



Managing Eastern Filbert Blight and Bud Mite in Ontario Hazelnuts



Melanie Filotas
Horticulture IPM Specialist -OMAFRA
OHA Symposium, March 27, 2018



Hazelnut Pests found in Ontario

- Diseases

- Eastern filbert blight
- Bacterial blight
- Powdery mildew
- Botryosphaeria canker
- Phomopsis canker

- Mites

- Filbert bud mite
- Tetranychopsis horridus
- European red mite
- Two spotted spider mite
- *Eotetranychus* spp.

- Insects

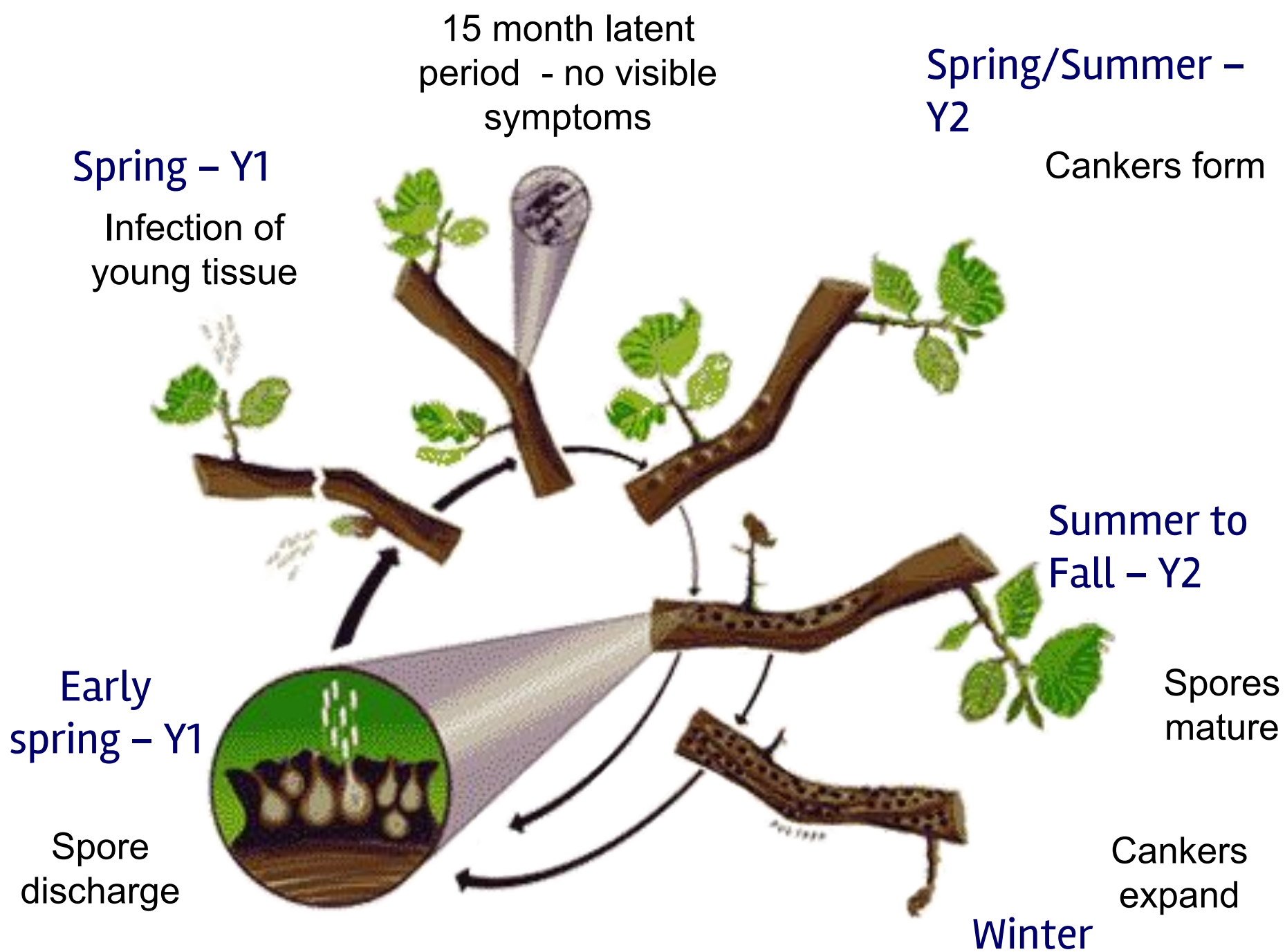
- Japanese beetle
- Aphids
- Leafhoppers
- Obliquebanded leafroller
- Lecanium scale
- Hazelnut weevil
- Filbertworm
- Brown marmorated stink bug
- Spring-feeding caterpillars
- Birch sawfly
- Blotch leafminer
- Birch and beech girdler

What is Eastern Filbert Blight

- Fungal disease (*Anisogramma anomala*)
- Grows under the bark
- Cankers, dieback and death of susceptible hazelnuts
- Major limiting factor in commercial hazelnut production in eastern North America



Source: E. Bush, Virginia Polytechnic, forestry images.org



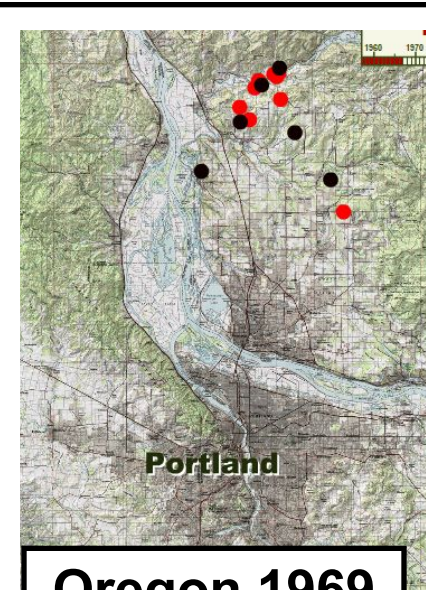
Source: Oregon State University

Eastern Filbert Blight in North America

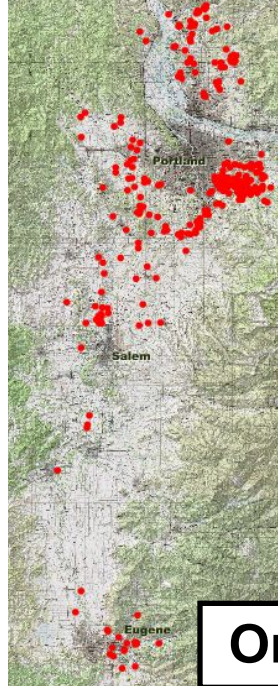


Native range of American hazelnut and EFB (T. Molnar)

- Mild to no symptoms on native American Hazelnut (small thick-shelled nuts)
- Lethal to the introduced European Hazelnut
- Not present in Europe or in NW US when commercial production of European varieties began 100 years ago
- Crossed the Rocky Mountains in 60s, hit main production areas 80s-90s



Oregon 1969



Oregon 2005

Eastern Filbert Blight in Ontario

- Within native range of EFB.
- Wild American hazelnuts a source of inoculum for commercial orchards
- EFB has been observed in the few commercial orchards in the province for > 15 years.
- What is the current level of disease?



Eastern Filbert Blight Survey - 2018



- University of Guelph-OMAFRA study funded by Growing Forward 2 – February/March 2018. Dr. Katerina Jordan and Cathy Bakker
- Survey at least 10% of trees in 6 orchards (3 mature, 3 new).
- Record cankers and assign a severity ranking from 0 (no cankers), 1 (one small canker) to a maximum of 7 (tree dead due to EFB)
- Data used to calculate incidence (% infection) and a disease severity index (incidence x severity across the orchard)

Growing Forward 2 

 Ontario

Canada 

EFB Survey 2018

Eastern Filbert Blight incidence and severity in 6 commercial hazelnut orchards in Ontario – Spring 2018

Orchard	Planting Year	EFB Management	% EFB Infected	Severity rating- infected trees (1-7)	Severity Index (0-100)
ESTABLISHED ORCHARDS					
Orchard 4	2011-2014	Pruning	1.0%	6.0	1.00
Orchard 5	2003-2015	Pruning	11.2%	2.5	4.60
Orchard 6	2007	Some Pruning	9.2%	4.8	7.30
NEW ORCHARDS					
Orchard 1	2016-2017	None	1.3%	4.6	1.00
Orchard 2	2016-2017	None	0.1%	4.0	0.04
Orchard 3	2016-2017	None	0.1%	6.0	0.10

•Data – Cathy Bakker and Katerina Jordan, University of Guelph

EFB Survey 2018

Eastern Filbert Blight incidence and severity in 3 new orchards – Spring 2018

Cultivar	No. of Orchards Scouted	% EFB Infected	Severity rating- infected trees (1-7)	Severity Index (0-100)
NEW ORCHARDS				
Delta	1	0.00%	..	0.00
Gamma	2	1.10%	3.5	0.62
Jefferson	3	0.70%	5.0	0.56
Lewis	1	0.00%	..	0.00
Santiam	2	0.00%	..	0.00
Slate	1	0.00%	..	0.00
Theta	2	0.90%	4.3	0.65
Tonda di Giffoni	1	0.00%	..	0.00
Yamhill	3	0.20%	4.6	0.17

EFB Survey 2018

Eastern Filbert Blight incidence and severity in 3 established orchards – Spring 2018

Cultivar	No. of Orchards Scouted	% EFB Infected	Severity rating- infected trees (1-7)	Severity Index (0-100)
ESTABLISHED ORCHARDS				
Delta	1	0.0%	..	0.00
Gamma	2	1.1%	3.5	3.50
Jefferson	3	0.7%	5.0	5.05
Lewis	1	0.0%	..	0.00
Santiam	2	0.0%	..	0.00
Slate	1	0.0%	..	0.00
Theta	2	0.9%	4.3	4.33
Tonda di				
Giffoni	1	0.0%	..	0.00
Yamhill	3	0.2%	4.6	4.58

EFB Survey 2018

Eastern Filbert Blight incidence and severity in other varieties in 3 established orchards – Spring 2018

Cultivar	No. of Orchards Scouted	% EFB Infected	Severity rating- infected trees (1-7)	Severity Index (0-100)
ESTABLISHED ORCHARDS				
Adelphia	1	50.0%	1.0	8.33
Alex	2	0.0%	..	0.00
Epsilon	1	100.0%	2.0	33.33
Faroka	2	5.6%	5.4	5.03
Gene	2	0.0%	..	0.00
Halle's Giant	1	50.0%	3.0	25.00
Julia	1	100.0%	3.0	50.00
NY398	1	25.0%	1.0	4.16
NY616	1	100.0%	2.0	33.33
Rutter	1	33.3%	1.0	5.55
Skinner	1	25.0%	3.0	12.50
Slagl	1	100.0%	3.0	50.00

Managing Eastern Filbert Blight

- Resistant/tolerant varieties
- Regular scouting
- Removal of infected material
- Fungicides
- Clean planting material



2. Resistant/tolerant varieties

- Some confusion around “resistance”, “immune” and “tolerant”
- What is resistance?
 - **Immune** = not subject to attack by pest
 - **Resistance** = restricts growth of the pathogen under normal pest pressure
 - **Intermediate Resistance** = restricts growth of the pathogen but still has symptoms
 - **Tolerance** = can endure pathogen infection with less serious consequences for growth, yield, etc.
- With EFB, these terms are often used interchangeably. Many “resistant” cultivars are actually tolerant.

Resistance/tolerance characteristics

- Can be due to many factors – e.g.
 - Physical barrier to spore entry
 - Chemical prevention of germination
 - Growth inside the plant is inhibited
- Resisting the pest requires energy from the plant – this can lead to costs in terms of yield, vigor, resistance to other stresses.
- Strains of the pathogen vary with geographic area. Resistant varieties are not always resistant to every strain.

Oregon

Recommendations

Table 5. Eastern



Scientia Horticulturae

Volume 235, 17 May 2018, Pages 367-372



Assessment of the 'Gasaway' source of resistance to eastern filbert blight in New Jersey

Megan Muehlbauer^a, John M. Capik^a, Thomas J. Molnar^{a,✉}, Shawn A. Mehlenbacher^b

Show more

<https://doi.org/10.1016/j.scientia.2018.03.019>

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Highlights

- The 'Gasaway' R-gene appears not to be breaking down in New Jersey.
- Completely resistant seedlings were identified but not following expected ratios.
- The R-gene provides a predictable level of at least tolerance in segregating populations.
- Modifying genes/factors appear to play a role in final disease response.
- Cultivars selected in Oregon may lack modifying factors for full protection in East.

Highly resistant (have the Gasaway resistance gene)

Dorris

Jefferson

Stepster

Whill

York

Epsilon

Delta

Zeta

"Resistance" column, Sacajawea liners.

Resistant varieties in Oregon can get EFB in eastern North America!

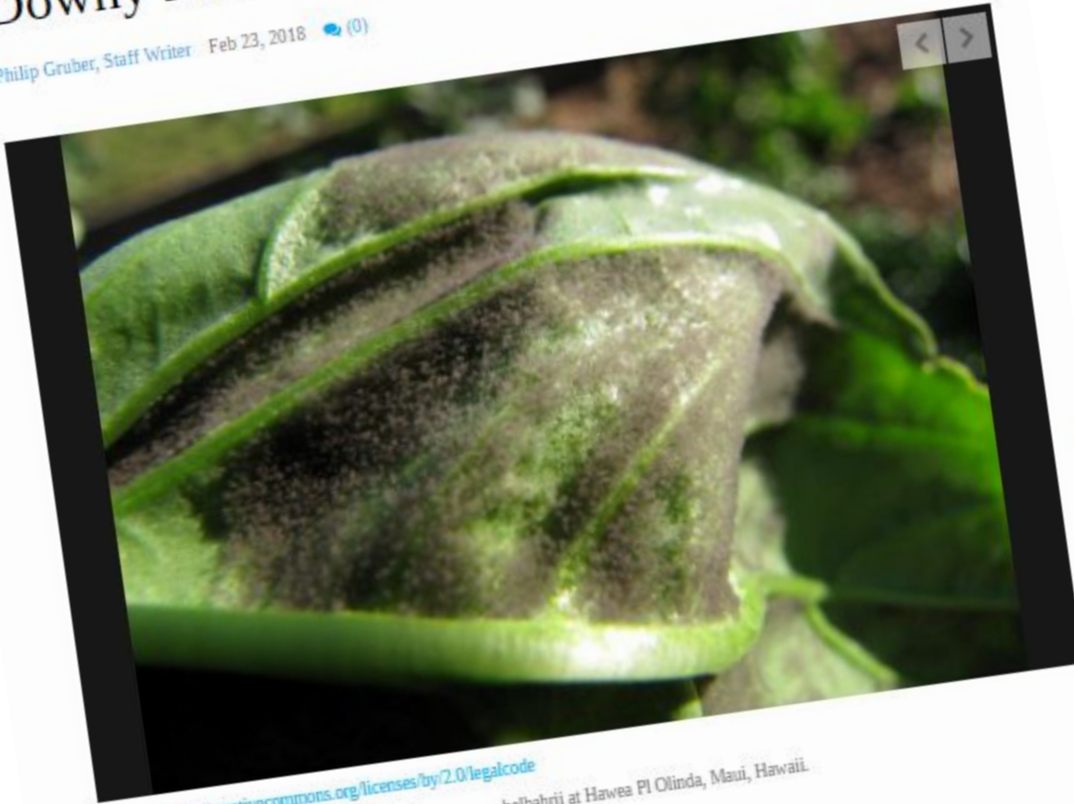
Resistance/tolerance characteristics

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- Strains of the pathogen vary with geographic area. Resistant varieties are not always resistant to every strain.
- Strains of the pathogen can evolve to fight resistance over time.

Cucumber downy mildew 2004

Downy Mildew a Truly Wily Foe

Philip Gruber, Staff Writer Feb 23, 2018 (0)



License: <https://creativecommons.org/licenses/by/2.0/legalcode>
Leaves and spores with basil downy mildew *Peronospora belbaharii* at Hawes PI Olinda, Maui, Hawaii.
Forest and Kim Starr, Flickr.com, Creative Commons usage



Tolerant Varieties identified in U of G trial

Cultivar	EFB Found 2018?	Catkin Survival	Yield
Gene	No	Good	Very good
Chelsea	No	Good	Good
Norfolk	No	Good	Good
Slate	No	Fair	Good
Alex	No	Good	Good
Gamma	Yes	Fair	Good
Jefferson	Yes	OK	Okay
Yamhill	Yes	Poor	Okay

Data courtesy of Dr. Adam Dale, University of Guelph

- Most of the cultivars either developed EFB at other sites or are not currently acceptable to Ferrero
- We don't understand the mechanism for resistance/tolerance, and therefore the cost to the plant.



- Tolerant/resistant varieties are a critical part of EFB management, but they only part of the solution.
- Do not expect to plant tolerant varieties and do nothing else!
- Use them as part of an integrated program.

2. Scouting

- More than just looking at trees while doing other tasks
- Dedicated scouting should be done several times/year
- Flagging branches in summer, black cankers in fall/winter

- Raised black cankers running lengthwise in straight rows
- Bumps in bark can be seen earlier in summer prior to eruption



- More visible in winter





- Girdled branches – attached leaves “flag” disease
- Most visible summer symptom



- Resistant cultivars can have cankers that may look like cracks, flat/sunken areas, have smaller black stromata and over time become callused or healed over



Photo by Jay W. Pscheidt, 2012.

3. Remove Cankers

- Prune 2-3 ft below infection.
- Tree removal for severely infected trees, where pruning will cut into main trunk and susceptible cultivars.
- Sanitize cutting tools
- Destroy infected cuttings prior to budbreak!! ‘
- Fall after harvest or late winter early spring when freezing temperatures are not expected.
- Symptomless infections will likely have to be pruned the following year





**Can still
infect!**



**Burn or
bury!**

4. Fungicides

- All registered EFB fungicides are preventative – no effect after fungus has penetrated the bark!
- Good coverage required
- Best timed to protect young susceptible tissue in spring. Begin sprays at bud break and continue approximately every 2 weeks until heavy rains end ca. 8 weeks later
- Rotate between fungicide groups to prevent resistance!
- Fewer sprays may be needed for tolerant varieties



Photo: Ken Johnson

Products registered for EFB in Ontario

Product	Active ingredient	Group	US Efficacy Rating*	Spray Interval	Comments
Bravo ZN	chlorothalonil	M	Excellent	20 d	
Copper Spray/ Guardsman Copper	Copper oxychlorid	M	?	10-14 d	
Cueva	Copper octanoate	M	?	5-10 d	
Quash	Metconazole	3	Good*	10-14 d	
Flint	trifloxystrobin	11	Good to Excellent	14 d	Toxic to grapes
Quadris	azoxystrobin	11	Fair to Good	7-10 d	Toxic to apples

- If possible, save copper applications for fall bacterial blight control. May not be possible if Bravo is limited.
- Potential rotation: Bravo/Quash/Flint/Bravo

Bud mites



- Most important “insect” pest of hazelnuts
- Microscopic relatives of spiders

- Increasing reports of bud mite damage 2017-2018
- Two species:
 - *Phytoptus avellanae*
 - *Cecidophyopsis vermiformis*





- Feeding causes “big buds”: swollen, fleshy, deformed and pinkish. Once infested:
 - Vegetative buds develop weak, unhealthy shoots
 - Catkins become stiff and brittle, with little pollen
 - Female buds produce no nuts
- Most of life cycle spent inside buds – controls have limited effect
- Brief exposed period in spring when they migrate to new buds







White, worm-like mites, approx.
0.2mm long

Bud mite





Jan



Feb

April

May



June

July

Aug

Sept



Nov

Dec

Buds blast due to
P. avellanae, open
and start to dry

**Mites leave blasted
buds and migrate
to new buds**

**Mites feed within
buds and increase
in number**

Blasting due to *C.
vermiformis*,
possibly some
movement of Cv to
other buds

**Continued feeding
and population
increase**

Mite management



- Bud mites prefer some varieties
 - Small, tight buds resist penetration by mites
- Predatory mites present on leaves and in buds but do not seem to be able to reduce populations
- Miticides? Sprays ineffective when mites are inside buds
- For small trees – remove and destroy blasted buds



Bud mite incidence and severity in affected varieties – Simcoe Research Station

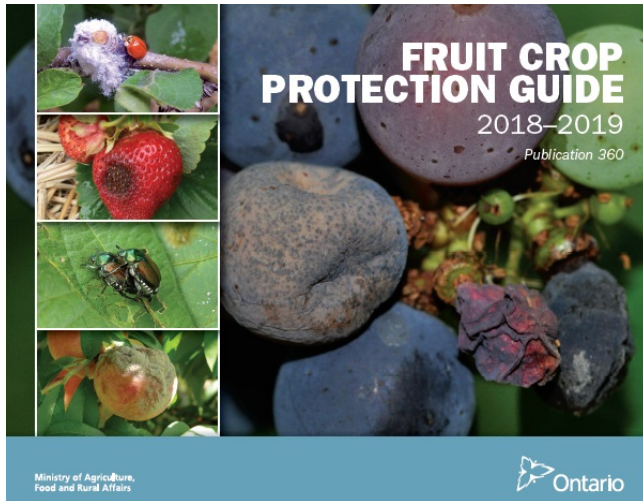
Orchard	Planting Year	% Trees with Bud Mite	Severity Index (0-100)
Slate	2010	92%	22.9
Norfolk	2008	100%	44.5
C-409	2008	79%	19.6
Clark	2008	10%	2.5
Gasaway	2008	67%	16.7
Aldara	2015	100%	54.2
Andrew	2015	100%	29.2
Linda	2015	100%	100.0
Marion	2015	100%	85.4

Varieties with no symptoms of bud mite – Simcoe Research Station:

- 2008:** Barcelona, Butler, Chelsea, Gene, Grimo-186, Jemstegaard, Lewis
- 2010:** Barcelona, Delta, Epsilon, G-17, Gamma, Gene, Halle's Giant, Jefferson, Santiam, Theta, Tonda Giffoni, Yamhill, Zeta
- 2015:** Carmela, Dorris, Felix, McDonald, Wepster, Yamhill, York

- Monitor for mite movement in early spring (late March – early June) using double sided sticky tape, tanglefoot or other sticky substance
- Check for movement of mites using a hand lens
- Movement occurs with daily max temperatures above 59°F (15°C) or average temperatures of 48°F (9°C), particularly during long-term warming trends
- Most effective treatments when 50% of mites have migrated out of blasted buds

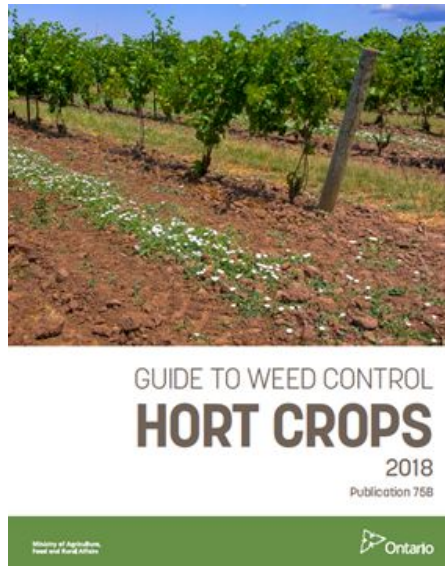
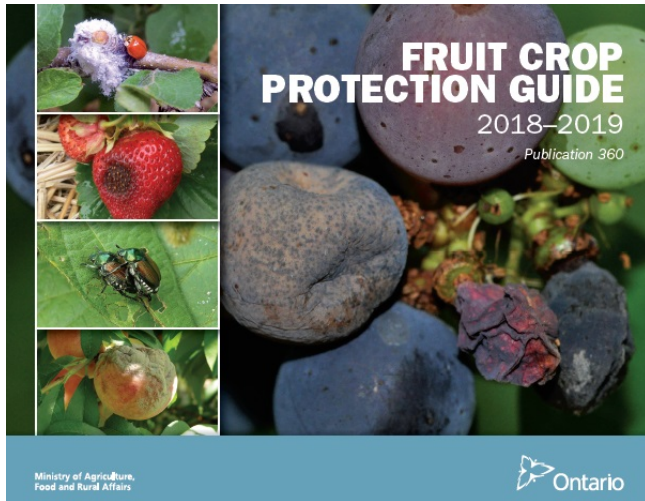
Miticides for hazelnut



- No products registered for bud mite control on hazelnuts in Canada.
- Miticides registered for foliar mites:

Product	Active ingredient	Used for bud mite in US?	Comments
Kanemite	acequinocyl	No	Efficacy unknown
Envidor	spirodiclofen	Yes	Lower rate than in US
Acramite	bifenazate	No	Efficacy unknown
Kopa/Opal	insecticidal soap	Yes	Phytoxicity?
Purespray Green Spray Oil	mineral oil	No	Potential for crop injury when applied near freezing temperatures
Vegol Crop Oil	canola oil	No	

Resources



Hazelnuts in Ontario - Pests

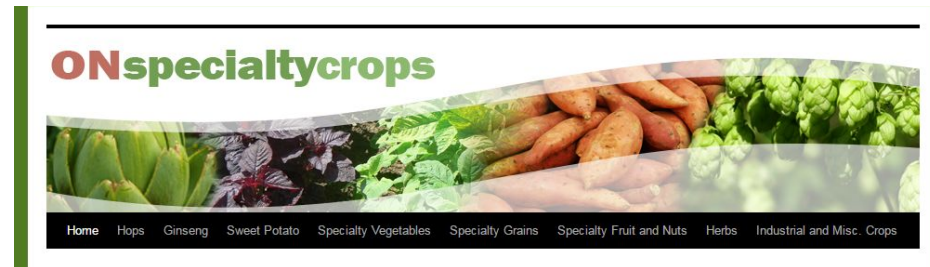
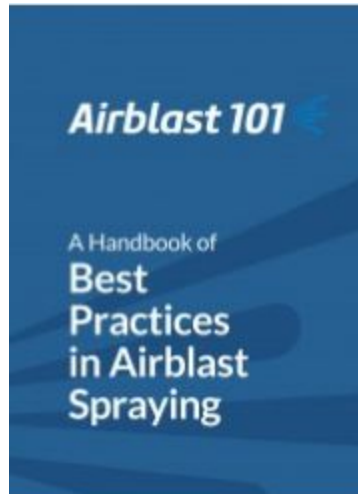
FACTSHEET	
ISBN 1198-712X Queen's Printer for Ontario	
Agdex#:	240
Publication Date:	January 2012
Order#:	12-009
Last Reviewed:	January 2012
History:	
Written by:	M. Filotas, A. Dale, D. Galic, T. Leuty, E. Currie

PDF - 712 kb

Table of Contents

1. Introduction
2. Diseases
3. Insect Pests

www.ontario.ca/crops



<https://onspecialtycrops.wordpress.com>

www.sprayers101.com



Hazelnut IPM Scout Training

OMAFRA Simcoe Resource Centre Auditorium
Wednesday May 2, 2018
1 pm – 4:30 pm

To register: Call OMAFRA's Agricultural Information
 Contact Centre at 1-877-424-1300



For more information:

- **Todd Leuty – Agroforestry Specialist**
1 Stone Rd. W, Guelph, ON
Phone: 519-826-3215, Email: todd.leuty@ontario.ca
- **Melanie Filotas – Horticulture IPM Specialist**
Simcoe-OMAFRA Resource Centre, Simcoe, ON
Phone: 519-426-4434, Email: melanie.filotas@ontario.ca



Thank you!

Questions?