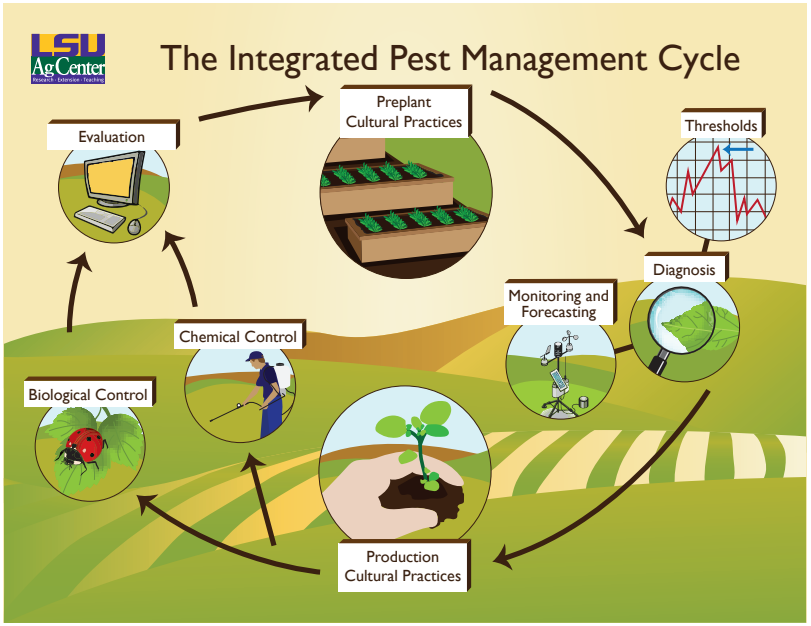
Prevention and Management of Hop Diseases

OSU HOPS CONFERENCE AND TRADE SHOW

MARCH 2018

Principles of Integrated Disease Management

1. Prevention
2. Forecasting
3. Monitoring
4. Diagnosis
5. Thresholds (economic and/or aesthetic)
6. Targeted management tactics
7. Program evaluation and improvement



Disease Prevention in the Hop Yard

- Select a site that promotes strong and vigorous growth
  - Sunny location (8 hours sun)
  - High(er) ground for frost protection
  - Well draining soils
  - Deep soils rich with organic matter
  - pH 5.7-7.5

Disease Prevention in the Hop Yard

- Plant clean stock material
  - Reputable sources
    - Clean Plant Center Northwest (CPCNW)
    - Virus and viroid tested
    - Unrooted green shoots $25
  - Known and trusted propagators
    - Virus testing by private laboratories

agdia®

Agdia Hops Disease Screening

Hops

Hop Screen (11 tests)

Pathogen	Symbol	Format
Alfalfa mosaic virus *	AMV	ELISA
Apple mosaic virus *	ApMV	ELISA
Arabis mosaic virus *	ArMV	ELISA
Carlavirus group test (American hop latent virus, Hop latent virus, Hop mosaic virus)	Carla	PCR
Cherry leaf roll virus	CLRV	ELISA
Phytophthora *	Phyt	ELISA
Prunus necrotic ringspot virus *	PNRSV	ELISA
Strawberry latent ringspot virus	SLRSV	ELISA
Tobacco ringspot virus *	TRSV	ELISA
Tomato bushy stunt virus	TBSV	ELISA
Tomato ringspot virus *	ToRSV	ELISA

- Cost of first sample in shipment = $372.00
- Approximate cost of each additional sample in shipment = $60.00

* Fruit Pathology Lab (diagnostics only)

Relative Disease Susceptibility Among Hop Varieties

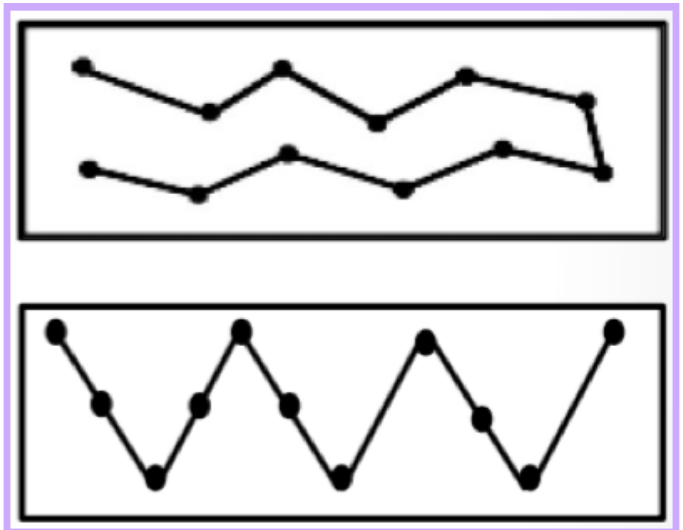
Variety	Disease Susceptibility*		
	Downy Mildew	Powdery Mildew	Verticillium wilt
Brewer's Gold	S	S	MR
Bullion	S	S	R
Cascade	S	R/MS	MR
Centennial	S	MS	U
Chinook	S	S	R
Columbia	MR	MS	S
Cornet	S	R	R
Crystal	S	R	R
East Kent Golding	S	S	MR
Fuggle	MR	MR	S

S **S**usceptible
MS **M**oderately **S**usceptible
MR **M**oderately **R**esistant
R **R**esistant
U **U**nknown

Ohio Hop Disease Management Guide (PP Series No. 155), pages 12-14

Monitoring Diseases in the Hopyard

- Scout yards regularly for disease and insect pests
  - At least once a week
  - Early detection is critical to successful disease control



Walk in a W or zig-zag pattern across a block and closely examine each vine to be sampled (shown by●) within your scouting pattern. *Image courtesy of OMAFRA*.

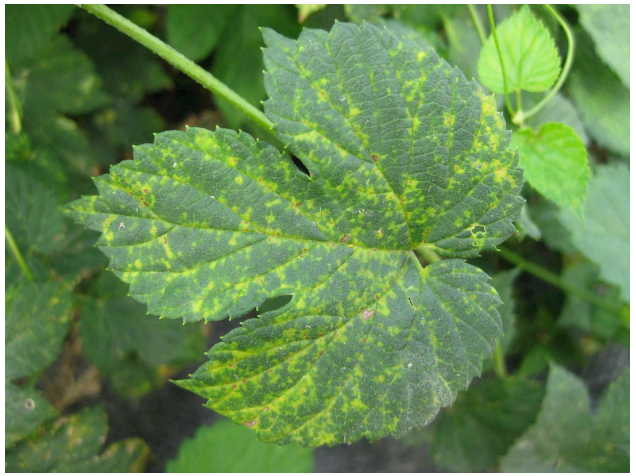
Monitoring Diseases in the Hopyard

- Inspect from the ground to the top
- Look at bottom and top of leaves and the entire cone
- Note any patterns
- Document the date and what you observed

Photo credits: Erin Lizotte, MSU Extension

Hop Disease Diagnosis

- Confirm what the problem is BEFORE treating
- Contact Extension Specialist
- Send samples to the Fruit Pathology lab for confirmation
  - Fungal diseases
  - Oomycete diseases
  - Some viruses



Hop mosaic virus

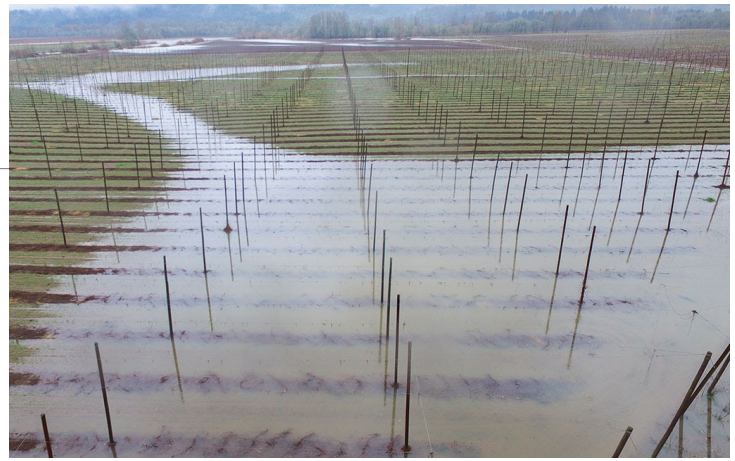
Strategic Pest Management

- Cultural and sanitation practices
- Pesticides
  - Pesticide resistance management
  - Impact on beneficial organisms
  - Impact on human health
  - Impact on hops and beer quality

•IPM is a "Science-based decision making process that allows us to respond to a pest using the most effective and least risk options"

Cultural Practices

- Water management
  - No standing water
  - Tiling
  - Raised beds
  - Deep ripping between rows



Phytophthora citricola

Cultural Practices

- Water management
  - No standing water
  - Tiling
  - Raised beds
  - Deep ripping between rows

Deep ripping between rows

Cultural Practices

- Weed management
  - Herbicides
  - Hand weeding

Photo credits: Camps Raod Farm

Cultural Practices

- Weed management
  - Mulch/compost
    - Certified from reputable source

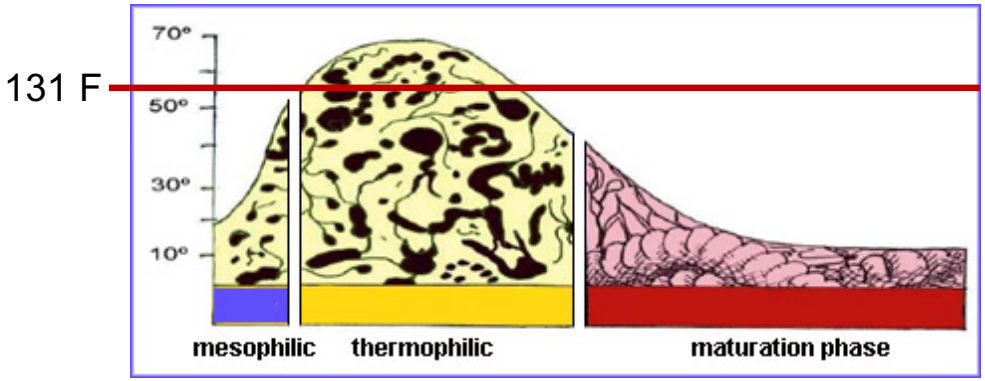


Photo credits: Camps Road Farm

Cultural Practices

- Alternative weed management practices

Graze on 4-5 ft of hop plant, soil compaction, ate all weeds in 10 days

Steam, 2 applications, kills weeds and weed seeds

Photo credits: Left: Ruhstaller Hop Yard; Right: Univ. Vermont;

Cultural Practices

- Alternative weed management practices

Flaming, kills weeds, used for topping crown, kills downy mildew on emerging spikes, increases soil pH

Photo credits: Farm Marketing Solutions

Sanitation Practices

- Important for virus, viroid and downy mildew control (secondary spread)
  - Avoid damaging the crowns during pruning and cultivation
  - Prune healthy plants first (viruses and viroids)
  - Remove and destroy escaped bines
  - Removal and destruction of all plant material
    - All pruning activities
    - End of season

Sanitation Practices

- Wear clean clothes
- Clean and disinfest tools between plants
  - Lysol
  - 10% chlorox
  - 20% skim milk
  - KleenGrow
  - Virkon S
  - GreenShield

Preventative Fungicides

- Downy mildew is the driver of a fungicide spray program

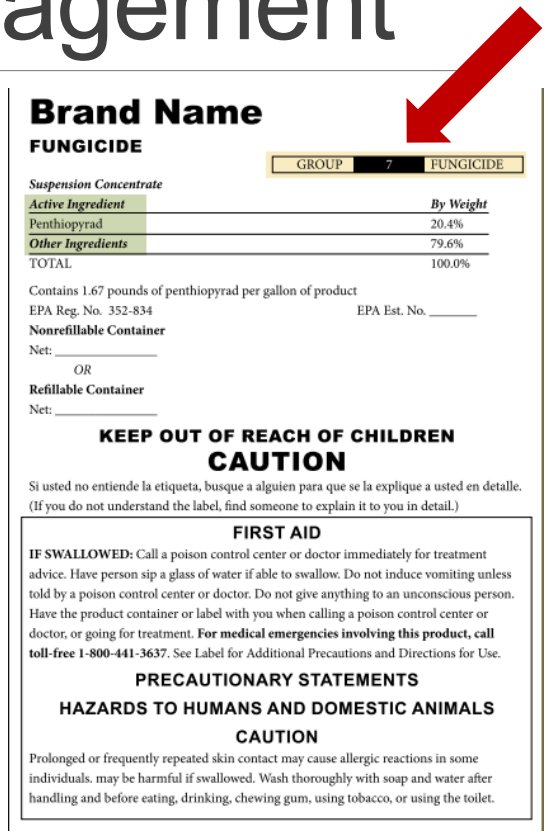
- Other diseases covered in the program
  - Alternaria cone disorder
  - Powdery mildew
  - Gray mold

Preventative Fungicide Applications

Growth stage	Diseases
Before bine training (6 in. shoots)	Downy mildew
Beginning of bine training	Downy mildew Powdery mildew
After burr development	Alternaria cone disorder Downy mildew Gray mold
After harvest	Downy mildew Powdery mildew

Fungicide Resistance Management

- Accurate diagnosis
- Alternate modes of action
  - Use the 2-spray rule
- Apply fungicides according to the label
- Monitor effectiveness
  - Report potential failures



Brand Name

FUNGICIDE

GROUP 7 FUNGICIDE

Suspension Concentrate

Active Ingredient	*By Weight*
Penthiopyrad	20.4%
Other Ingredients	79.6%
TOTAL	100.0%

Contains 1.67 pounds of penthiopyrad per gallon of product

EPA Reg. No. 352-834 EPA Est. No. _____

Nonrefillable Container

Net: _____

OR

Refillable Container

Net: _____

KEEP OUT OF REACH OF CHILDREN

CAUTION

Si usted no entiende la etiqueta, busque a alguien para que se la explique a usted en detalle.
(If you do not understand the label, find someone to explain it to you in detail.)

FIRST AID

IF SWALLOWED: Call a poison control center or doctor immediately for treatment advice. Have person sip a glass of water if able to swallow. Do not induce vomiting unless told by a poison control center or doctor. Do not give anything to an unconscious person. Have the product container or label with you when calling a poison control center or doctor, or going for treatment. **For medical emergencies involving this product, call toll-free 1-800-441-3637**. See Label for Additional Precautions and Directions for Use.

PRECAUTIONARY STATEMENTS

HAZARDS TO HUMANS AND DOMESTIC ANIMALS

CAUTION

Prolonged or frequently repeated skin contact may cause allergic reactions in some individuals. may be harmful if swallowed. Wash thoroughly with soap and water after handling and before eating, drinking, chewing gum, using tobacco, or using the toilet.

Biocontrol for Disease Management

Fungicide	Rate/100 gal
Serenade ASO (*Bacillus subtilis* QST 713 strain)	4.0-6.0 qt
Serenade MAX (*Bacillus subtilis* QST 713 strain)	2.0-3.0 lb
Sonata (*Bacillus pumilis* QST 2808 strain)	2.0-4.0 qt
Trilogy (Neem oil)	0.5-1.0%

Program Evaluation and Improvement

- Time for reflection!
  - What worked and what didn't work?
  - Changes in disease incidence or severity
  - Evaluate fungicides efficacy

New and Emerging Diseases

- Hops stunt viroid
- First report in 2017
  - Leaf yellowing
  - Leaf curling
  - Stunted plants
  - Small cones

New and Emerging Diseases

- Powdery mildew
- Not officially reported

Contact Information

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