



# MSU PLANT PATHOLOGY AND PROGRAM DIRECTIONS

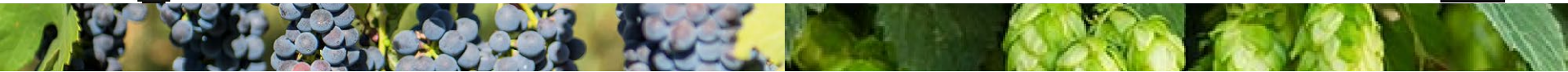


**TIMOTHY MILES**



# SMALL FRUIT AND HOP PATHOLOGY

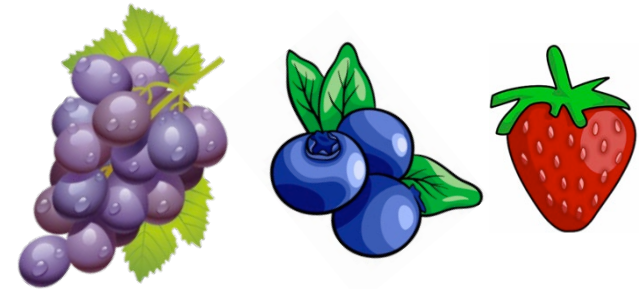
## MICHIGAN STATE UNIVERSITY



- Laboratory is located on campus in the Center for Integrated Plant Systems
- Housed within the Department of Plant, Soil and Microbial Sciences with significant collaboration with Entomology and Horticulture departments
- Program has laboratory, greenhouse and field space to conduct research

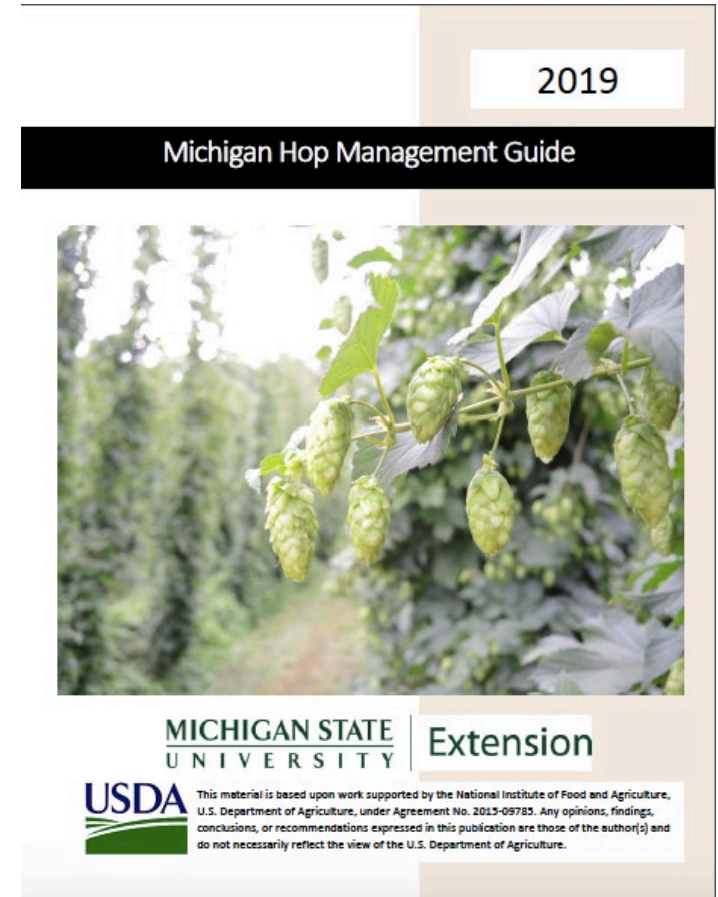


**PLANT SOIL  
& MICROBIAL  
SCIENCE  
DEPARTMENT**



# Michigan Industry priorities

- Greenhouse/propagation
- **Pest/Disease management**
  - Priority areas: Downy mildew management, IPM education, cultural practices for downy, herbicide protocol and registration needs, postharvest downy mildew management research
- Postharvest
- Horticulture
- Crop management
- Business/marketing
- Regulatory/Internal needs
- Updated August 2015

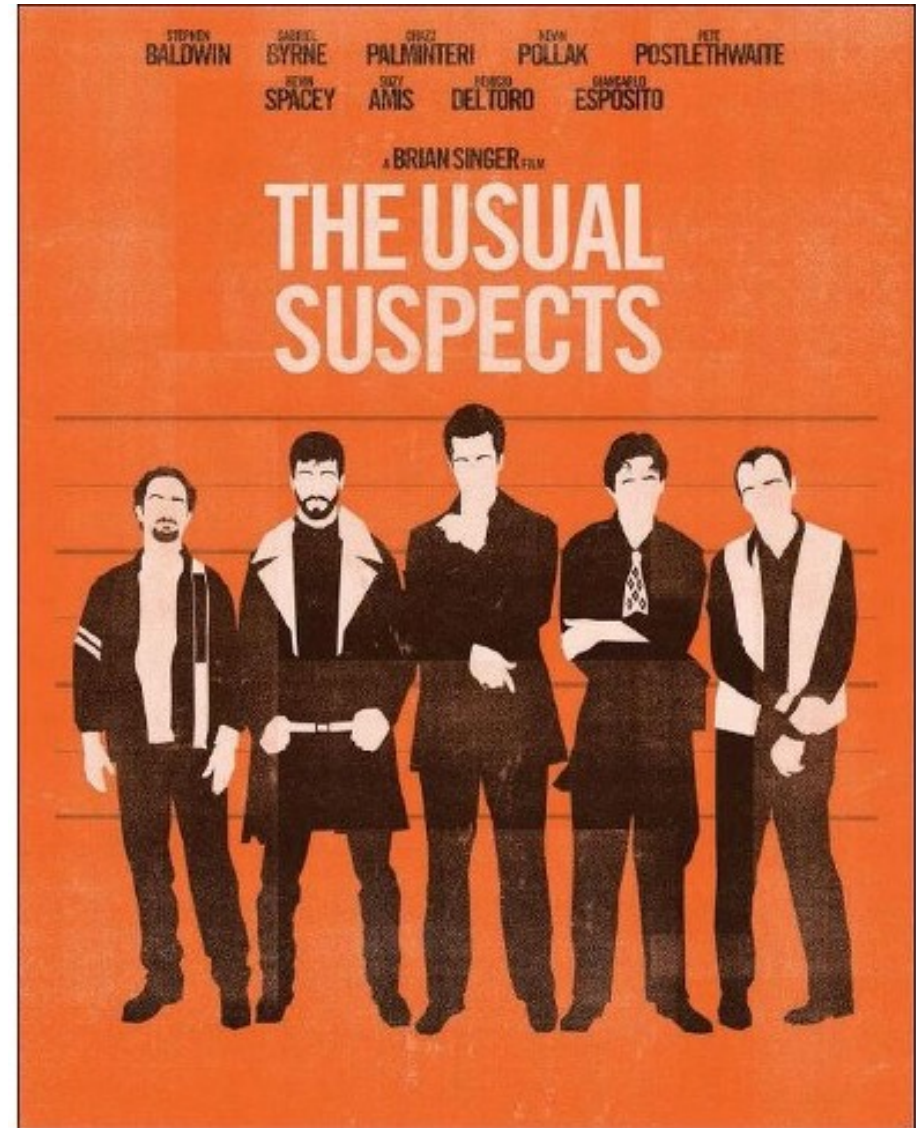


Compiled by Erin Lizotte



# Hop diseases: The usual suspects

- Diseases
  - Fungal or fungal-like
    - Powdery mildew
    - Downy mildew
    - Fusarium
    - Black root rot
    - Gray mold
    - Phoma wilt
    - Cone tip blight
  - Viruses
    - Hop stunt viroid
    - Hop mosaic virus
    - Apple mosaic virus



# Controlling these diseases

- Downy mildew and powdery mildew are the most critical diseases of hops
- Cultural Management
  - e.g. DM favors humidity and relatively warm temperatures
- Chemical Control Management Options
  - Resistant management is important



Photos by Erin Lizotte and Dave Gent



# Timing and frequency of control

- Sprouting
- Leaf development
- Vegetative growth
- Burr / Cone development
- Harvest
  
- Spray interval?



Photo by Erin Lizotte

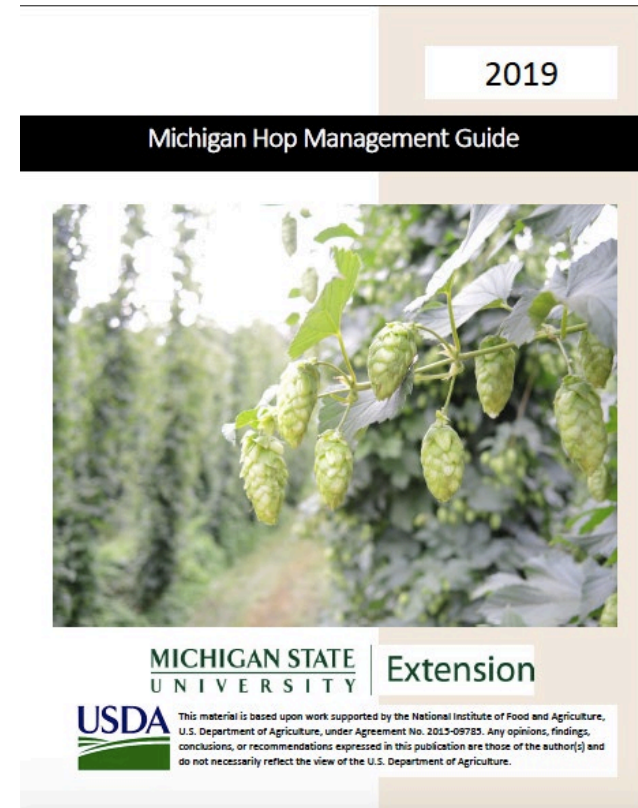
Secondary sporulation of downy mildew, not an easy time to control this disease



# Many fungicide choices

- 11 different single site actives
  - e.g. cyflufenamid (Torino, U6), or cyazofamid (Ranman, 21)
- 11 different multisite actives
  - e.g. basic copper sulfate (Cuprofix), or copper octanoate (Cueva)
- 6 different premix actives
  - E.g. Lina Experience, or Zampro
- 3 different plant defense inducers
  - e.g. Aliette
- 14 different biopesticides
  - e.g. Double Nickel

Consult this guide



# Outline of my talk

- A location for field efficacy work at MSU's Plant Pathology Farm
- A new foliar disease of hops
- Survey of cone diseases coming in 2019





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# Future fungicide efficacy work

- Setting up a hopyard for fungicide efficacy research at the Plant Pathology Farm (gifted by Hausbeck). 40 plants per row, 11 rows ~ 0.75 acres, cv Centennial



September 14, 2018



November 13, 2018



# Establishing a new planting

- Goal is to plant a 0.5 acre low trellis plot at MSU's Plant Pathology farm
  - Establish more DM susceptible Centennial
  - Establish a multi variety hop planting for future host resistance work to various pathogens
- This is a pending grant from Michigan Craft Beverage Council



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# New foliar disease

- New foliar fungal disease?
- Samples submitted to the diagnostic clinic
- Cultivar: Centennial
  - ID'd by Jan Byrne as Phoma or Phoma like
  - Subcultured by Miles laboratory
- 2 other locations were also sampled
  - Chinook
  - Cashmere

Research group: Miles, Higgins, Byrne, Hausbeck, and 2 undergraduate students



Scanned leaf from Jan (cv Centennial)



(cv Chinook)



# Pictures of the disease

- Mostly foliar, some damage to cones
- Causing defoliation, seems to spread easily to small plants

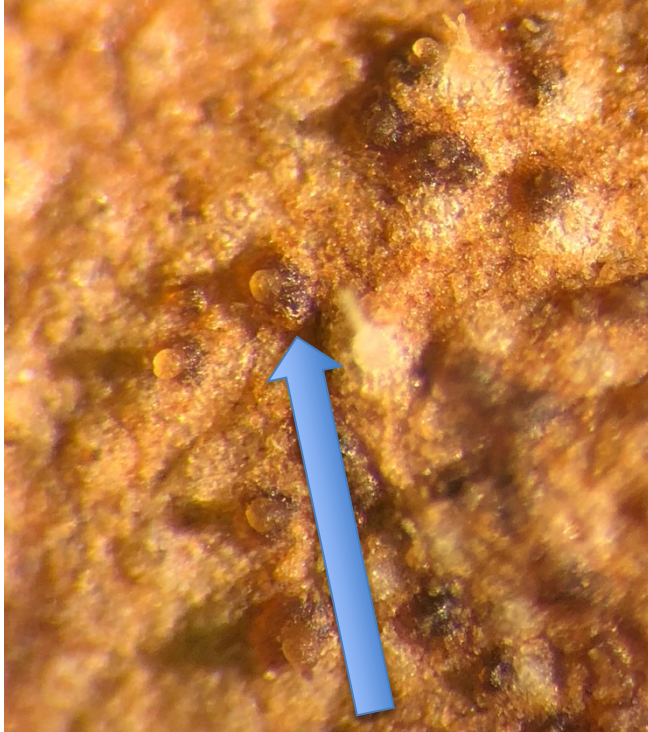


Symptoms on 'Crystal' (left 2 photos), and 'Chinook' (right).

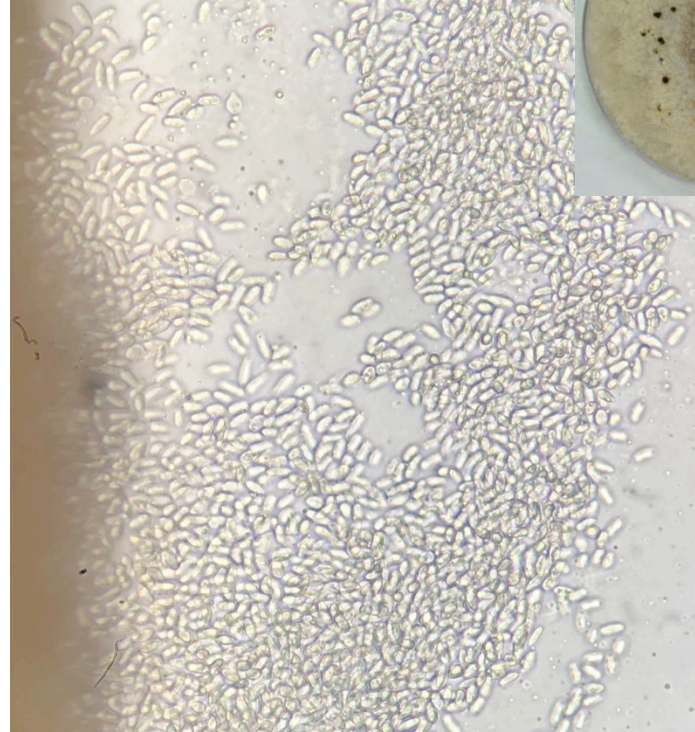
Symptoms on new Cashmere plants



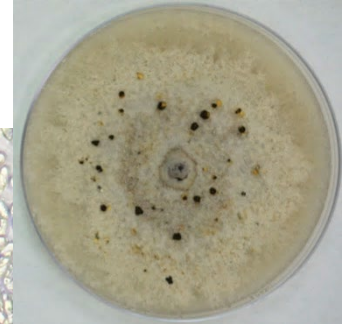
# Microscopic pictures



Symptomatic leaves have fungal pycnidia



~60% of isolated cultures have pycnidia

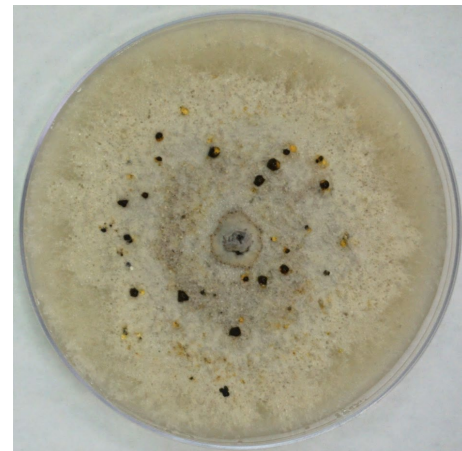
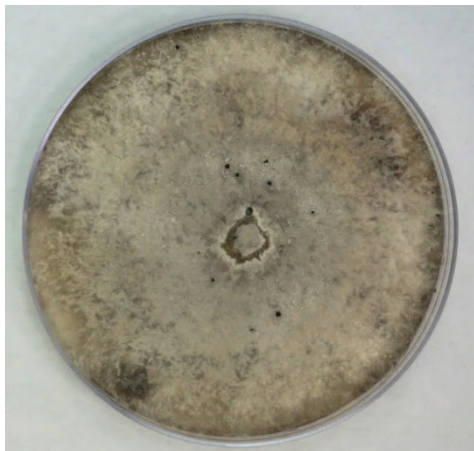


Conidia look similar among isolates



# *Diaporthe* spp. on hops

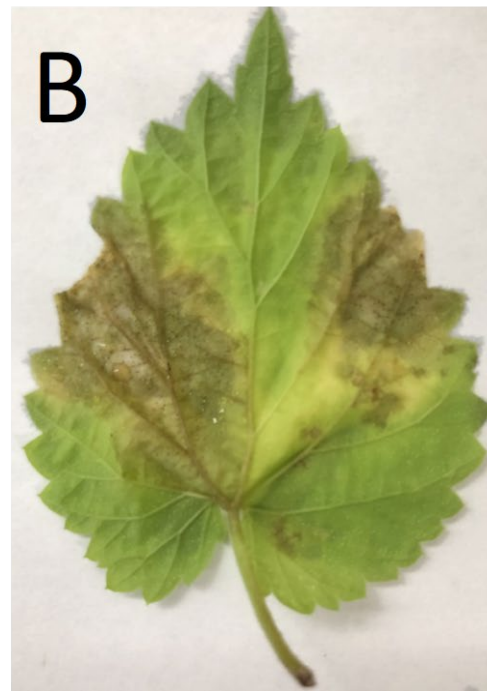
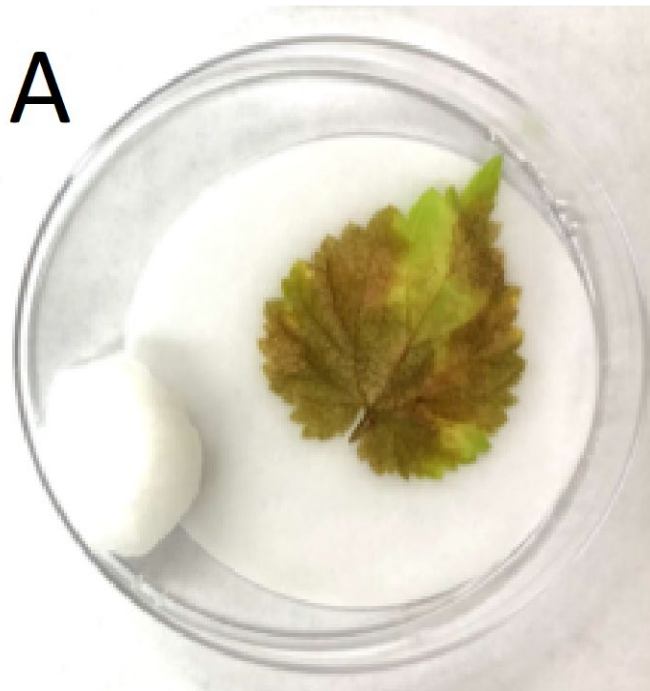
- Current status:
  - 41 isolates from the 3 sampling trips. 60% are were identified using molecular markers as a *Diaporthe sp.*
  - Also isolated a *Alternaria sp.* and *Phoma sp.* but in lower frequencies





# Detached leaf assay for *Diaporthe* sp.

- Currently in the process of screening 32 cultivars for host tolerance
- This assay will allow us to look at other aspects of biology of this disease



# We aren't alone! and next steps

- This is a photo from a NY hopyard with similar symptoms
- More investigation is required to determine how important this disease is and how damaging it might be on cones



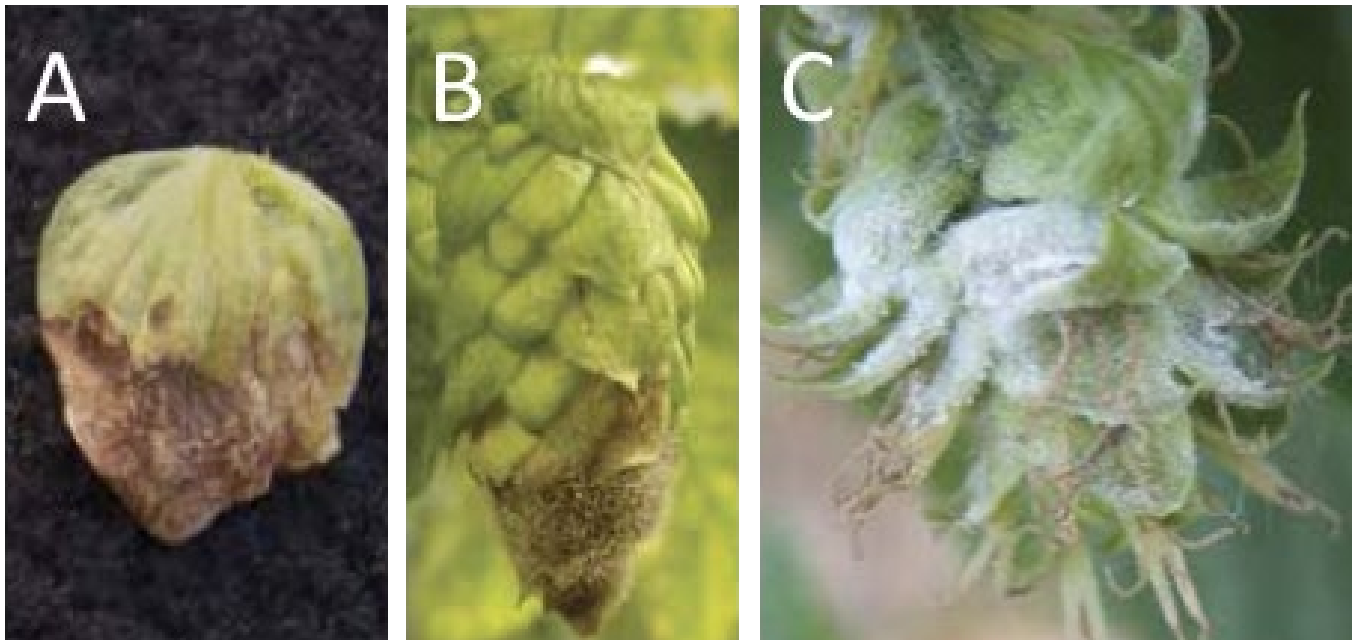
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# Cone diseases

- Hops also get a variety of cone diseases that are particularly common in humid weather
- Effect quality and the chemical properties



Some of the Cone diseases of hops. A) *Alternaria* (photo D. Gent), B) *Botrytis* (photo by S. Radišek) and C) Powdery mildew (photo by D. Gent).



# Where are all of these cone diseases?

| Active ingredient (FRAC) | Trade Name  |
|--------------------------|---|
| fluopyram (7)            | Luna Privilege  |
| flutriafol (3)           | Rhyme   |
| quinoxifen (13)          | Quintec   |
| tebuconazole (3)         | Monsoon, Onset 3.6L, Tebucon 3.6F and others          |
| trifloxystrobin (10)     | Envidor, Envidor 100                                  |
| triflumizole (3)         | Procure 480 SC, Trionic 4SC                           |
| copper octanoate (M1)    | Cueva   |
| metrafenone (U8)         | Vivando   |
| sulfur (M2)              | Cosavet DF Edge, Microfine Sulfur, Sulfur DF, Thiolux |

Powdery mildew  
fungicide applications



# Survey goals

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- Survey 25 hopyards throughout MI for 6 different known fungal diseases
- Investigate greenhouse fungicide efficacy against several of the identified diseases
- Collaborate with Erin Lizotte and Jan Bryne on providing nice quality diagnosed photos of each of the diseases on cones in the survey



# Additional information

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- Jerri Gillett
- Roger Sysak
- Safa Alzohairy
- Marivi Colle
- Nancy Sharma
- Ross Hatlen

## **Other contact information:**

Twitter: @Tmiles\_MSU

Facebook: /SmallFruitNHopPathology/

Laboratory website:

<https://www.canr.msu.edu/smallfruitnhopathology/>



# Questions?

- Thanks for all of the support, it has been a great 9 months, a special thanks to:
  - Matt Gura, Hop Head Farms
  - Erin Lizotte and Rob Sirrine, MSU Extension
  - Dr. Haubeck's research laboratory
  - Doug Higgins PhD student in Dr. Hausbeck's program
  - Dave Gent, Oregon State University / USDA-ARS
  - Sandy Ridge Farms

- Go Green!

