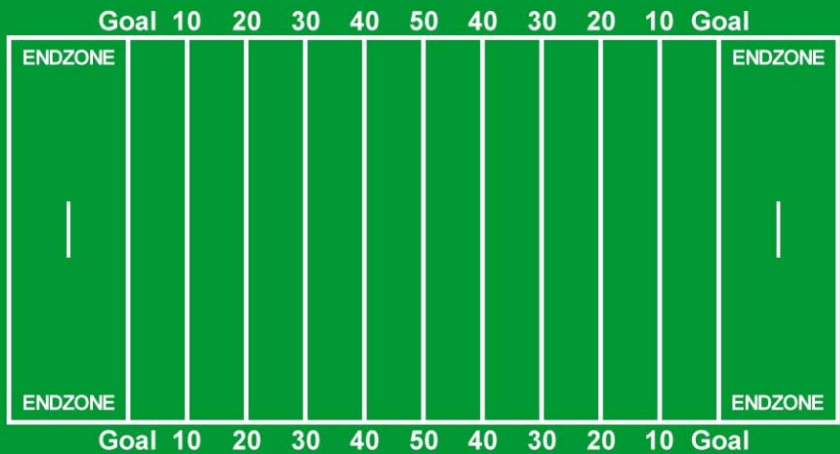


Late-season disease control
options to manage diseases, but minimize
fermentation problems and wine defects

Tony Wolf, Virginia Tech

Late-season disease control options to manage diseases...



.....but minimize fermentation problems and wine defects

Point of this slide is to suggest that the objectives mentioned in title of talk often put growers and vintners on opposite sides of the field. Our effort with talk is to review ways and materials that will increase the likelihood that we're on same team.

- “Late-season” – anytime after veraison; 30 to 60 days prior to harvest
- Diseases of importance
- Fungicides that can negatively impact wine quality or must fermentation, and how [others such as mancozeb, are very potent inhibitors, but disallowed within 66 days of harvest].
 - captan
 - coppers
 - sulfur
 - others? (thiophanate methyl [Topsin M], fenarimol [Rubigan])
- Alternative materials/strategies

So, the fungicides of concern from a wine production standpoint are mainly captan, coppers and sulfur. Those with long PHIs, such as mancozeb, should not be an issue if PHI is followed.

Diseases

- Powdery and downy mildew
- Ripe rot
- Bitter rot
- Phomopsis
- Macrophoma fruit rot
- Botrytis
- Non-specific bunch rot or sour rot

These are the principal diseases of concern late-season. Black rot, for example, is not a major late-season issue, unless you've failed to avoid earlier infections.

Mildews

- Fruit acquires resistance to infection as it matures
- “late-season” sprays would be targeting foliar infections – could be important with significant disease present and need to retain functional canopy



Powdery mildew

- Alternatives to sulfur for powdery mildew (most have 14-day or less PHI)
- Period of concern? (30-45 days)
- Strobilurins
- Quintec
- Horticultural oils
- Endura (boscalid)
- DMIs (e.g., Elite)
- Oxidate (hydrogen dioxide)
- Inorganic salts (Nutrol, Kaligreen, Armicarb, etc.)



Powdery mildew

Quintec (ex. of testing with a very specific MOA fungicide)

Lopez et al., 2004. Influence of Quinoxifen on fermentation of grape musts. Food Technol. and Biotechnol. 42:89-97

Vines (Sangiovese and Trebbiano) treated with recommended dose; up to five applications at 14-day intervals; with PHIs of 7 to 28 days.

- Quinoxifen residues at or lower than 0.012 mg/L in musts = lower than the threshold (0.5 mg/L) allowed under Italian law
- No significant effects of quinoxifen on yeast dynamics
- Secondary compounds not affected by quinoxifen

Downy mildew

- Alternatives to captan or copper for downy mildew (most have 14-day or less PHI)
- Period of concern? (30-45 days)
- Strobilurins (some, but be cognizant of resistance issues)
- Pristine
- Phosphorous acid (e.g. ProPhyt, Phostrol)



Ripe rot

- Fungus overwinters in diseased fruit, wood or other tissues
- Spores dispersed by rain and wind
- Infection can occur throughout the season
- Symptoms absent until fruit begins to ripen
- Salmon-colored spores can cause repeating infection cycles with warm, rainy weather.



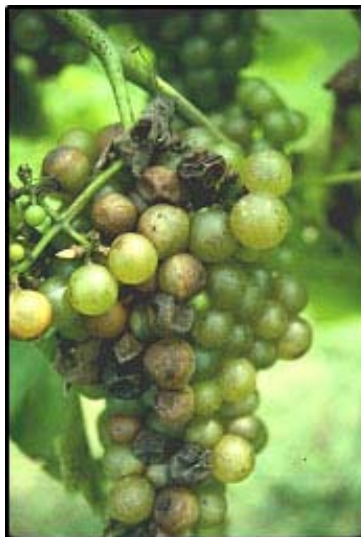
Figure 1. Ripe rot on grapes.

Fungicide	Phomopsis	Bitter rot	Ripe rot	Macrophoma	Black rot	Botrytis
Strobilurins Pristine	++	+++	+++	++++	+++	++ ++++
Topsin M	++	+++	+	+++	+	++
Captan	++++	+++	++++	++++	+	+
Vanguard/ Rovral						++++
Elevate/ Scala						++++
DMI		++++		++	++++	
Copper	+	+?	+?	+?	+	
Mancozeb	++++	++++	++++	++	++	
Sulfur						

The more crosses, the more effective the fungicide for a particular disease. A question mark means that there is some uncertainty about efficacy.

Bitter rot

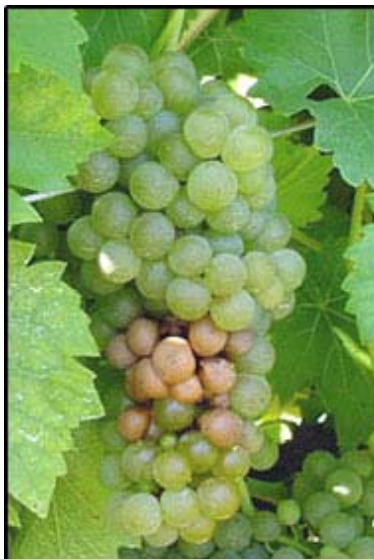
- Fungus overwinters in diseased fruit, wood or other tissues
- Spores dispersed by rain and wind
- Infection of berries through pedicels occurs between bloom and veraison and needs a wetting period and warm temperatures
- Symptoms absent until fruit begins to ripen
- Affected berries have bitter taste



Fungicide	Phomopsis	Bitter rot	Ripe rot	Macrophoma	Black rot	Botrytis
Strobilurins Pristine	++	+++	+++	++++	+++	++ ++++
Topsin M	++	+++	+	+++	+	++
Captan	++++	+++	++++	++++	+	+
Vanguard/ Rovral						++++
Elevate/ Scala						++++
DMI		++++		++	++++	
Copper	+	+?	+?	+?	+	
Mancozeb	++++	++++	++++	++	++	
Sulfur						

Non-specific or sour rot

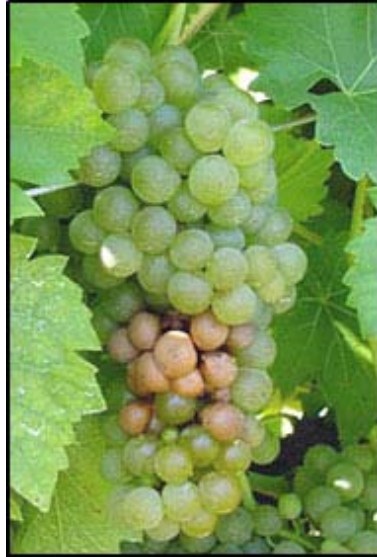
- Often caused by injury (e.g., bird pecking, grape berry moth, or fruit splitting due to rain, cluster compactness)
- Acetic acid odors caused by bacteria
- May include yeasts, fungi, bacteria
- Fungicides after the fact have little benefit



Note the last bullet – there's not much point in applying a fungicide for a non-fungal rot. It might be tempting to apply captan in this situation, but bear in mind that captan residues can retard alcoholic fermentation.

Non-specific or sour rot

- Cultural controls
 - Canopy management to promote fruit drying
 - Crop thinning later to minimize compensating berry size increase
 - Fruit sorting at harvest
- Manage other pests that might cause primary injuries (e.g., gbm)
- Application of a fungicide would be of questionable value, particularly for bacterial rots.



Botrytis

Conditions for disease development (late)

- cultivar
- humid and/or wet fruit
- existing infections from early season

Cultural control measures

Chemical control measures



Fungicide	Phomopsis	Bitter rot	Ripe rot	Macrophoma	Black rot	Botrytis
Strobilurins Pristine, Flint	++	+++	+++	++++	+++	++++ ++++
Topsin M	++	+++	+	+++	+	++
Captan	++++	+++	++++	++++	+	+
Vangard/ Rovral						++++
Elevate/ Scala						++++
DMI		++++		++	++++	
Copper	+	+?	+?	+?	+	
Mancozeb	++++	++++	++++	++	++	
Sulfur						

Botrytis

Influence of fenhexamide (Elevate)

Cabras et al., 2001. Food Additives and Contaminants 18:625-629)

Cabras et al. 2003. J. Agric. Food Chem. 51:5012-5015

Fenhexamide did not affect alcoholic or malolactic fermentation (similar results with Vangard and Scala)

Fenhexamide residues in wine decreased by fermentation on skins

Fermentation did not degrade fungicide and later paper (2003) suggested yeast cell wall components (chitin and glucans) adsorbed residue



Conclusion: Elevate a very specific compound and not likely to interfere with fermentation.

Some general conclusions

- Exercise effective disease control measures to avoid early infections of late-season rots (many fungicide alternatives)
- Post-veraison, particularly in last 45 days, avoid those fungicides known to affect fermentation or wine quality
- Use alternative products and or fungicides not shown to affect wine quality when used at label rates and timing
- Do not use fungicides for non-fungal diseases