Cold-Climate Wine Grape Disease Management Based on Cultivar Susceptibility and Fungicide Sensitivity

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NORTHERN GRAPES PROJECT

USDA NIFA

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Pillars of Disease Management

- Knowing **susceptibility of vines** to major diseases
  - Varies among varieties and plant growth stage
- Knowing **biology of diseases** so that appropriate cultural practices can be done
  - Where do pathogens overwinter?
  - What weather conditions drive disease?
- Knowing **how fungicides work** (or don't) on different diseases.

Cultivar Resistance: Cornerstone of Integrated Disease Management

La Crescent

Marquette

Lots of Unknowns for Cold Climate Cultivars

Cultivar	Black rot	Downy mildew	Powdery mildew	S	Cu
Brianna	?	+	?	?	?
Edelweiss	?	?	?	?	?
Maréchal Foch	++	+	++	Yes	Yes
Frontenac	+++	+	++	No	?
Frontenac gris	++	+	++	No	?
La Crescent	++	+++	++	?	?
La Crosse	+++	++	++	?	?
Marquette	+++	+	+	?	?
St. Croix	?	++	++	?	?

Degree of susceptibility/sensitivity: + = slightly; ++ = moderately; +++ = highly; ? = not known

Downy Mildew (*Plasmopora viticola*)

Downy Mildew (*Plasmopora viticola*)

- Total crop loss possible in severe cases.
- Lesser amounts of disease can result in rejection by winemakers.
- Premature defoliation leads to
  - reduced sugar in berries.
  - reduced winter hardiness in buds and vines.
- DM can develop *very quickly* during mild, rainy periods with extended cloud cover.

Downy Mildew Disease Cycle

- Overwinters on the ground in old leaves and soil.
- First infections: ~1 inch rain + 50 ^{o}F.
- Suckers or volunteer seedlings often the first infected, because close to the ground.
- Further infections: 2 hours + 77 ^{o}F
- Dormant sprays have no effect on DM.

Powdery Mildew (*Erisyphe necator*)

Powdery Mildew Disease Cycle

- Develops later in the season than downy mildew.
- Spores don’t require free water to germinate, just high humidity.
- Disease favored by high humidity and temps 68 to 80 ^{o}F.

Black Rot
(*Guignardia bidwellii*)

Field Trials at two locations in Wisconsin

Cultivars

- Brianna
- Frontenac
- Frontenac gris
- La Crosse
- La Crescent
- Marquette
- St. Croix
- Valiant

Diseases rated

- Downy mildew
- Powdery mildew
- Black rot rated

Rating = % canopy diseased

1 = 0%

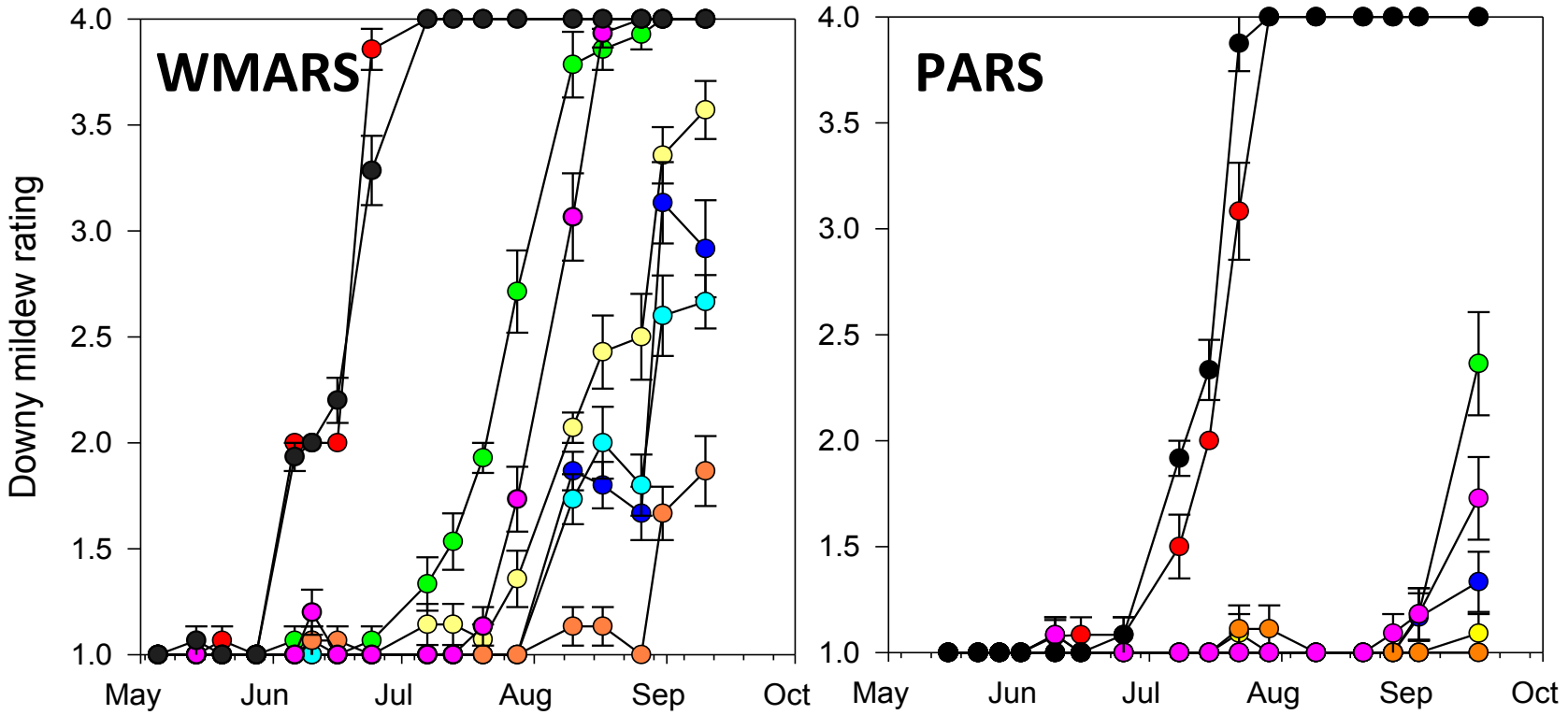
2 = 1 to 25%

3 = 26 to 50%

4 = more than 50%

Peninsular Agricultural Research Station (PARS), zone 5b
West Madison Agricultural Research Station (WMARS), zone 5a

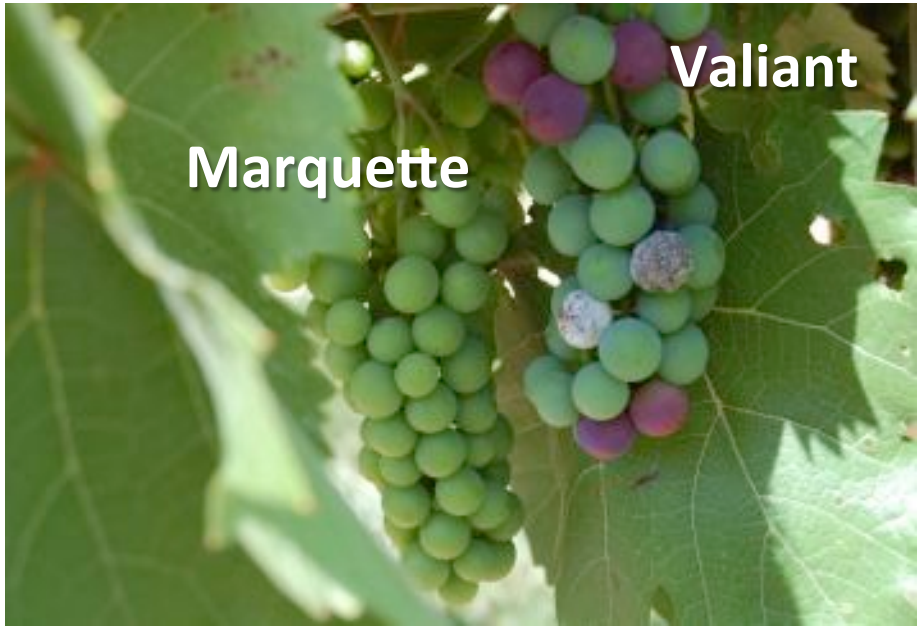
Downy Mildew on Leaves in 2015

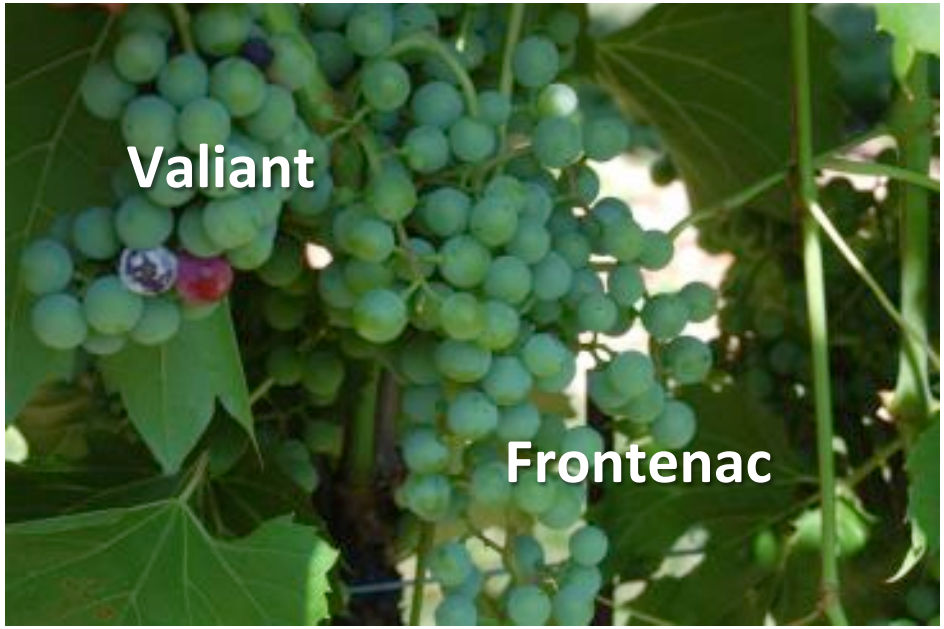


Similar trends in 2016 & 2017

Downy Mildew on Fruit

- Valiant >90% damaged by downy mildew in both years at both sites.
- No downy mildew on fruit of other cultivars in our trials 2015, 2016, 2017.





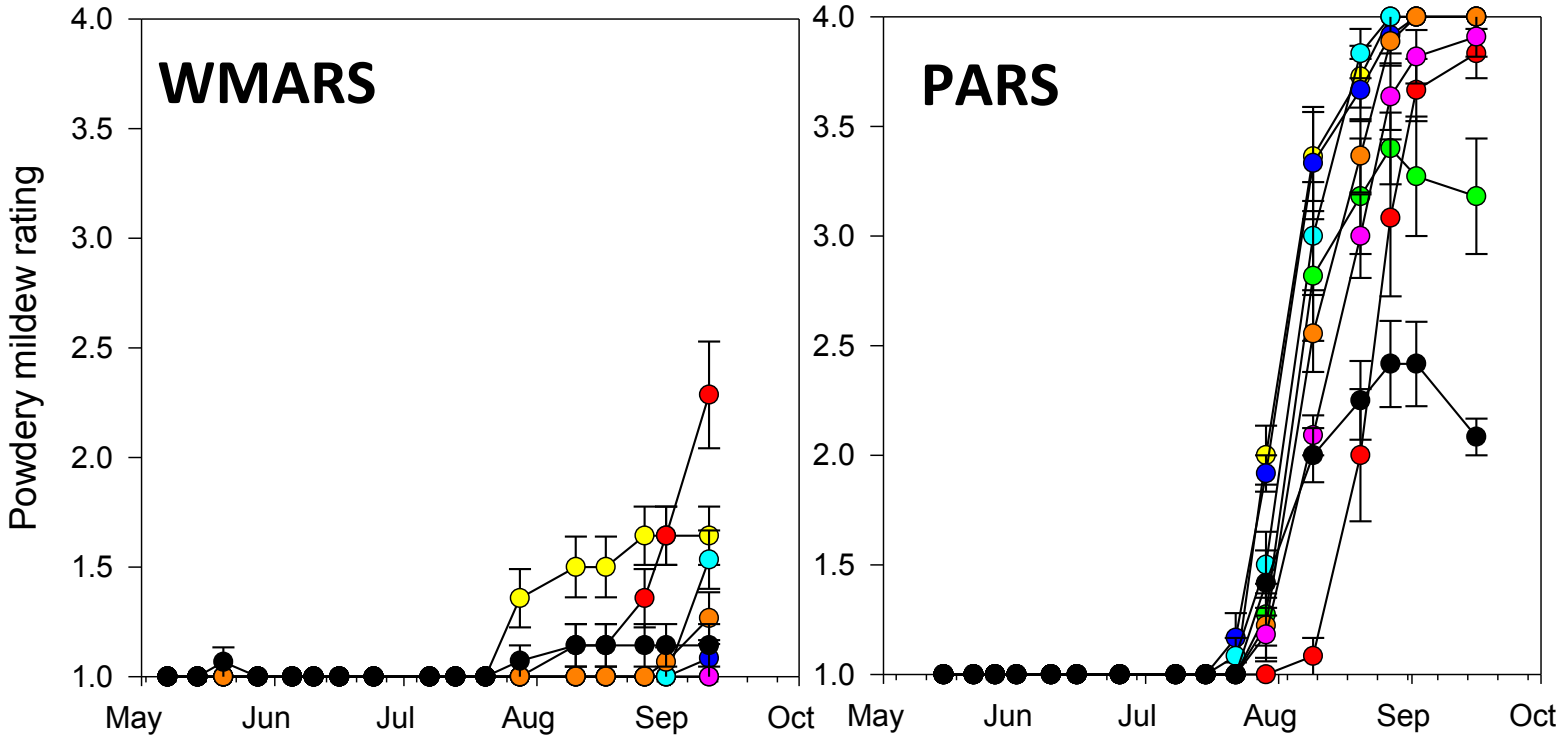
Susceptible

Less susceptible

Downy Mildew on Leaves
Valiant = LaCrosse
La Crescent
St. Croix
Brianna
Frontenac = Frontenac gris
Marquette

Many cold-climate cultivars are vigorous and can withstand minor leaf injury.

Powdery Mildew on Leaves in 2015



Similar trends in 2016 & 2017

Powdery Mildew on Fruit

- All cultivars had PM on fruit and/or rachis.
- Brianna, Frontenac, Frontenac gris most susceptible.
- Consistent with foliar ratings.

PM on Brianna rachis

PM on Frontenac gris berries →

Susceptible

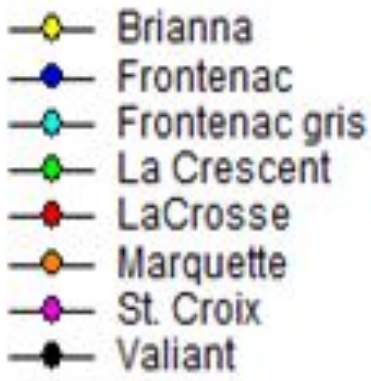
Less susceptible

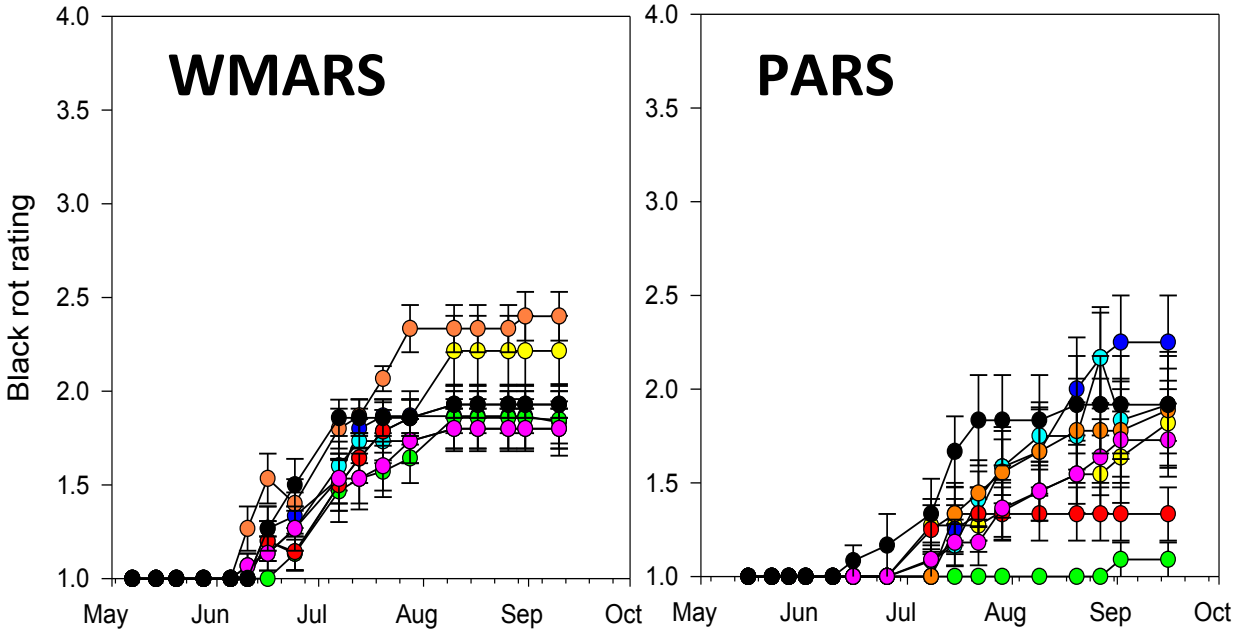
Powdery Mildew
Brianna** = Frontenac* = Frontenac gris*
Marquette*
La Crosse**
St. Croix*
La Crescent = Valiant

*PM primarily on rachises

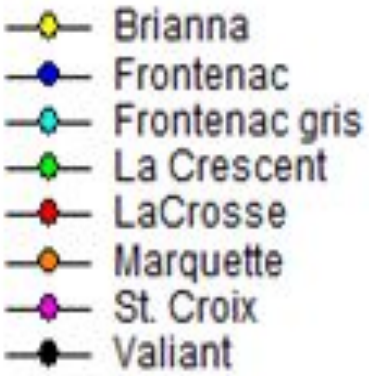
**PM on both berries and rachises

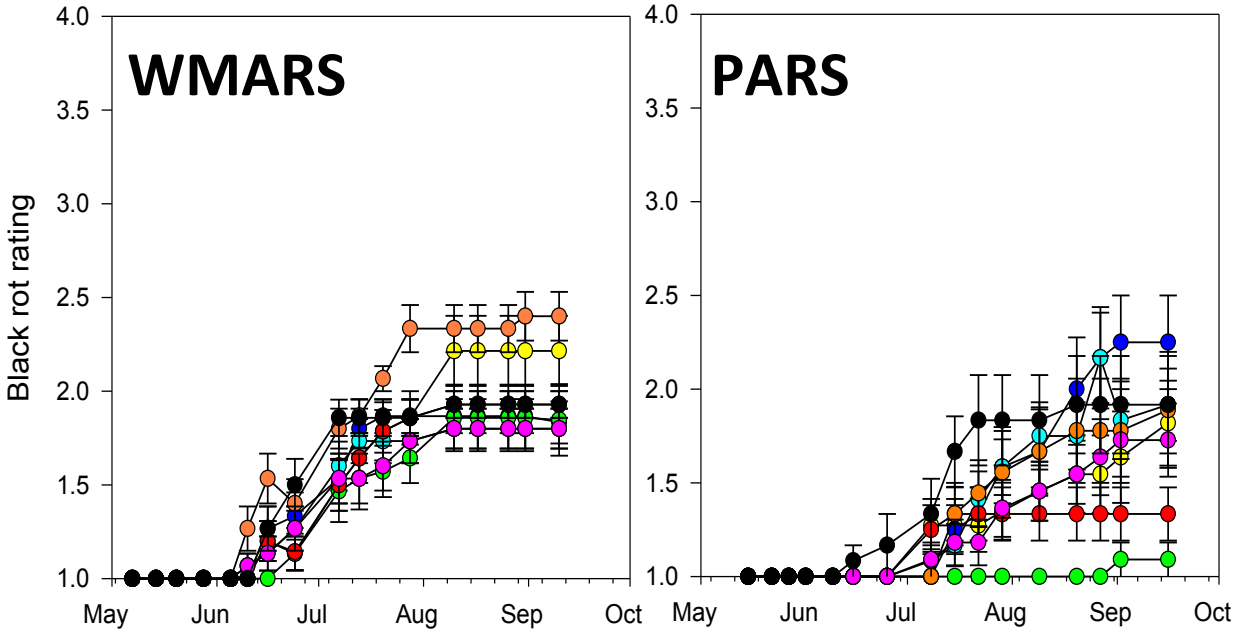
Black Rot on Leaves 2015



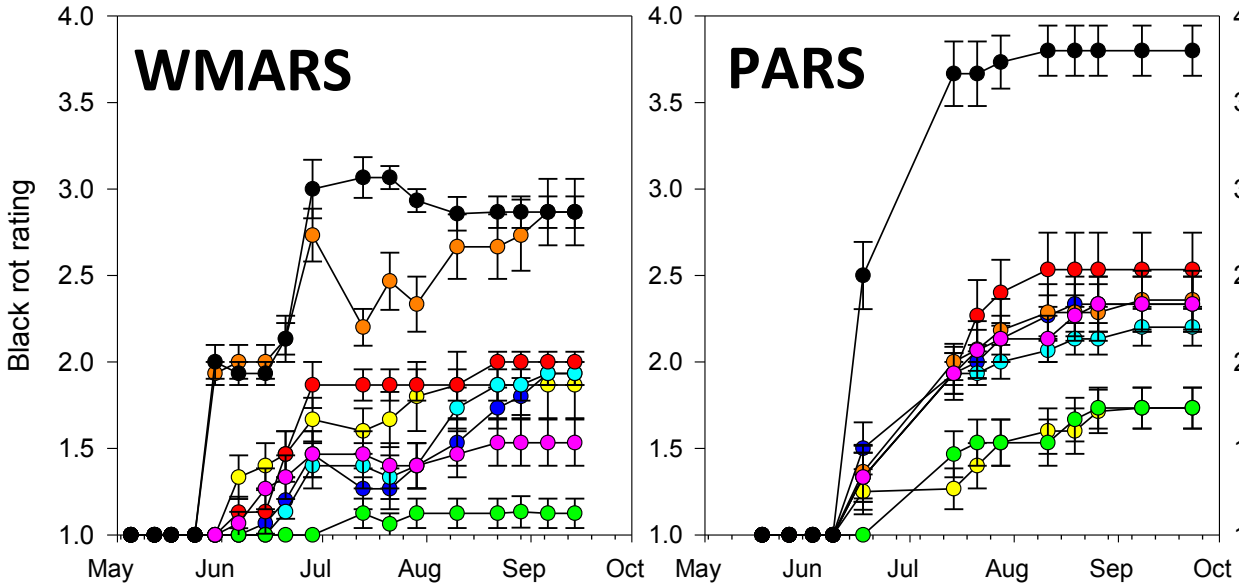


Black Rot on Leaves 2015

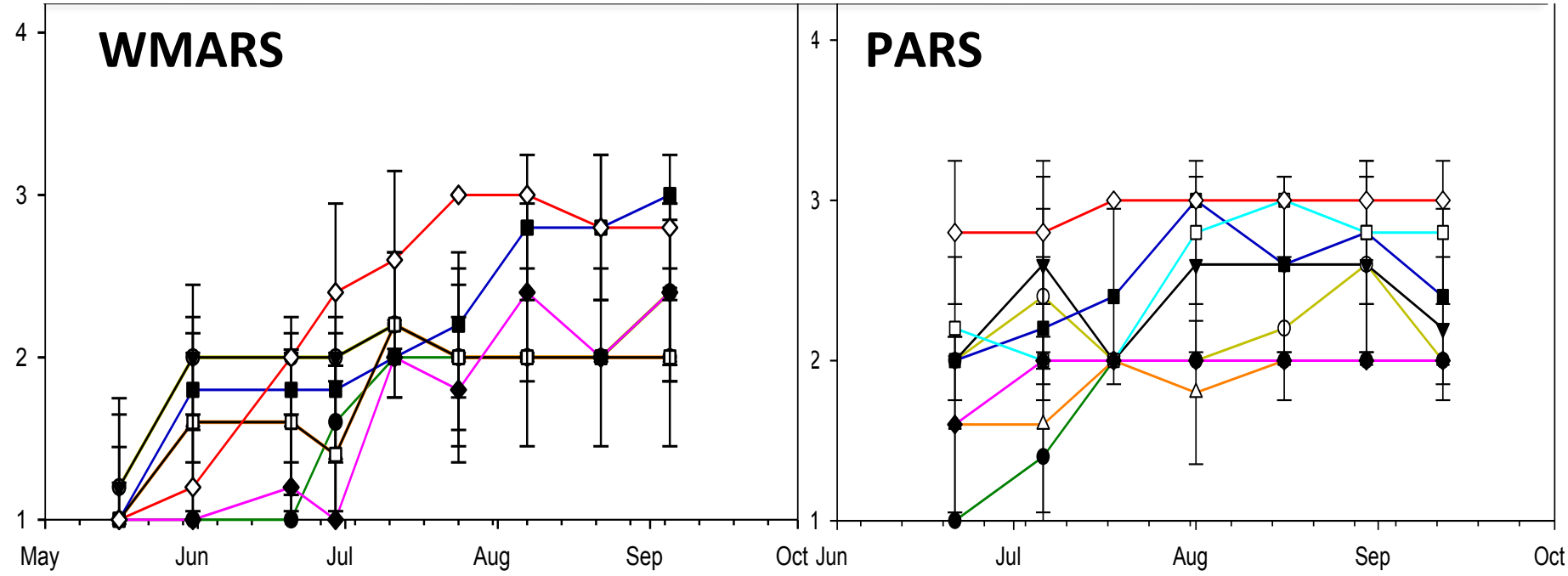




Black Rot on Leaves 2016



Black Rot on Leaves 2017



Black Rot on Fruit

- **2015:** scattered rot on Valiant, Marquette, Frontenac, Frontenac gris
- **2016:** BR on 20 – 80% of clusters of Valiant, Marquette, Frontenac, Frontenac gris, LaCrosse,
- **2017:** BR on 25 – 100 % of clusters of Valiant, Marquette, Frontenac, Frontenac gris, LaCrosse, St. Croix, Brianna, and LaCrescent

Left unchecked, black rot builds from one year to the next.

Susceptible

Less susceptible

Black Rot
Valiant = Marquette
Frontenac = Frontenac gris
La Crosse
Brianna = St. Croix
La Crescent

Berries highly susceptible

Leaves can sustain minor to moderate BR, but winemakers have very low tolerance for diseased fruit.

Phomopsis Leaf Spot and Fruit Rot (*Phomopsis viticola*)

2015 & 2016: Trace amounts
2017: Trace amounts on several cultivars; > 25% of St. Croix leaves diseased.

Susceptible

Less susceptible

Downy mildew	Powdery mildew	Black rot
Valiant, LaCrosse	Brianna, Frontenac, Frontenac gris	Valiant, Marquette
La Crescent	Marquette	Frontenac, Frontenac gris
St. Croix	La Crosse	La Crosse
Brianna	St. Croix	Brianna, St. Croix
Frontenac, Frontenac gris	La Crescent, Valiant	La Crescent
Marquette		

St. Croix relatively susceptible to Phomopsis

Caveats

- Study limited to 3 years, 2 locations.

- Diseases may have interfered with each other.
  - Early downy mildew on Valiant and La Cresecent may have prevented development of powdery mildew later.
  - Severe downy mildew and black rot on fruit in July make it difficult to rate Phompsis fruit rot in August.

Conclusions

- Cold-climate cultivars vary widely in susceptibility to diseases.
- Susceptibility to leaves and fruit differs for some cultivars.
- Disease symptoms can vary among cultivars and throughout the season.
- Without control, severity of black rot and phomopsis builds over years.

Lots of Unknowns for Cold Climate Cultivars

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Frontenac gris	++	+	++	No	?
La Crescent	++	+++	++	?	?
La Crosse	+++	++	++	?	?
Marquette	+++	+	+	?	?
St. Croix	?	++	++	?	?

Degree of susceptibility/sensitivity: + = slightly; ++ = moderately; +++ = highly; ? = not known

Copper

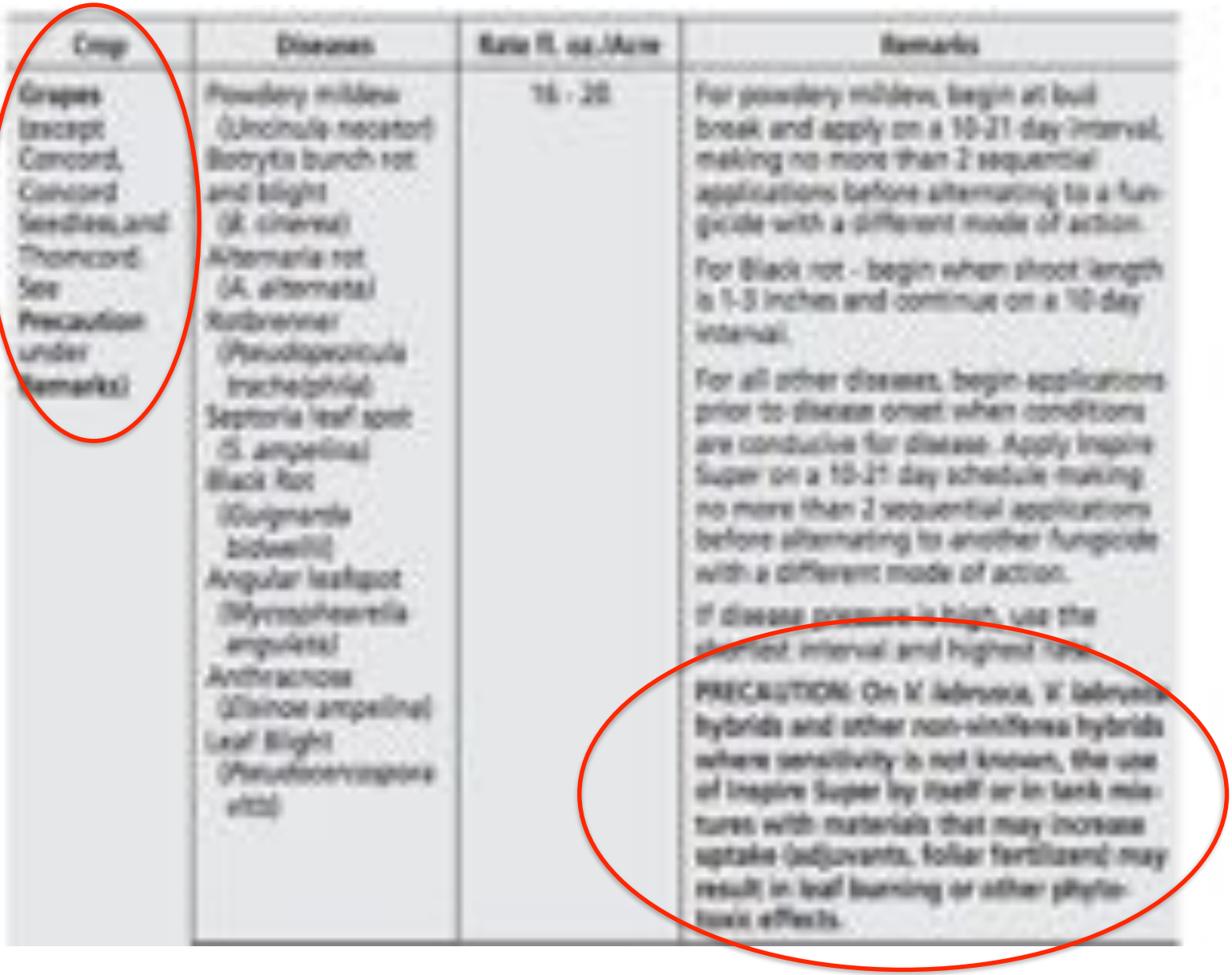
- Highly effective on downy mildew.
- Limited activity against other pathogens.

Sulfur

- Highly effective on powdery mildew.
- Little or no activity on other pathogens.

Difenoconazole

- 2nd generation sterol demethylation inhibitor.
- An active ingredient in the “pre-mixed” fungicide Inspire Super (other half is cyprodinil).
- Inspire Super effective against black rot, anthracnose, powdery mildew, Botrytis bunch rot.



Crop	Diseases	Rate fl. oz./Acre	Remarks
Grapes (except Concord, Concord Seedless and Thomcord. See Precaution under Remarks)	Powdery mildew (Uncinula necator) Botrytis bunch rot and blight (B. cinerea) Alternaria rot (A. alternata) Rotbrenner (Pseudopeziculla tracheiphila) Septoria leaf spot (S. ampelina) Black Rot (Guignardia bidwellii) Angular leafspot (Mycosphaerella angulata) Anthracnose (Elsinoe ampelina) Leaf Blight (Pseudocercospora vitis)	16 - 20	For powdery mildew, begin at bud break and apply on a 10-21 day interval, making no more than 2 sequential applications before alternating to a fungicide with a different mode of action. For Black rot - begin when shoot length is 1-3 inches and continue on a 10 day interval. For all other diseases, begin applications prior to disease onset when conditions are conducive for disease. Apply Inspire Super on a 10-21 day schedule making no more than 2 sequential applications before alternating to another fungicide with a different mode of action. If disease pressure is high, use the shortest interval and highest rate. PRECAUTION: On V. labrusca, V. labrusca hybrids and other non-vinifera hybrids where sensitivity is not known, the use of Inspire Super by itself or in tank mixtures with materials that may increase uptake (adjuvants, foliar fertilizers) may result in leaf burning or other phytotoxic effects.

Crop injury warning for products containing difenoconazole

Each cultivar tested in 5 to 11 independent trials

Brianna
Frontenac
Frontenac gris
La Crescent
LaCrosse
Léon Millot
Maréchal Foch
Marquette
NY76
St. Croix
Valiant

Treatments

- **Copper:** *Cuprofix Ultra 40 or Champ WG*
- **Sulfur:** *Microthiol Disperss*
- **Difenoconazole:** *Inspire Super*

Applied 3 to 6 times at 2- to 3-week intervals

Applied at highest labeled rate

Fungicides applied alone; not mixed with adjuvants or other pesticides.

Copper injury on Brianna

Sensitivity to Copper

- Do not apply copper to Brianna.

- Restrict copper to 1 or 2 sprays/season, avoiding consecutive sprays, on Frontenac, Frontenac gris, LaCrescent, Léon Millot, Maréchal Foch, Marquette, and St. Croix.

Sulfur injury on Maréchal Foch

Sulfur injury on Maréchal Foch

Sensitivity to Sulfur

- Do not apply sulfur to Maréchal Foch, Léon Millot, or Brianna.

- Restrict sulfur to 1 or 2 sprays/season on La Crescent and St. Croix.

Sensitivity to Difenoconazole

- Noiret was the only cultivar sensitive to difenoconazole.

Copper and Sulfur in Spray Programs

- Do you have reason to use copper and/or sulfur?
  - Organic
  - Fungicide resistance management
  - Economics
- Are copper and sulfur compatible with other products you rely on?
  - Copper or sulfur applied alone in our trials—no adjuvants, no tank mixes.
  - Read labels carefully.

Copper and Sulfur in Spray Programs

- Weather at time of application and within 24 hours after
  - Hot temps (> 85 F) increases risk of sulfur injury.
  - Cool temps, prolonged wetness increase risk of copper injury.

Northern Grapes News

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In This Issue:

- Cost of Production in Cold Hardy Grapes. 1-3
- Small Sprayers for the Smaller Vineyard. 3-6
- NGP Team Profile: Diana Cochran. 7
- NGP Team Profile: Anna Wallis. 8
- Fungicide Sensitivity in Cold Hardy Wine Grapes. 9-11

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Wisconsin Fruit

UW Fruit Program

fruit.wisc.edu

Thank You!

Questions?