13 Relationship between cluster compactness and bunch rot in Vignoles grapes

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• *Vignoles* is a cold-hardy interspecific *Vitis* hybrid widely grown in the eastern United States for the production of sweet wines. It produces small compact clusters that are very susceptible to bunch rot, caused by *Botrytis cinerea*. The goal of this study was to determine the importance of cluster compactness and floral debris retention in bunch rot development. The information gathered would help in the design of treatments to improve bunch rot management.

• The trials took place at the experimental vineyard of Lake Erie Grape Research and Extension Center (N-W Pensylvania). On the first year of the trial (2001), the researchers flagged **"loose" and "compact" clusters** from the north (shaded) side of the row, where rot was most severe. They later used the flagged clusters to record:

1) **number of berries per centimeter of cluster rachis**
2) **incidence** of bunch rot
3) **severity** of bunch rot
4) **retention of floral debris** (number of dried out calyptras and flowers).

• On the second year of the trial (2002), researchers tried out the effects of removing the floral debris from some of the clusters before repeating the above measurements. They also incubated floral debris samples on petri dishes to verify whether they were a source of Botrytis. (The vineyard suffered winter damage in 2003 and there was little fruit to monitor that year). Two additional treatments were incorporated in the study on the third year of the trial (2004): 1) doubling the amount of floral debris naturally present on the clusters; and 2) modifying the degree of cluster compactness by the early removal of basal leaves.

• **Results.**
1) "Berries per centimeter" as an indicator of bunch compactness. In all 3 years of the study, clusters visually judged to be compact had significantly more berries per centimeter of rachis (11.8 berries on average) compared to loose clusters (6.6 berries on average). This reassured the researchers that they could continue using a visual classification of clusters in future studies.

2) Relationship between degree of compactness and bunch rot. In each trial year, *incidence* of bunch rot was significantly higher in compact clusters than in loose clusters (e.g. 72% vs. 6% in 2001). Bunch rot *severity* was up to four times higher in compact clusters than loose ones (e.g. 21% vs. 5% in 2004). Using mathematical equations, the author was able to calculate these two statements: 1) "every additional berry-per-centimeter unit of compactness almost doubled the odds of a cluster becoming infected with bunch rot", and 2) "clusters with less than 9 berries per centimeter were unlikely to become infected".

3) Effect of amount of floral debris on bunch rot. Floral debris removal decreased bunch rot. This removal benefited compact clusters much more (40% rot reduction) than loose clusters (25% bunch rot reduction). Conversely, doubling the natural accumulation of debris by adding more dried-out floral parts increased bunch rot (12% increase compared to the debris removal control). However, rainfall affected the importance of the presence of floral debris. (For instance, in 2002, a dry year less conducive to disease, removal of retained debris barely reduced rot, and instead, the presence of berry moth played more of a role.) Lab results showed that 61% of incubated floral debris samples were able to sporulate and be a source of *Botrytis.*

4) Effect of basal leaf removal on bunch rot. In both years tested**,** removal of basal leaves at trace bloom reduced cluster compactness and led to a reduction of bunch rot incidence and severity. This difference was only significant in a dry year like 2005 (68% and 82% reduction of incidence and severity, respectively). An unwanted effect of basal leaf removal was approximately 20% lighter clusters. This could be a potential concern in terms of yield reduction. However, recent studies have shown that cluster compactness can be reduced without negative effects on yield (See original article for references).

• The authors discussed the many ways in which cluster compactness can affect the severity of bunch rot:

_ by reducing berry cuticle thickness – an important barrier to infection – at the points where berries touch;
_ by affecting the time clusters stay wet after rainfall;
_ by affecting the amount of floral debris retained in the clusters
_ by affecting the efficacy of pesticide sprays: Vignoles clusters begin to close 2 weeks after bloom, meaning sprays may not penetrate during the most susceptible stage – berry ripening.

Conclusions.

_ "Berries per centimer of rachis" is an excellent indicator of cluster compactness for Vignoles, a grape variety which does not have extensive lateral development;
_ Removing floral debris from the clusters was generally effective to reduce bunch rot (but not if the year was particularly dry);
_ Removing the four basal leaves at the beginning of bloom was effective in reducing cluster compactness and lead to reduced bunch rot incidence and severity.

Based on this study, the author believes that cluster loosening must be part of an integrated bunch rot management program in the eastern United States. His ongoing research is addressing how to further modify cluster architecture.

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