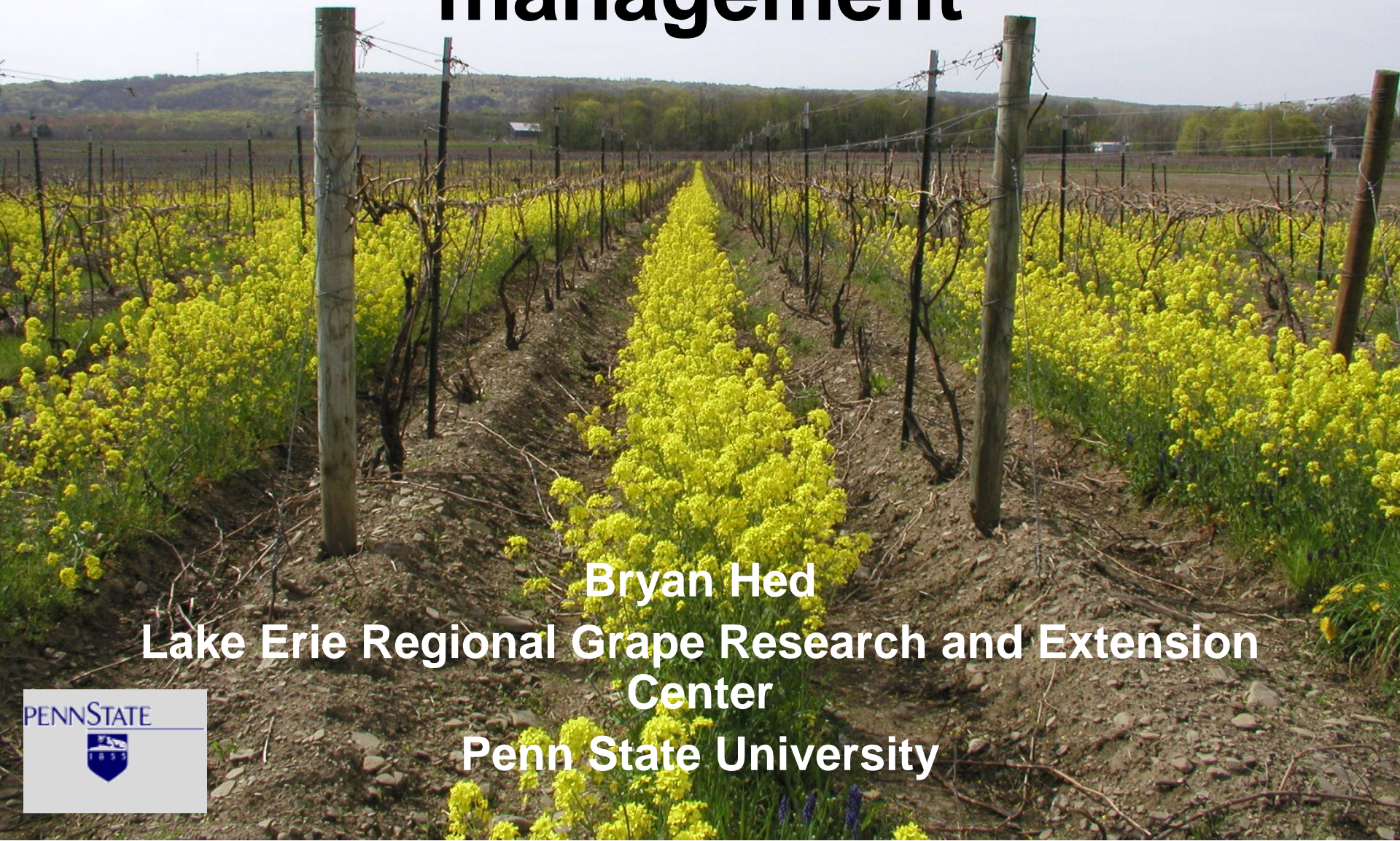


Early season grape disease management



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Phomopsis viticola



- **Over-winters on canes/old rachises and tendrils, live/dead wood**
- **Spores spread by spring rain**
- **Most infection occurs early...**
- **Disease development dependant on over-wintering inoculum load**

Phomopsis viticola

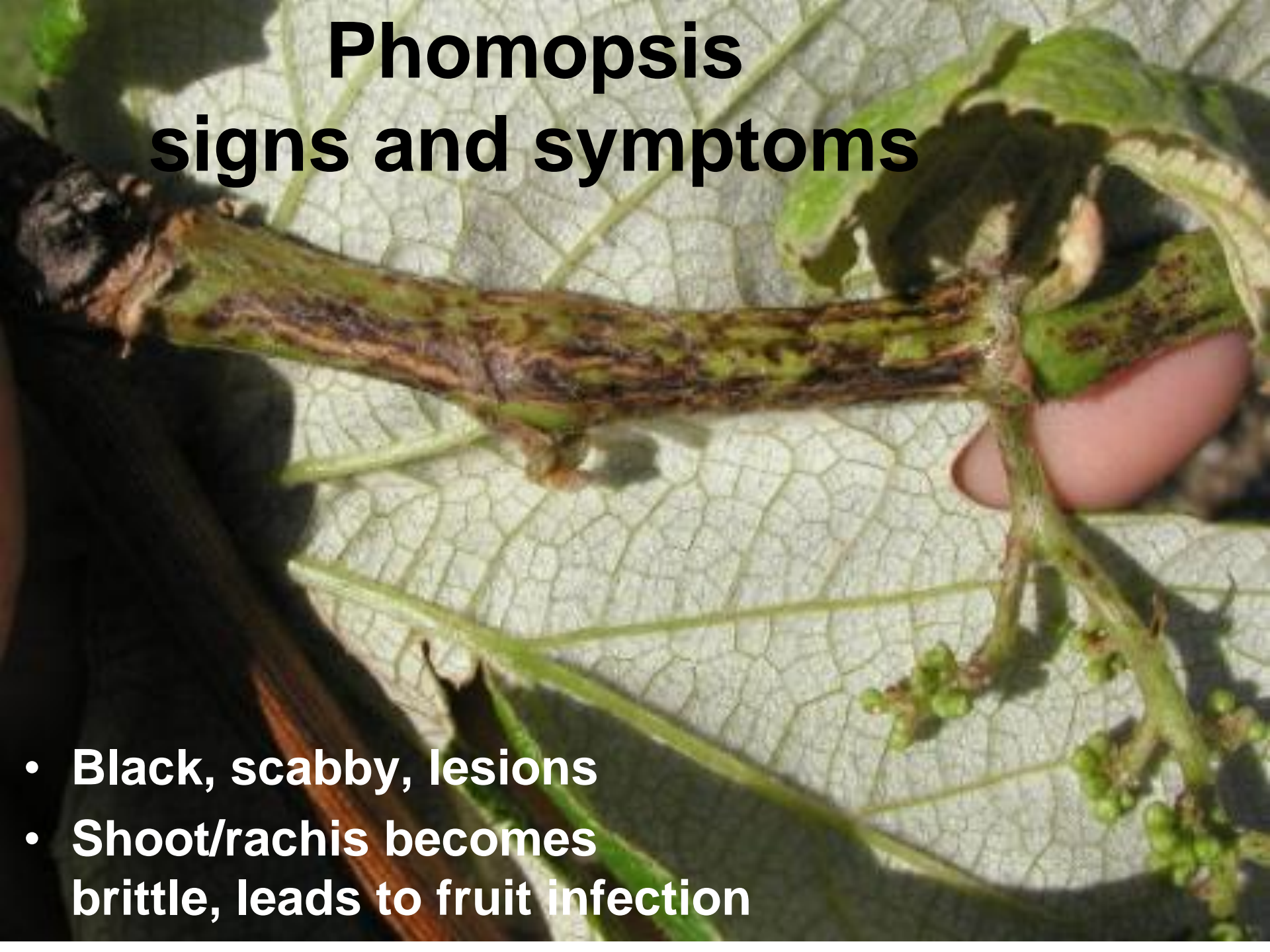


Phomopsis viticola



Phomopsis signs and symptoms

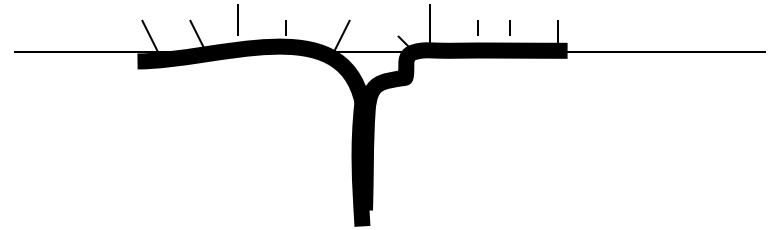
- **Black, scabby, lesions**
- **Shoot/rachis becomes brittle, leads to fruit infection**



Reduce presence of pathogen; Spur vs cane prune (also br, pm)

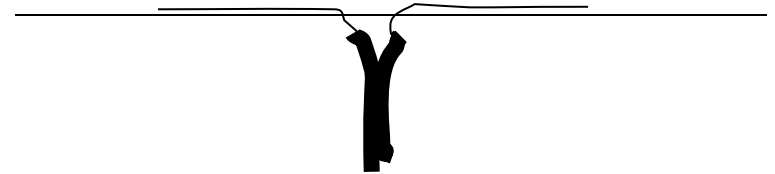
- **Spur pruning**

- requires cordons
- retains more old wood
- retains more inoculum (pathogen source)



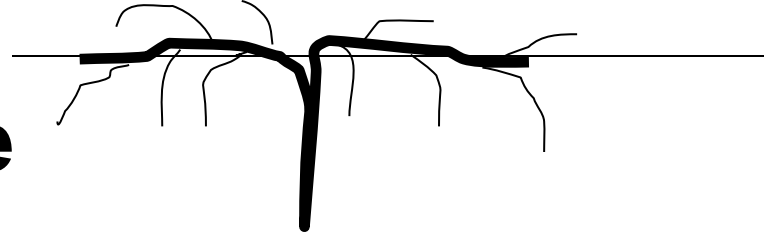
- **Cane pruning systems**

- Minimizes older wood
- Minimizes over-wintering inoculum
- inoculum source is below trellis wire

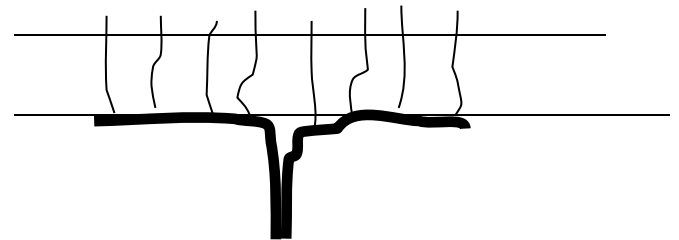


Trellis systems: reduce suscep/environ (also br, pm)

- High wire, no tie
 - juice, hybrid wine
 - 3 D



- Vertical shoot position
 - hybrid, *vinifera* wine
 - 2D (aeration, sunlight, fungicides)



- Shred prunings

Phomopsis; Chemical Management

- **Seasonal sprays of Captan, Mancozeb, Ziram;**
 - inexpensive and effective
 - protect shoots, rachises at first emergence
 - Immediate pre-bloom and 1st post-bloom sprays critical for fruit infections.
- **Few spores available by mid July; infection risk low after pea sized berries (MSU and Cornell).**



Leaf lesions appear 2 weeks after infection

Black rot: *Guignardia bidwellii*

Black rot symptoms

Lesions appear 2 weeks after infection in spring



Dark pycnidia within lesions

Black rot



- **Tan (chocolate milk) spots on berries**
- **Berries turn dark brown with numerous pycnidia**





Black Rot; Biology/Disease Cycle

- Over-winters in infected fruit and wood on ground and in trellis.
- Spores released by rain, splashed to green tissue.
- New infections may produce inoculum in 2-3 weeks
- ***Most fruit infection from secondary sources.***

Black rot

- Leaf and shoot tissue susceptible as long as still expanding.
- Fruit very susceptible from start of bloom to 3-4 (Concord) to 4-5 weeks (*vinifera*) after bloom.
- Fruit highly resistant by 6 (Concord) to 8 (*vinifera*) weeks after bloom.



Cultural/Chemical control of black rot

- Reduce pathogen (sanitation)
 - remove fruit mummies; potent sources of inoculum
 - chop, plow, till into soil.
- Reduce environment/host suscep: Maximize air, light, pesticide penetration into fruit zone and canopy



- Fungicides:
 - Sterol inhibitors; (Rally, Elite, Mettle, Rhyme, Inspire Super/Revus Top)
 - Strobilurins; (Flint, Pristine, Sovran, Abound)
 - SDHIs (Miravis Prime)
 - Old Standards: Mancozeb, Ziram, Captan
 - Organic?...copper formulations

Scouting for black rot





***Scouting for
black rot***

Powdery mildew: *Uncinula necatur*



Powdery mildew signs and symptoms; Leaves



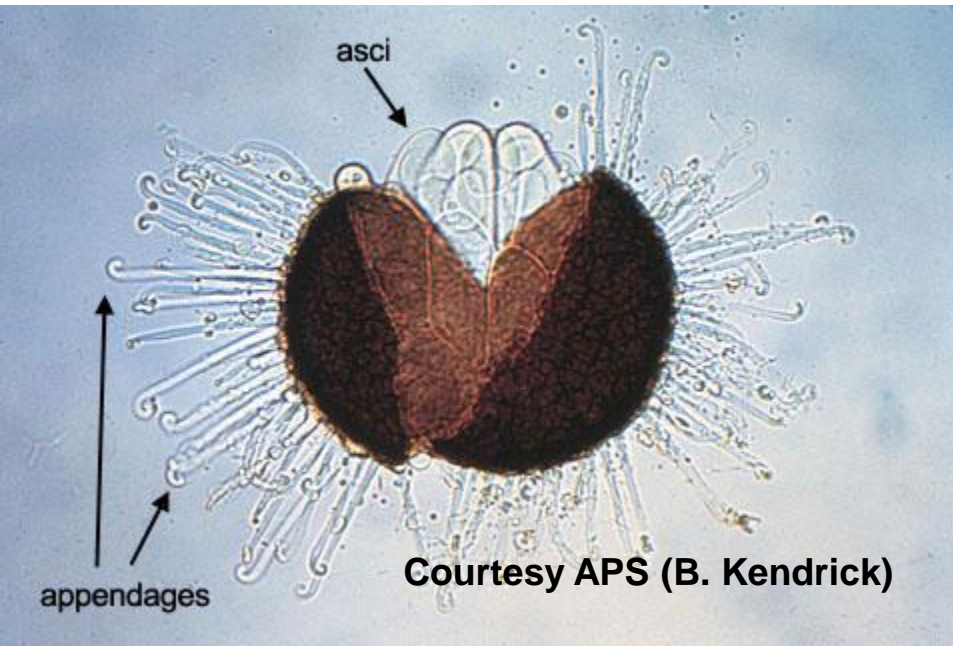
Powdery mildew Signs and Symptoms; Fruit



**Infections at bloom
can cause poor fruit
set**

Powdery Mildew; Primary Infection Cycle

- Chasmothecia overwinter in bark
- Swell, split open during spring rain, ascospores released (0.1" rain, >50F)
- Ascospores blown to emerging tissue
- Can infect wet or dry tissue.
- Ascospore supply exhausted shortly after bloom.





Courtesy APS (W. Gärtel)

Powdery Mildew; Secondary Infection Cycles

- **Spores (conidia) from primary infections wind dispersed**
- **Rainfall not required**
- **Generation time only 5-7 days under ideal conditions (constant 60s-80sF; 85% RH)**



Powdery Mildew Management; Fruit

- **Peak** fruit susceptibility period is limited
Concord: immediate pre-bloom to 2-3 weeks post bloom
Sensitive hybrids and vinifera: immediate pre-bloom to 4 weeks post bloom

- Best materials
- Full rates
- Best coverage
- Tightest intervals



Powdery mildew infections on fruit....rots later

- Protect fruit for 3-4 wks after capfall.
- Early infections = severe mildew, splitting.
- **Late infections = diffuse infections**, “invisible”
 - breaches, dead zones in skin
 - exacerbates fruit splitting
 - provides opportunities for rot fungi.



Powdery Mildew; Cultural Control

- Reduce environment:
 - leaf removal/shoot thinning to maximize air circulation, sun exposure, pesticide penetration, reduce RH
 - good weed control
 - nutrient management/cover crops to limit canopies
- Reduce susceptibility - delay summer hedging with palissaging, minimize regrowth



Powdery Mildew; Chemical Control

- Strobilurins; Flint/Flint Extra, Sovran, Abound, Pristine
 - Combos: Luna Sensation, Quadris Top, Topguard EQ
 - Resistance widespread; not recommended!
- Sterol inhibitors; Rally, Elite/Orius/Tebuzol, Mettle, Procure/Viticure/Trionic, Rhyme, Topguard EQ, Cevya
 - Combos: Inspire Super/Revus Top/Quadris Top (difenoconazole), Luna Experience (teb)
 - efficacy slipped due to resistance; restrict use to outside of critical fruit protection period.

Powdery Mildew; Chemical Control

- **Quintec (quinoxifen)**
- **Vivando/Prolivo (metrafenone/pyriofenone)**
- **Torino (cyflufenamid)**

- **SDHIs: Succinate dehydrogenase inhibitors**
 - **Endura (boscalid)**
 - **Luna Experience (fluopyram + tebuconazole),
Luna Sensation (fluopyram + trifloxystrobin)**
 - **Aprovia (benzovindiflupyr/solatanol)**
 - **Aprovia Top (+ difenoconazole)**
 - **Miravis Prime (pydiflumetofen + fludioxinil)**

Powdery Mildew; Chemical Control

Old standards, Alternatives

- **Sulfur, lime sulfur**
- **Copper and lime**
- Monopotassium phosphate (Nutrol)
- Potassium bicarbonate (Kaligreen, Armicarb, Milstop...)
- Oils (Stylet, Purespray, Ultra-fine, soybean, etc...)
- **Plant extracts - EF400, Vineyard Magic, GC-3, Citrex, Sporan, Regalia**
- **Biologicals: Bacillus bacteria (Serenade, Sonata, Taegro, Double nickel, etc.**
- **OSO, PH-D, Tovano (polyoxin D zinc salt)**

Downy Mildew: *Plasmopara viticola*



- Yellow “oil spots” in spring

Downy Mildew Signs and Symptoms; Underside of Leaves

Downy
sporulation
on
underside
of leaf



Downy Mildew; Shoots

Tissues thicken



White downy sporulation



Tissues blacken and die



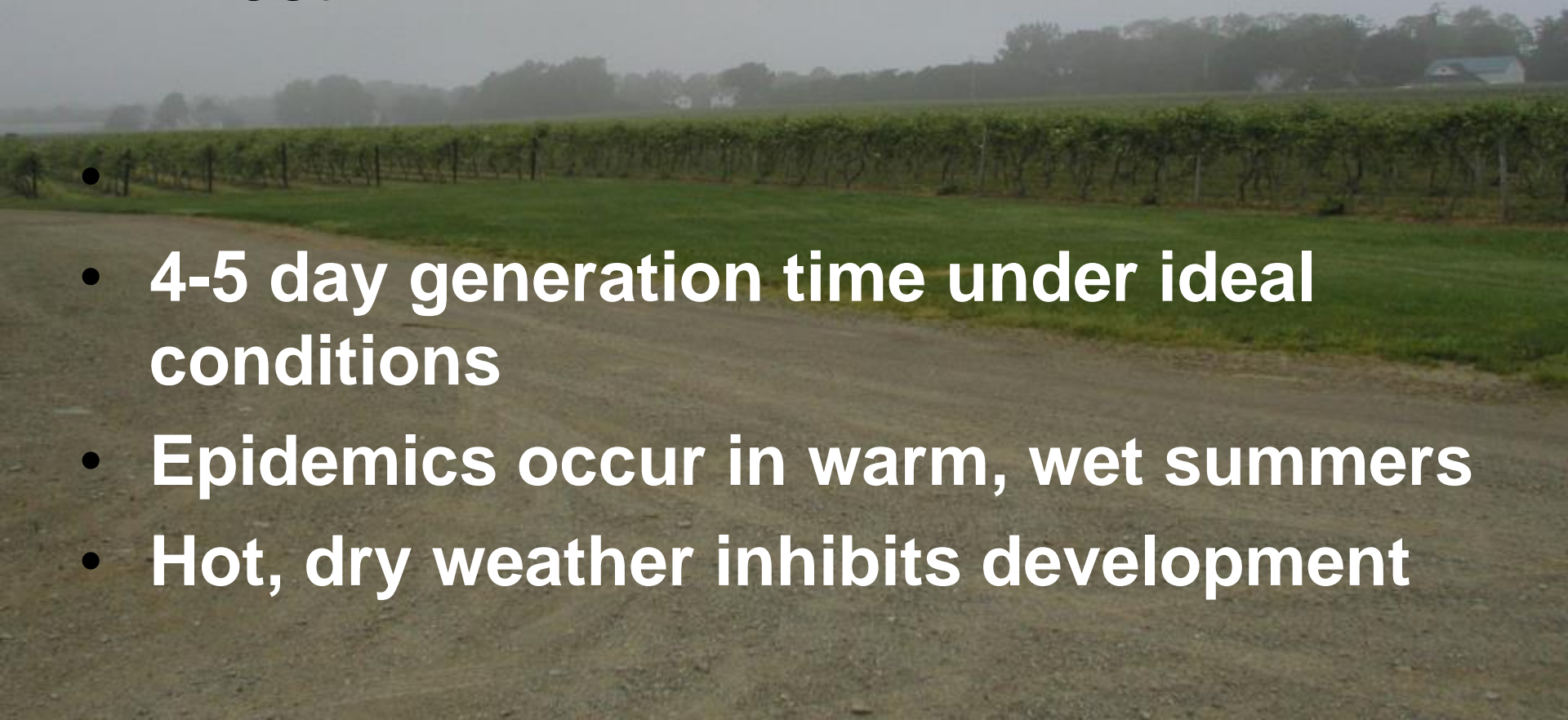
Downy Mildew; Primary Cycle



- Over-winters as oospores in infected leaves on vineyard soil
- Primary cycle; 5-6 leaf stage to fruit set
 - spores released at 0.1" rain, >52F
 - splashed from soil to canopy
 - requires wet leaf surface for infection

Downy Mildew; Secondary Cycles

- **Infections sporulate at night, >95% RH**
- **spores blown to wet plant surfaces, infect**
- **4-5 day generation time under ideal conditions**
- **Epidemics occur in warm, wet summers**
- **Hot, dry weather inhibits development**



Downy Mildew; Management

- **Leaves can be infected all season; less susceptible after fully expanding**
- **Clusters susceptible as soon as pathogen is active (5-6 leaf stage).**
- **Fruit resistant 2-4 weeks after bloom but...**
- **Rachises still susceptible after fruit are resistant (2-3 weeks longer?)**

Downy Mildew; Cultural control

- Reduce environ/suscep
 - appropriate trellis, canopy management
 - good air, soil drainage
 - good weed control
- Reduce pathogen
 - light spring cultivation to bury overwintering inoculum
 - early sucker control

Downy Mildew; Chemical control

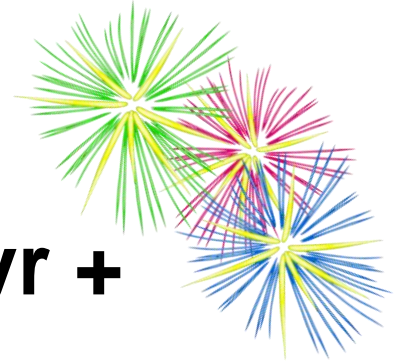
- Old Standards: mancozeb, captan, ziram, **copper/lime**
- Gavel 75DF: zoxamide (22) + mancozeb
- Ridomil (w copper or mancozeb); mefanoxam (4)
- Phosphites/phosphorous acid (Rampart, ProPhyt, Phostrol, Fosphite, Reveille, etc)
- Revus 2SC (mandipropamid; 40)
- Ranman; cyazofamid (21); effective alone and mixed with phosphorous acid.
- Zampro: New in 2013, Initium (45) + dimethomorph (same FRAC (40) as Revus)
- *Bacillus mycooides*: LifeGuard (?)
- **Strobilurins: (11) Flint, Sovran, Pristine, Abound**
- **Reason 500 SC; fenamidone (11); dm control only**

Newer fungicides to consider in 2020

- **Aprovia** (benzovindiflupyr: Syngenta)
 - ***Powdery mildew (good/excellent)***
 - Black rot, Botrytis (modest/suppression)
 - Phomopsis?
 - FRAC code 7: SDHI (same code as boscalid (Endura, Pristine), fluopyram (Luna))
 - 12 hour REI, 21 day PHI



Newer fungicides to consider in 2020



- **Aprovia Top** (benzovindiflupyr + difenoconazole: Syngenta)
 - ***Powdery mildew, Black rot***
(good/excellent)
 - **Phomopsis?**
 - **Botrytis (modest/suppression)**
 - **FRAC code 7: SDHI (same code as boscalid, fluopyram)**
 - **FRAC code 3: Sterol inhibitors**
 - **12 hour REI, 21 day PHI**

Newer fungicides to consider in 2020



- **Intuity** (mandestrobin: Valent)
 - Powdery mildew (suppression)
 - **Botrytis (fair to good)**
 - FRAC code 11: related to strobies
 - Restricted in NY (not for Long Island)
 - No sequential apps/rotate with non-FRAC 11, max 3 apps/season
 - **Do not use** on *V. labrusca*, *V. labrusca* hybrids, non-vinifera hybrids
 - Avoid mixing with organosilicone surfactants
 - 10 day PHI

Newer fungicides to consider in 2019



- **Fracture**
- **Biopesticide with novel active ingredient; a polypeptide derived from Lupines.**
- **Binds with and ‘fractures’ chitin in fungal pathogen cell walls.**
- **Fair to good powdery mildew and Botrytis/bunch rot control.**

Newer fungicides to consider in 2020



- **Miravis Prime**: pydiflumetofen + fludioxonil
 - ***Powdery mildew, black rot, Botrytis.***
 - FRAC group 7: SDHI (same code as Boscalid (Endura, Pristine), fluopyram (Luna), benzovindiflupyr (Aprovia))
 - FRAC group 12: fludioxonil (older, unrelated to anything)

New fungicide for 2020

- Cevya
- FRAC 3: sterol biosynthesis inhibitor
- mefentrifluconazole
- *Good to excellent on powdery mildew*
- Label restrictions: no use on *Vitis labrusca*/hybrids.

- Black rot?



New fungicide for 2020



- **Gatten - Powdery mildew**
- **FRAC group U13: new class of active ingredient**
- **Excellent results on pm in NY trials**
- **12 hour reentry, 14 day PHI**

Newer formulations to consider

- **Luna Sensation: fluopyram (7) + trifloxystrobin (11) – br, pm, phom, maybe dm suppression**
- **Dexter Max: Mancozeb + Azoxystrobin (11) – br, dm, pm, phom**
- **Trionic (triflumizole; (3) – pm, similar to Viticure**
- **Rhyme (flutriafol; (3) – br, pm**
- **Topguard EQ (flutriafol + azoxystrobin, (11) – br, dm, pm, phom**





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