Improvement of Ontario hazelnut cultivars focusing on winter hardiness and pest tolerance, with an emphasis on management of Eastern filbert blight

Dr. Katerina S. Jordan (PI), John R. Watson M.Sc. (Research Technician), Dr. Asifa Munawar (Research Associate)

March 18, 2026

Ontario Hazelnut Association Symposium

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Agenda

1. Project overview
2. Experimental design and methods
3. HN120 – Spray timing Trial
4. HN220 – Spray efficacy trial
5. Data collected
6. Research findings
7. Acknowledgements
8. Brief question and answer period

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Project Overview

The Special Initiatives (SI) project encompasses the first Ontario-centric trials having a component that specifically investigates disease management and efficacy of fungicides for control of EFB

- Current EFB management practices are based on research in Oregon – this may not be applicable to Ontario, which has a greater number of disease strains present, and, a longer period of wet conditions in the spring
- We established replicated hazelnut trials (pathology orchard) at Simcoe Research Station (SRS) in 2020 that evaluated fungicide efficacy and timings
- The project at SRS addresses part B (EFB Management) of the larger OMAFA SI project that also funded Dr. Zandstra's cultivar trials
- Goals:
    - 1. Evaluate different spray timings for management of EFB in Ontario using a standard fungicide rotation
    - 2. Determine efficacy of fungicides for control of EFB in Ontario to provide information for improving management of EFB
- The fungicide timing and efficacy trials ran 2021-2025

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Some slide content adapted from Melanie Filotas (2021)

Experimental Design and Methods

HN120 – Spray Timing Trial

- Testing a rotation of chlorothalonil (Bravo)and trifloxystrobin (Flint)
- 4 treatments
  - Untreated control
  - 2 sprays applied at BB and 4 wks. post BB
  - Std. practice 4 sprays applied at BB, 2, 4, 6 wks. post BB
  - 6 sprays applied at BB, 2, 4, 6, 8, 10 wks. post BB.
- All trees inoculated in 2021 and 2022 following first spray with EFB pathogen

HN120 Trial Details

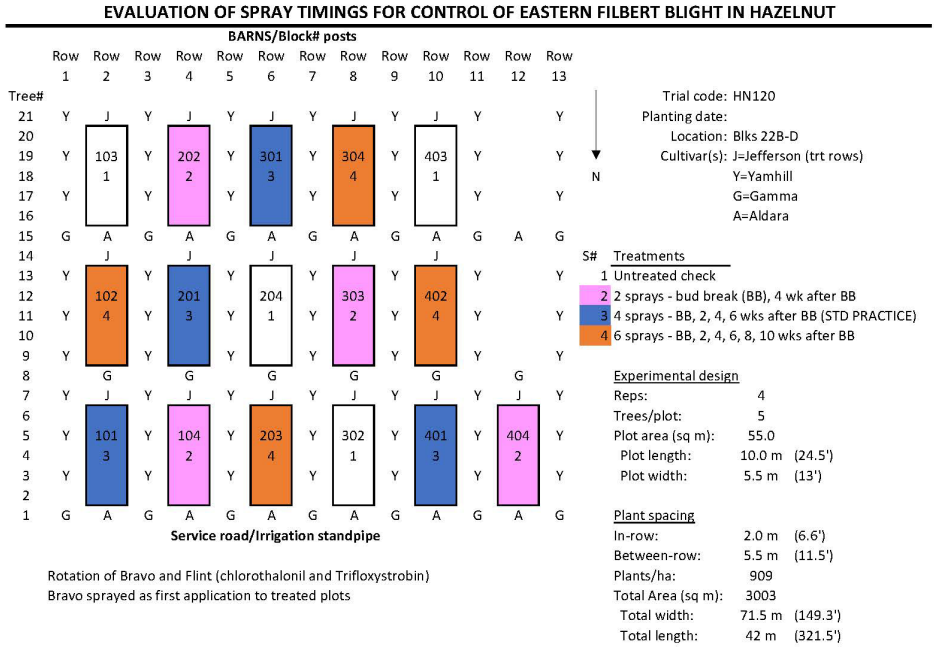

Table for HN120 Timing Trial Treatments – All products registered for use in Ontario

					APPLICATION			
Treatment	**Product**	**Rate (L or g/ha)**	**Details**	**Spray Volume (L/ha)**	**1**	**2**	**3**	**4**
1	Untreated control (Water only)	N/A	Every spray	300				
2	Chlorothalonil*	6.72	Rotate products 2 applications (2x)	300		■	■	■
	Trifloxystrobin	280			■		■	■
3	Chlorothalonil	6.72	Rotate products 4 applications (4x)	300		■		■
	Trifloxystrobin	280			■		■	
4	Chlorothalonil	6.72	Rotate products 6 Applications (6x)	300		■		■
	Trifloxystrobin	280			■		■	

* Chlorothalonil (500 g/L) = Bravo/ZN fungicide; Trifloxystrobin (50% by weight) = Flint 50WG fungicide

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Experimental Design and Methods

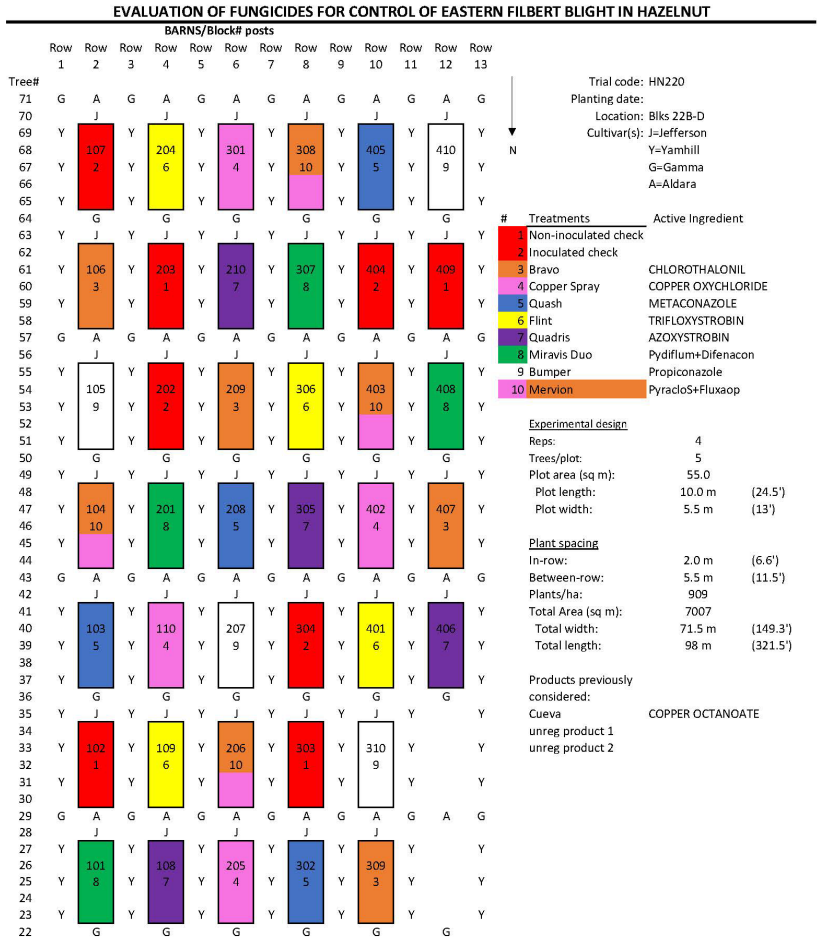
HN220 – Spray Efficacy Trial

- Testing 8 different products for efficacy on EFB
- 10 treatments
  - Un-inoculated, untreated control (natural infection)
  - Inoculated, untreated control
  - 8 fungicide chemistries
  - Std. practice 4 sprays applied at BB, 2, 4, 6 wks. post BB
- All trees (except un-inoculated, untreated control) inoculated in 2021 and 2022 following first spray with EFB pathogen

HN220 Trial Details

Table for HN220 Efficacy Trial Treatments - NOTE: Unregistered products currently not available for use in Ontario are noted as "UNREG"

Treatments	Trade Name	Rate mL or g/ha	Details	Spray Volume (L/ha)
Non-inoculated check	N/A - Water only	0	Spray ~every 14 days from budbreak for eight weeks (four applications total)	300
Inoculated check	N/A - Water only	0		300
Chlorothalonil (500 g/L)	Bravo/ZN	6720		300
Copper Oxychloride (50%)	Copper Spray	9000		300
Metaconazole (480 g/L)	Quash	255		300
Trifloxystrobin (50%)	Flint 50 WG	280		300
Azoxystrobin (250 g/L)	Quadris	900		300
Pydiflumetofen+Difenaconazole (75 g/L + 125 g/L)	Miravis Duo	1000		300
Propiconazole (418 g/L)	Bumper 432EC **UNREG**	585		300
PyracloStrobin + Fluxaop (250 g/L + 250 g/L)	Merivon UNREG	475		300



Data collected in both trials

- Tree circumference (2021, 2022, 2023) - NS – Multi Stem
- Record disease presence (2021-2023) – Good disease development
- Disease incidence (2024, 2025) - number of 'Jefferson' trees in each plot that had disease present
- Disease Severity (2024, 2025) – Rated on a scale of 0-7
    - 0 = no visible EFB cankers
    - 1 = a single small canker, ≤ 1% of tree affected, easily pruned
    - 2 = 2-10% of tree with cankers, still easily manageable with minor pruning
    - 3 = 11-25% tree affected, can be removed with moderate pruning
    - 4 = 26-50% tree affected, still possibly manageable with moderate-extensive pruning
    - 5 = 51-75% tree affected, extensive pruning required
    - 6 = > 75% of the tree affected, disease no longer manageable
    - 7 = tree dead (due to EFB) except for basal suckers

Data collected in both trials - continued

- Crop tolerance to spray applications (all years)
    - None observed in HN120
    - Minor phytotoxicity observed in HN220 (2021, 2022, 2023)
- Nut data
    - Total nut weight per tree (total production)
    - 50 nut subsample from each tree
        - Weight of subsample
        - Average nut weight
        - 50 kernel weight
        - Number of empty kernels per tree

Research findings HN120 Spray timing trial

2021-2023

- No significant differences found for any measures

2024

- Significant differences found in nut data, disease incidence and disease severity

2025

- No significant differences found in nut data.
- Significant differences found in disease incidence and disease severity

HN120 Nut data 2024

Treatment	Average number of nuts per tree	Average total nut weight per tree (g)	Average nut weight (g)		Weight of 50 nut subsample (g)		50 Kernel weight (g)	Average number of empty nuts per tree
UTC	186.5	558.49	2.98	A	149.94	A	45.7	10.5
2-Sprays	233.01	688.19	2.87	B	148.43	AB	44.99	9.95
4-Sprays	202.12	607.09	2.93	AB	154.24	A	48.94	6.72
6-Sprays	194.92	508.22	2.65	C	133.91	B	51.6	4.39
	NS	NS	0.03		4.73		NS	NS

* NS= no significance within column; nut data within each column with different letter groupings are statistically different.

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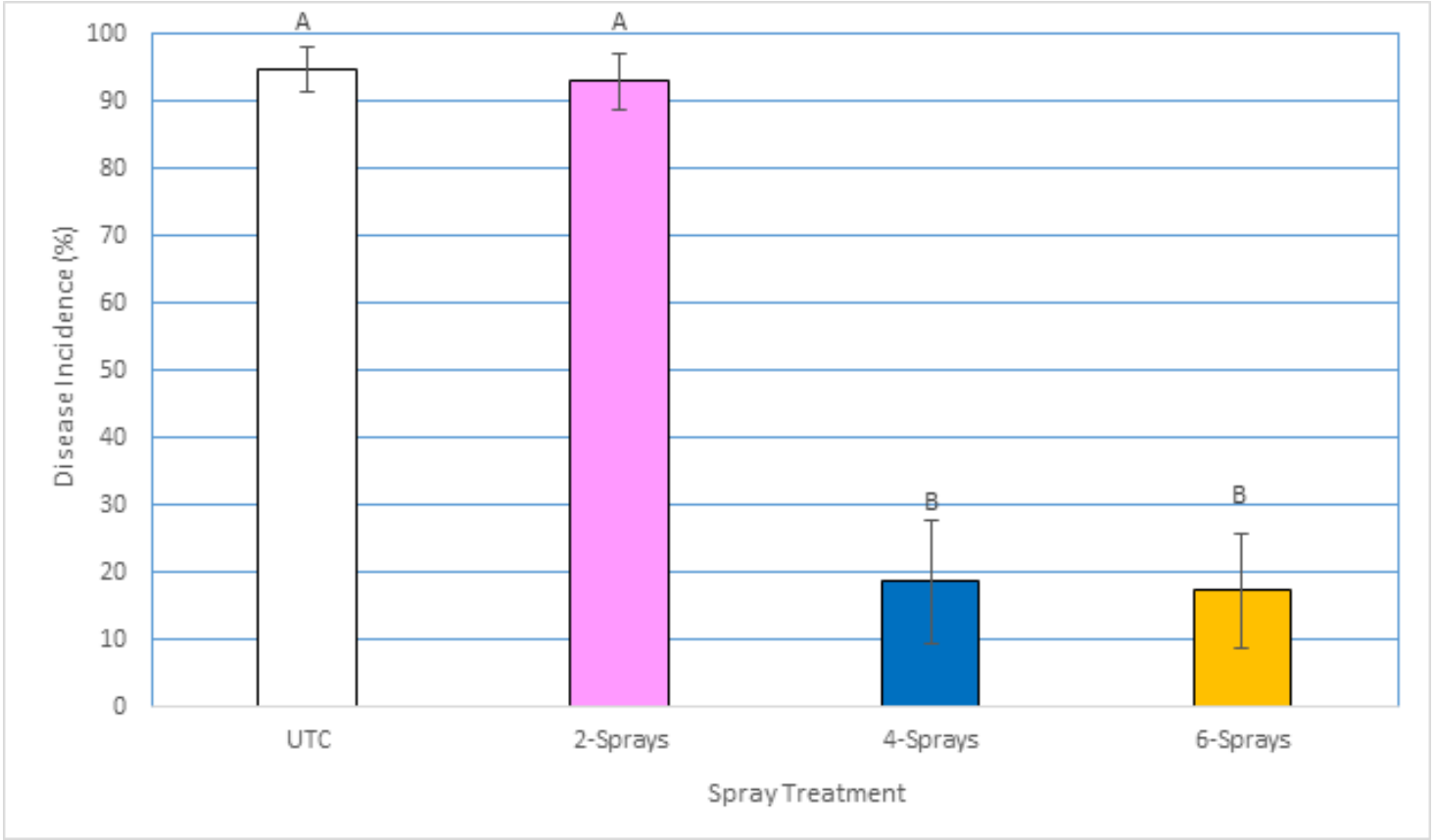
HN120 Disease incidence 2024



Disease incidence calculated based on number of 'Jefferson' trees in each plot that had disease presence

HN120 Disease severity 2024

Disease severity is rated on a 0-7 scale as follows:

0 = no visible EFB cankers

1 = a single small canker, ≤ 1% of tree affected, easily pruned

2 = 2-10% of tree with cankers, still easily manageable with minor pruning

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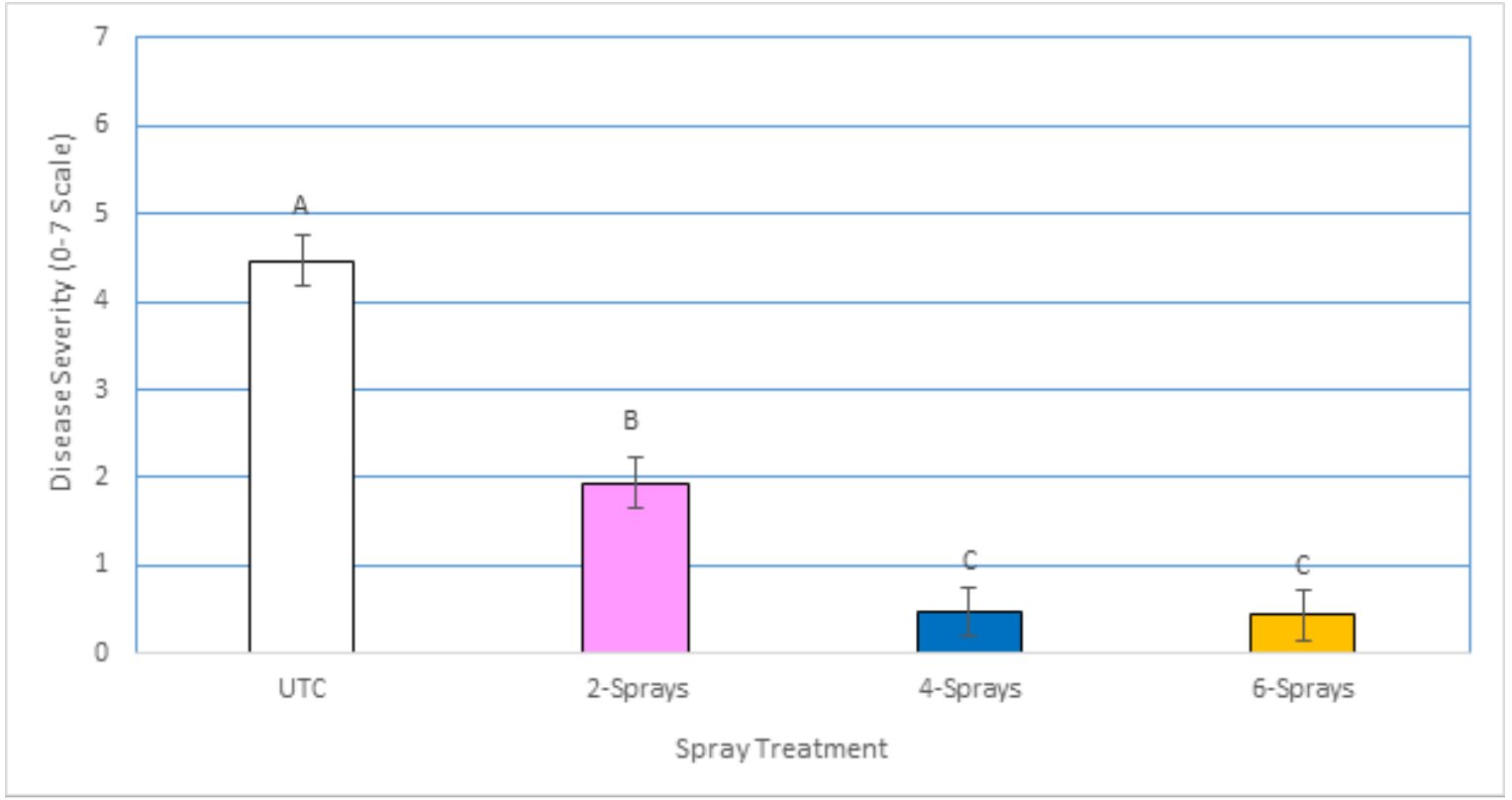

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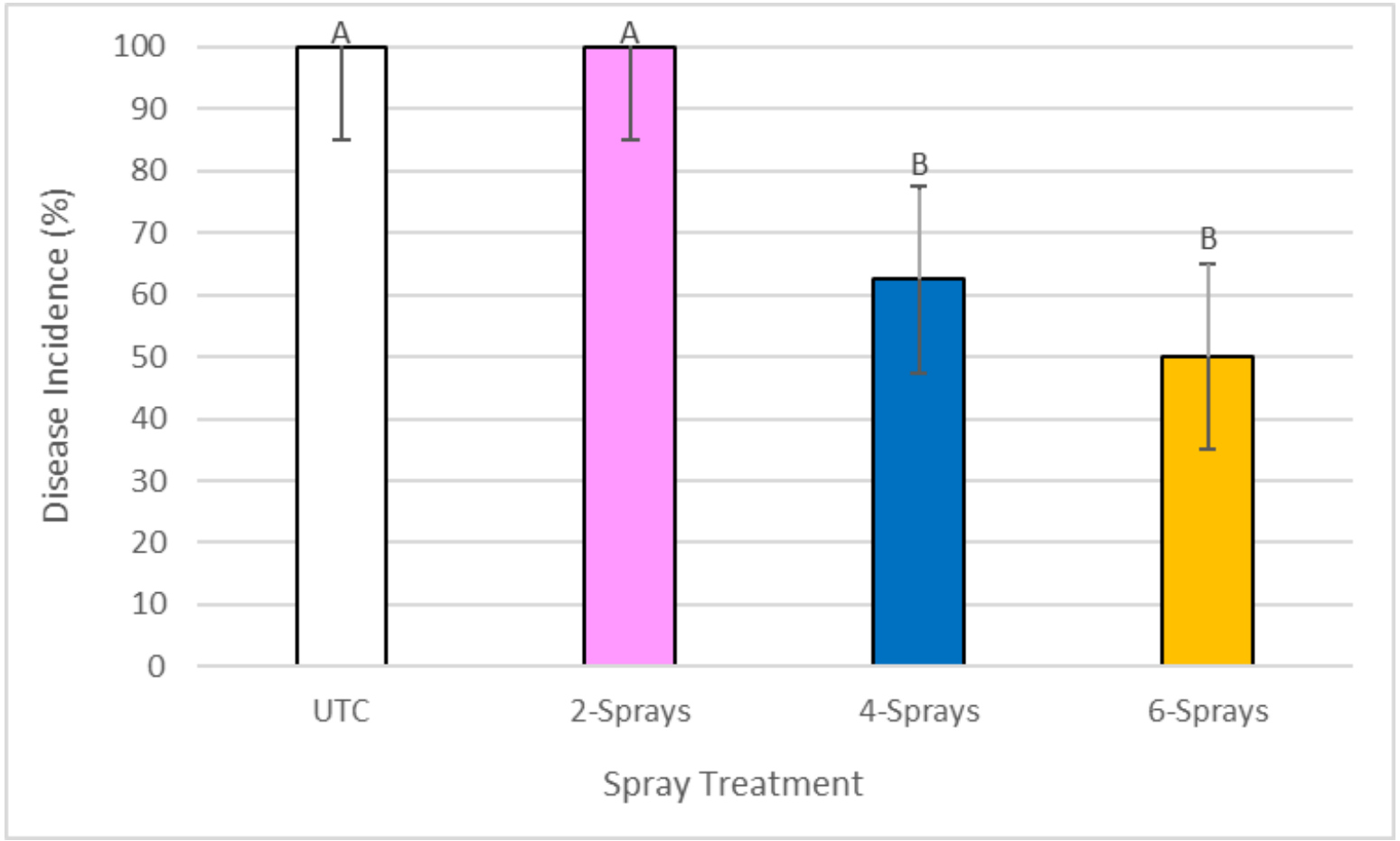
HN120 Nut data 2025

Treatment	Average total nut weight per tree (g)	Weight of 50 nut subsample (g)	Average nut weight (g)	50 Kernel weight (g)	Average number of empty nuts per tree
1-UTC	1.92	132.72	2.65	49.02	8.00
2-2S	1.94	142.59	2.85	54.75	4.66
3-4S	2.00	138.91	2.78	49.82	7.44
4-6S	1.84	145.08	2.90	57.02	5.81
	NS	NS	NS	NS	NS

* NS= no significance within column; nut data within each column with different letter groupings are statistically different.

HN120 Disease incidence 2025



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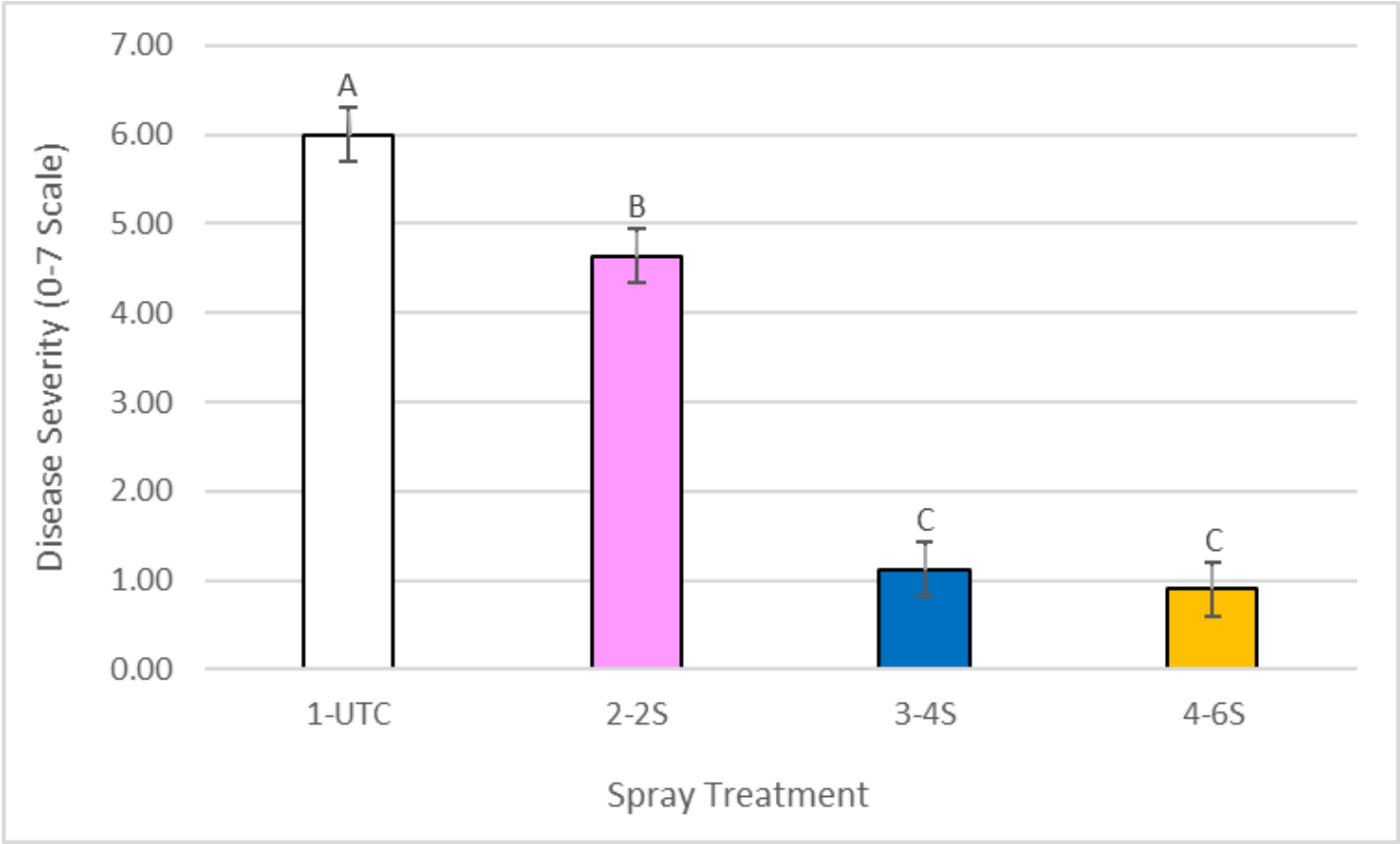

HN120 Spray timing trial conclusions

- Even with high disease incidence, disease severity can be significantly reduced with a spring fungicide program
    - 2 spray applications (one at budbreak and one 4-weeks later) are better than no spray applications at all
    - This trial shows there are no significant benefits going from a grower standard 4-spray program to a 6-spray program for additional disease control
    - The 4-spray program seems to be ideal based on efficacy and cost
- A vigilant pruning program is recommended for growers to remove any EFB present in the orchard on an annual basis

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Research findings HN220 spray efficacy trial

2021-2023

- No significant differences found for any measures

2024, 2025

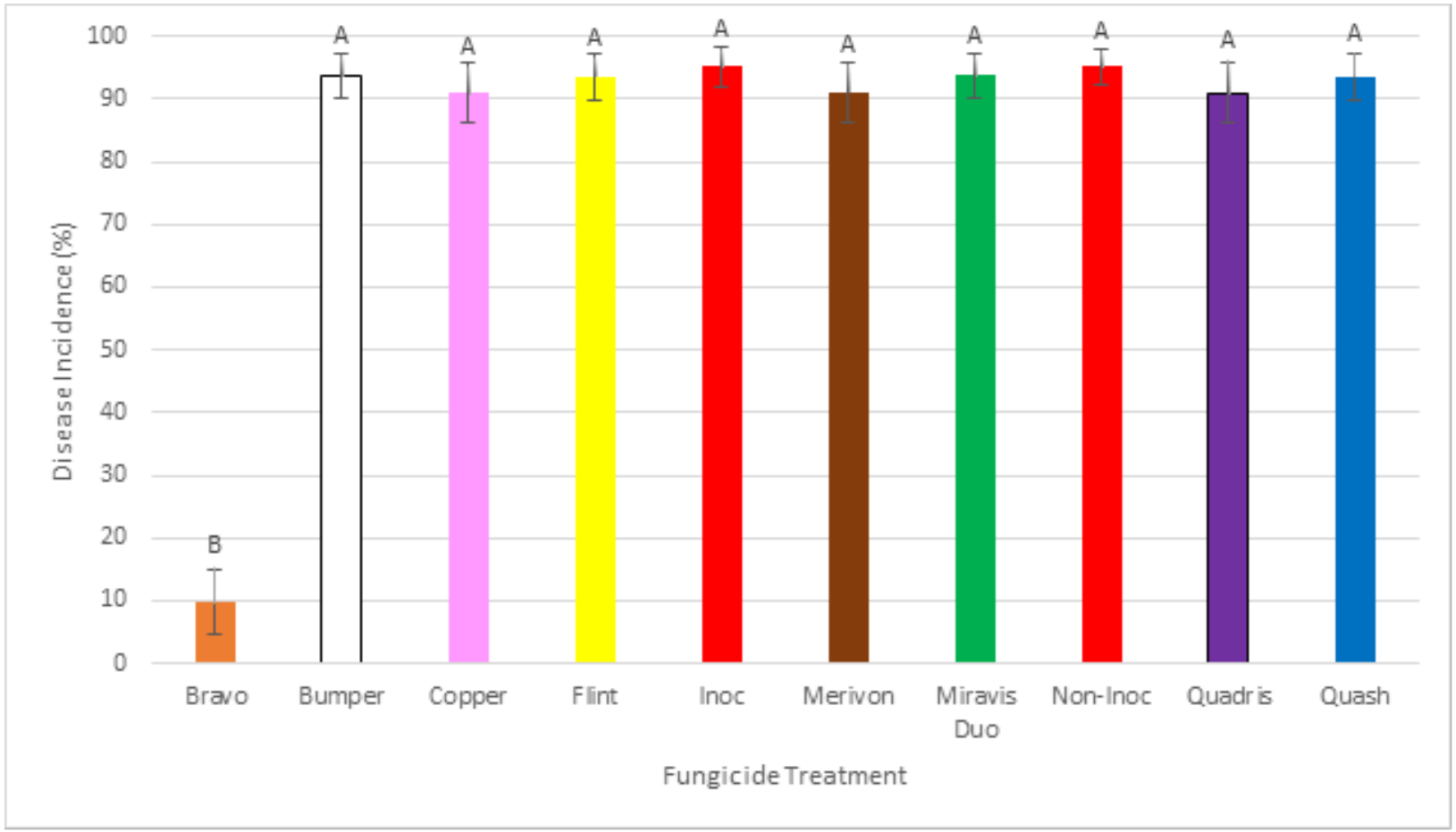
- Significant differences found in disease incidence and disease severity

HN220 Nut data 2024

Treatment	Average number of nuts per tree	Average total nut weight per tree (g)	Average nut weight (g)	Weight of 50 nut subsample (g)	50 Kernel weight (g)	Average number of empty nuts per tree
Non-Inoculated	152.37	463.00	3.02	151.02	47.27	10.71
Inoculated	230.39	698.66	3.03	155.18	56.78	6.21
Bravo	202.92	568.07	2.84	148.65	55.10	4.46
Copper	209.71	588.25	2.83	146.70	50.80	8.38
Quash	239.04	718.00	2.99	154.01	55.01	5.71
Flint	204.79	606.18	2.94	150.45	53.77	6.21
Quadris	215.29	623.75	2.90	148.52	51.86	6.63
Miravis	178.83	523.29	2.92	153.00	54.25	6.67
Bumper	251.46	747.51	2.96	150.76	53.81	6.15
Merivon	228.33	676.25	2.90	139.12	49.23	6.50
se	NS	NS	NS	NS	NS	NS

* NS= no significance within column; nut data within each column with different letter groupings are statistically different.

HN220 Disease incidence 2024



Disease incidence calculated based on number of 'Jefferson' trees in each plot that had disease presence

HN220 Disease severity 2024

Disease severity is rated on a 0-7 scale as follows:

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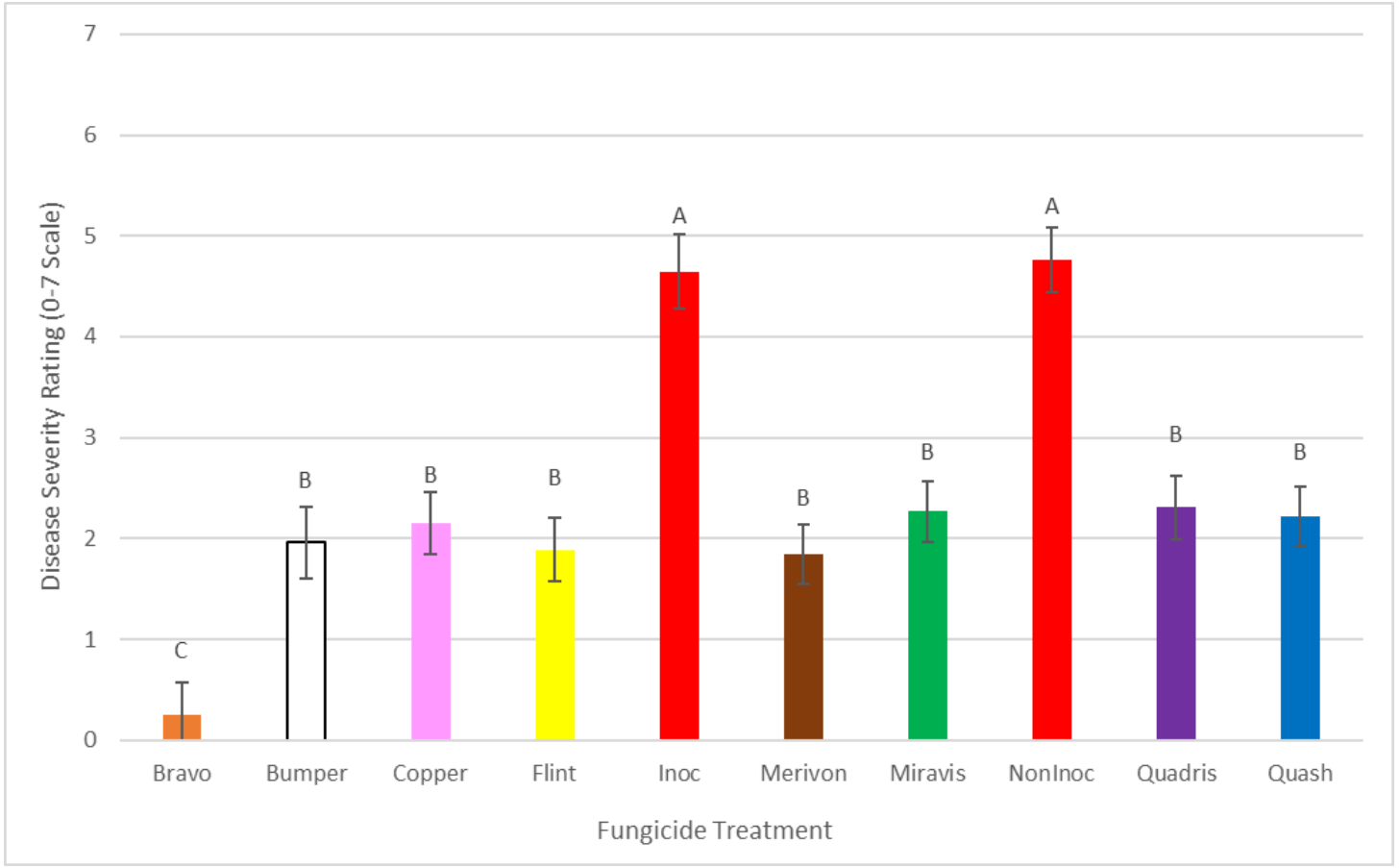

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HN220 Nut data 2025

Treatment	Average total nut weight per tree (g)	Average nut weight (g)	Weight of 50 nut subsample (g)	50 Kernel weight (g)	Average number of empty nuts per tree
Non-Inoculated	1.19 B	130.80	2.62	42.30	14.54
Inoculated	1.57 AB	133.10	2.66	45.31	11.35
Bravo	1.94 AB	148.81	2.98	55.53	6.17
Copper	2.17 A	142.53	2.85	55.57	5.21
Quash	1.56 AB	135.95	2.72	51.59	6.63
Flint	2.25 A	140.03	2.80	55.68	4.38
Quadris	1.78 AB	134.92	2.70	51.61	7.92
Miravis	1.83 AB	141.69	2.83	53.72	6.42
Bumper	2.12 A	145.16	2.90	55.64	6.00
Mervion	1.83 AB	145.09	2.90	57.65	5.46
se	0.25	NS	NS	NS	NS

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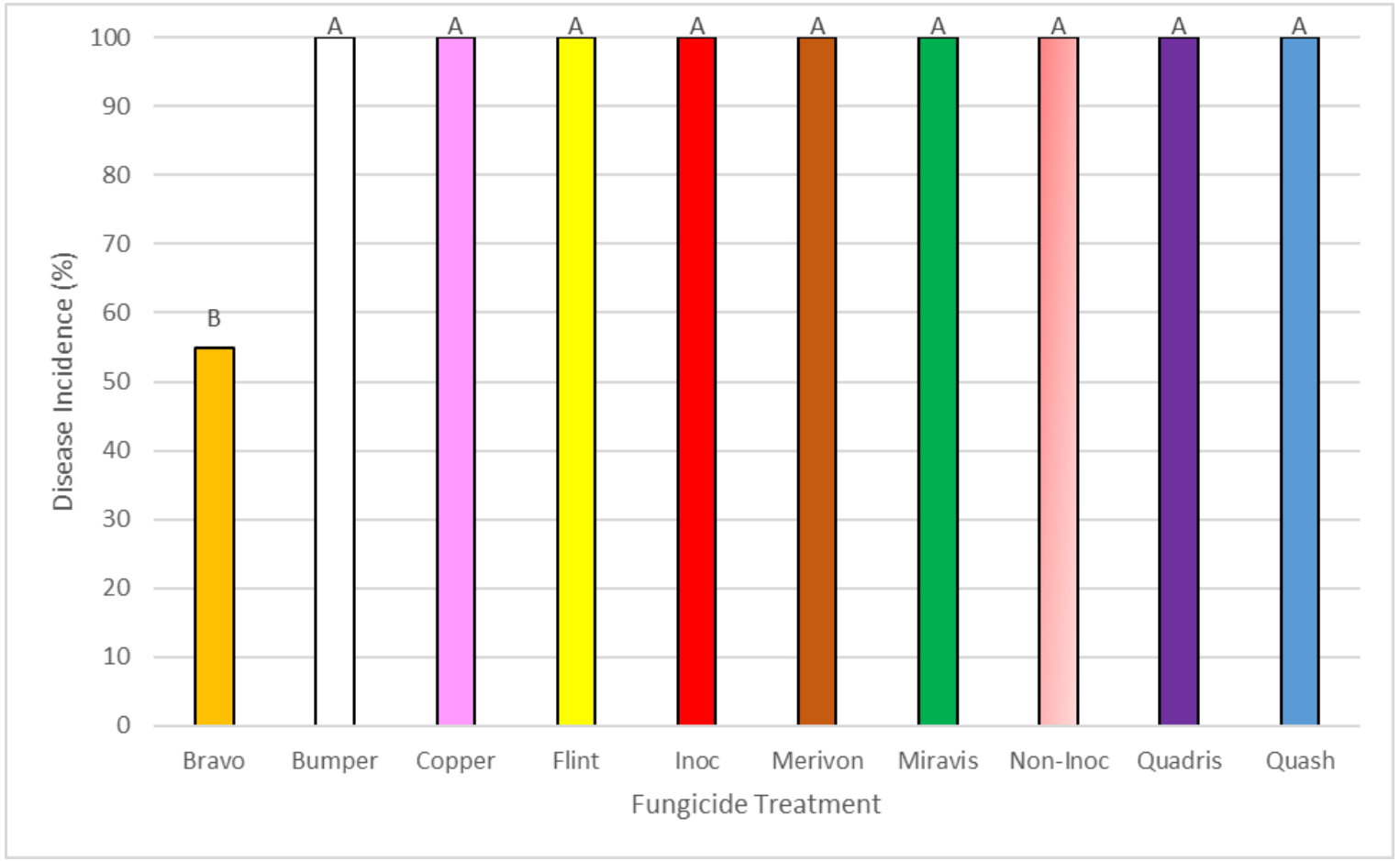
HN220 Disease incidence 2025



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HN220 Disease severity 2025

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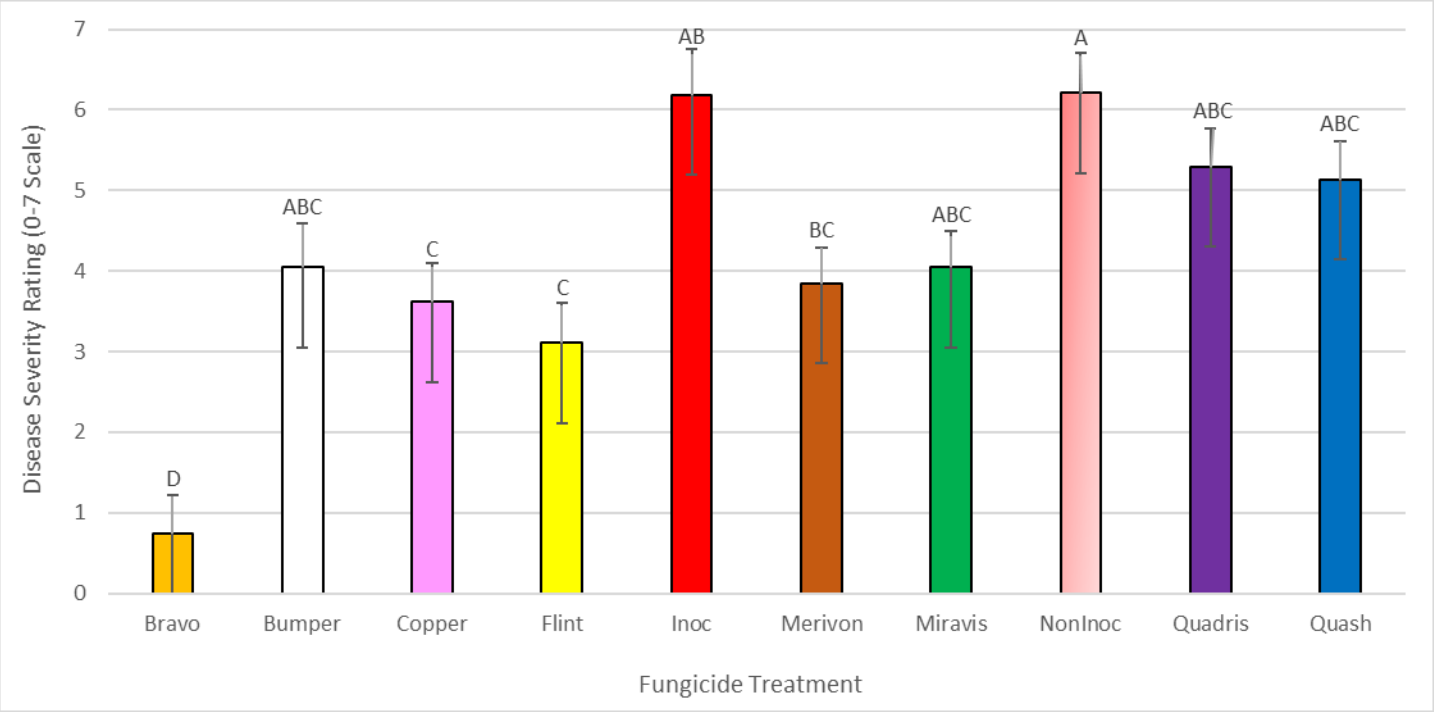

HN220 Spray efficacy trial conclusions

- Even with high disease incidence, disease severity can be significantly reduced with a spring fungicide program
    - Disease incidence was significantly higher in both the Inoculated and Non-inoculated control treatments when compared to any of the fungicide treatments in 2024
    - Both controls and many of the fungicide treatments are at a disease severity level that would require extensive pruning for any chance of tree survival in 2025
    - If extensive pruning occurred in early 2024, the fungicide treatments might have remained at a manageable level of disease severity, considering the high level of incidence
    - Similar to HN120 trial, this trial clearly indicates the importance of a fungicide management program for EFB, a vigilant pruning program, and, importantly, support having a fungicide product available that will significantly reduce disease severity

Acknowledgements

This research was funded by the Ontario Agri-Food Innovation Alliance, a collaboration between the Government of Ontario and the University of Guelph

Dr. Melanie Filotas - Horticulture Crop IPM Specialist, OMAFA

Jenny Liu – Former Maple, Tree Nut and Agroforestry Specialist, OMAFA

Barb Yates – Cultivar selection and orchard establishment advice

Jordan, Lyons, and Riddle Lab crews – U of G and SRS

Cathy Bakker, Lisa Weber – Research Technicians, SRS

Torin Boyle – SRS Station Manager

Jason Smith, Paul Splinter, Don Murdoch, Ravneet Kaur Chahal– SRS Farm Crew

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Questions?