E	100.00	
MAIA-F	58.41	
Rosalee	46.34	
MAIA-D	48.48	



- Optimal temperature 80-90 F

## Brown Rot Disease Progression - 2019



# Managing Bitter Rot by Mummy Removal

- On farm study using Honeycrisp
  - Significant losses due to bitter rot in 2018
- Four treatments for mummy removal
  - Physically dropped to ground
  - Dropped and removed from the orchard
  - Chemically dropped to ground
  - No removal
- Fungicides applied to all treatments



# Mummy and Bitter Rot Incidence 2019

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Treatment	Average No. Mummies/Tree		Avg Harvested Healthy Fruit (lb/tree)	Percent Bitter Rot
	Spring	Fall		
Physically Dropped	6.23	13.25	33.70	0.06
Dropped and Removed	6.70	21.5	30.30	0.20
Chemically* Dropped	8.98	14.25	17.28	0.58
No removal	39.53	38.5	15.54	0.32

\*Sulfur mixture applied 5/22/19



# ACKNOWLEDGEMENTS