

Persistence of elemental sulfur spray residue on grapes during ripening and vinification

Research in Plain English

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Background:

Elemental sulfur is an effective, durable, and economical spray material for managing powdery mildew, but growers and winemakers are leery of applying it too late in the growing season because of concerns about the impact of sulfur residues on fermentation and sulfur-associated off aromas. Sulfur residues exceeding 10 µg/g in musts are associated with increased hydrogen sulfide (H₂S “rotten egg aroma”) formation during fermentation. A key question for growers and wineries is ‘How long before harvest should a grower stop applying sulfur to avoid problems with residues in the wines?’ Little research has been done to determine the fate of field-applied sulfur or quantify where the sulfur ends up during the winemaking process. One obstacle has been the lack of a simple analytical method for quantifying elemental sulfur residues.

Using a [novel test](#) developed at Cornell, we conducted field trials over three growing seasons to quantify how the timing, formulation, and application rate of sulfur affected elemental sulfur residues on grapes and in musts. We also conducted separate trials to test the effect of different amounts of skin contact time during vinification and juice clarification on the fate of elemental sulfur residues.

Experimental Design:

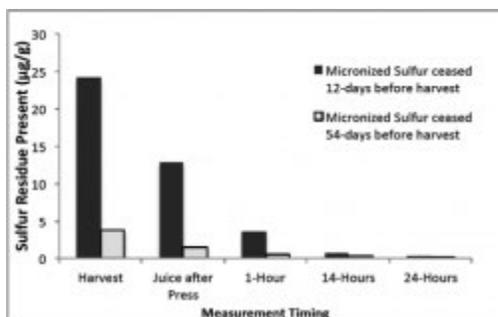


Figure 1. Sulfur residue concentrations found at different times during post-harvest processing of Riesling in 2011, in the Finger Lakes Region of New York. The fruit had received applications of micronized sulfur in the vineyard until either 12 or 54 days before harvest.

Sulfur persistence following field applications. Field trials in 2009–2011 included combinations of three variables:

- *Sulfur formulation:* Micronized sulfur (small particle size, and containing 20% other components to enhance adhesion) and wettable sulfur (large particle size) formations were compared.
- *Application rate:* A low rate (3 lb/acre) and a higher rate (5 lb/acre or 6 lb/acre) were compared
- *Timing:* The preharvest interval – that is, the time between the final sulfur application and harvest – was varied from as little as 8 days to nearly 10 weeks.

Sampling and Analyses

- *Measurement of residues in grapes before harvest:* Clusters were sampled in the field at 2–5 day intervals (9x from 32 to 0 days preharvest in 2010; 9x from 62 days preharvest to harvest in 2011).
- *Measurements of H₂S and S in wines:* H₂S production was measured daily during fermentation, and elemental sulfur was measured in juice before fermentation and during prefermentation settling.

Conclusions:

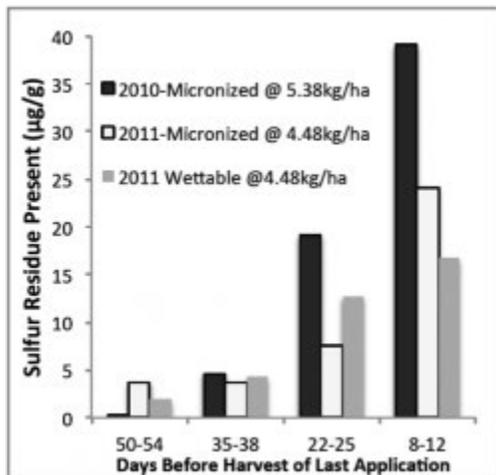


Figure 2. Sulfur residue concentrations found on Chardonnay (2010), and Riesling (2011) that had received micronized or wettable sulfur applications up until a given point where treatment was ceased before harvest. For all treatments, 35 days or longer was sufficient to achieve levels below 10 µg/ L, but concentrations above 1µg/ L persisted in some treatments even when application ceased 50 days before harvest.

- While past studies have shown high levels of elemental sulfur in must correlates with increased H₂S production during fermentation, less work has focused on elemental sulfur persistence in the vineyard.
- Limiting application rate and using a wettable powder rather than micronized spray may decrease the pre harvest interval necessary to meet desired residue levels.
- Sulfur residue should never be considered a problem when juice is clarified no matter how late it is applied. Even without clarification the amount of residue on grapes making into a white fermentation is roughly half.
- Nearly all residue on grapes destined for fermentation on the skins will make it into the fermentation. Vineyard management of sulfur residue is therefore necessary for red wines.
- Ceasing application 35-days or more prior to harvest resulted in concentrations below what has been widely shown to have a deleterious impact on wine quality. However, residue levels above 1ppm were found with sprays ceasing earlier, which in some cases may have a measurable increase on H₂S production, but not necessarily in wine quality.
- These results may help define application regimes and methodology for decreasing excess S-residues during fermentation without imposing unnecessary restrictions on grape growers

The bottom line: Elemental sulfur persistence is affected by application rate, formulation, and vintage. This study provides valuable insight on how and when elemental sulfur should be applied. Future work needs to be performed measuring

temperature, precipitation, and canopy management; as well as larger-scale studies across various sites.

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