



# Viticulture, enology and marketing for cold-hardy grapes



## Copper and Sulfur Sensitivity of Northern Grape Cultivars

Sturgeon Bay, WI and Madison, WI

*Patricia S. McManus and Matt Stasiak*  
*University of Wisconsin-Madison*

**Background and Rationale:** While many synthetic fungicides are failing owing to the emergence of fungicide-resistant pathogen populations, copper- and sulfur-based fungicides remain effective despite decades of use in vineyards. In grape production, sulfur is used primarily to control powdery mildew, whereas copper is used primarily to control downy mildew. Some copper- and sulfur-based products are allowed for use in organic production, and many formulations are relatively inexpensive. Thus, copper and sulfur continue to have an important place in modern grape production. Unfortunately, many important grape cultivars are sensitive to injury from copper and/or sulfur, but the sensitivity of the “northern” varieties is not known. Funding in Years 1 and 2 of the SCRI project were used to establish vineyards for the purpose of studying cultivar resistance to disease and sensitivity of cultivars to copper and sulfur. However, we also were able to conduct preliminary studies on copper and sulfur in 2012 and 2013 relying on an established research vineyard.

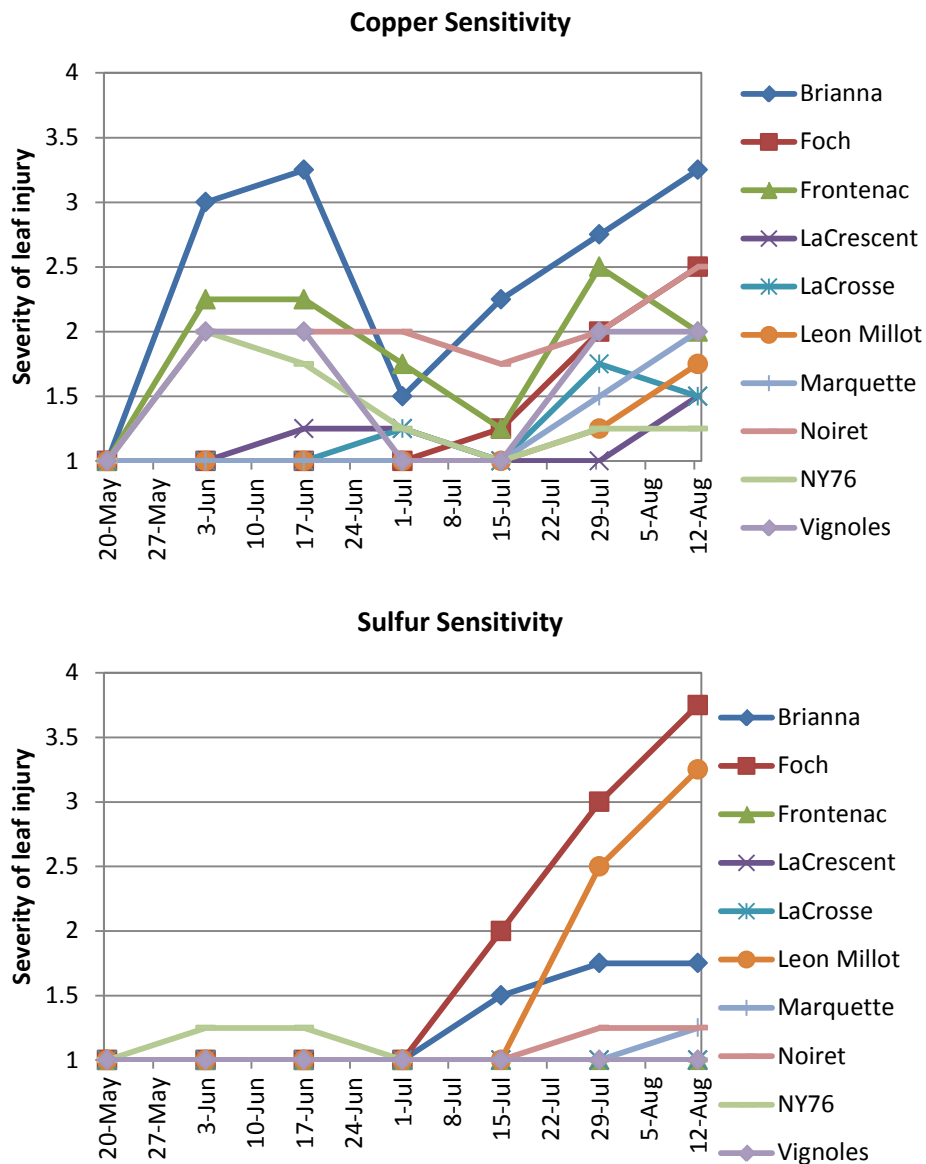
### Treatments:

- The following 10 cultivars in an established vineyard were treated at Peninsular Agricultural Research Station (PARS) in Sturgeon Bay, WI in 2012 and 2013: Brianna, Foch, Frontenac, LaCrescent, LaCrosse, Leon Millot, Marquette, Noiret, NY76, and Vignoles.
- The following 8 cultivars in a 1-year old vineyard were treated at West Madison Agricultural Research Station (WMARS) in Madison, WI in 2013: Brianna, Frontenac, Frontenac Gris, LaCrescent, LaCrosse, Marquette, St. Croix, and Valiant.
- Treatments were applied six times at approximately 2-week intervals from May through August at Sturgeon Bay and three times during July and August at Madison: Champ WG (copper hydroxide) at 4 lb/acre (= 2 lb metallic copper); and Microthiol Disperss (micronized sulfur) at 10 lb/acre (= 8 lb sulfur).

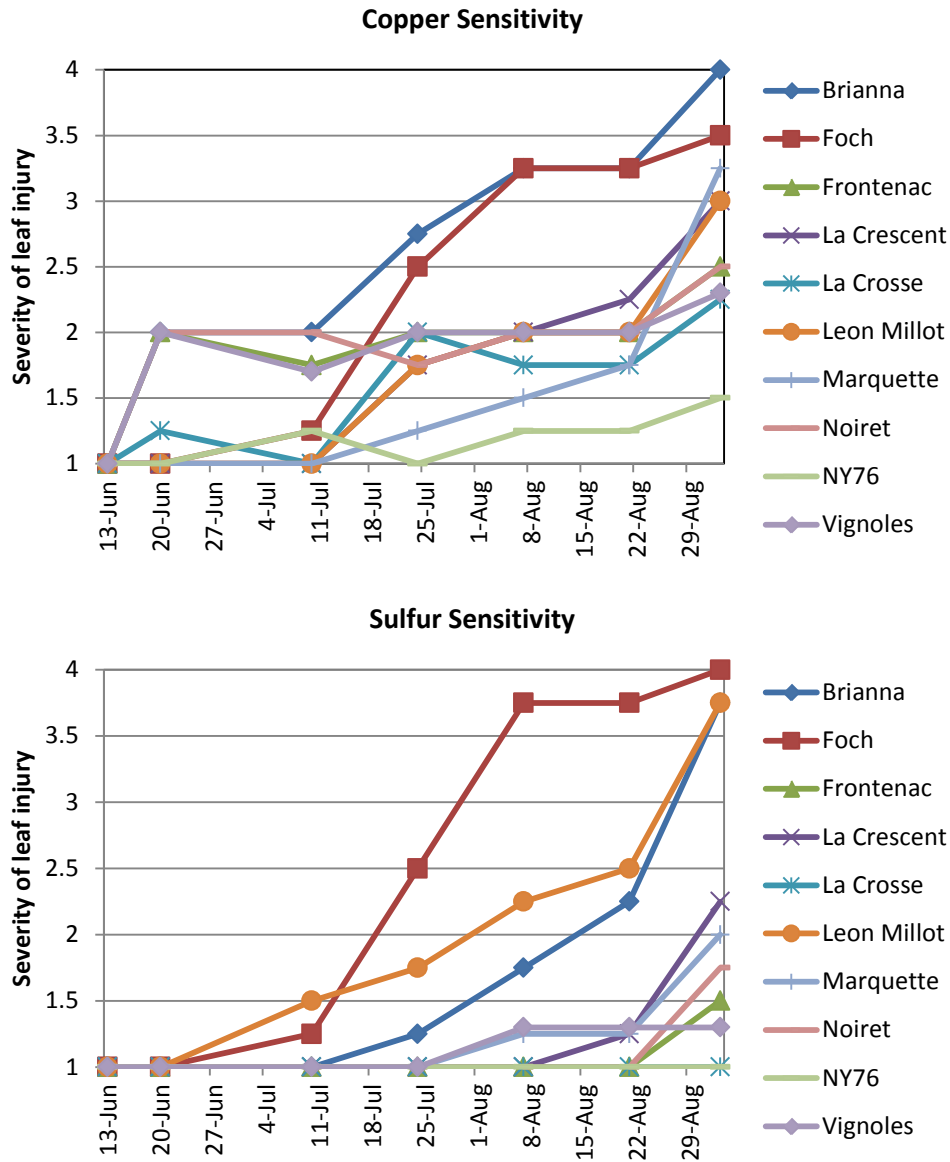
**Methods:** Foliage was rated on a visual scale of 1 (= no injury) to 4 (= severe injury) by one person for all treatments in a given trial. Individual leaves were not assessed; rather, the canopy as a whole was evaluated. At PARS, ratings were done throughout the season in both years; at WMARS, ratings were done on 4-Sept, 2013. Analysis of variance was performed and means for severity of injury to cultivars were compared by the Tukey-Kramer Honestly Significantly Different test.

**Results:** There were statistically significant differences in sensitivity to copper and sulfur among cultivars. However, to make graphs easier to read, season-long data from both years at PARS are

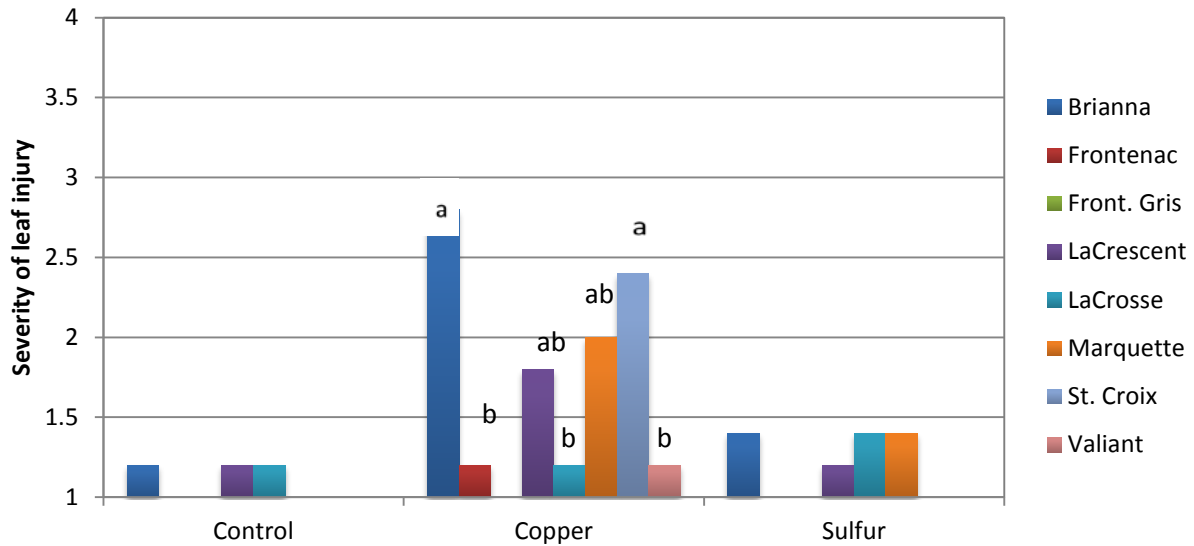
presented without error bars or letters designating significant differences (Figures 1 and 2). A rating of 2 or higher represents a level of injury that would be noticeable and possibly alarming to growers. Brianna was highly sensitive to copper at PARS (Figures 1 and 2) and WMARS (Figure 3). Foch was marginally sensitive to copper in 2012 but more sensitive in 2013. By the end of the 2013 season, most cultivars were noticeably affected by copper. Foch and its sibling, Leon Millot, both were sensitive to sulfur, consistent with observations reported previously. Brianna showed sulfur sensitivity at PARS in 2013, and although higher than other cultivars in at PARS 2012, its final severity rating was less than 2. Other cultivars were generally not sensitive to sulfur.



**Figure 1.** Sensitivity of northern grape cultivars to copper and sulfur, Peninsular Agricultural Research Station, 2012.



**Figure 2.** Sensitivity of northern grape cultivars to copper and sulfur, Peninsular Agricultural Research Station, 2013.



**Figure 3.** Sensitivity of northern grape cultivars to copper and sulfur, West Madison Agricultural Research Station, 4-Sept, 2013. Severity of leaf injury was rated on a visual scale of 1 (= no injury) to 4 (= severe injury). Bars with the same letter are not significantly different according to Tukey-Kramer Honestly Significantly Different test. Control,  $P = 0.6981$ ; copper,  $P < 0.0001$ ; sulfur,  $P = 0.4217$ .

**What the results mean:**

- While the experiments need to be repeated over more years and on more cultivars, we are documenting sensitivities to copper and sulfur that need to be considered when developing spray programs.
- We have established new vineyards at Madison and Sturgeon Bay, locations separated by about 170 miles. Some cultivars overlap with those in the established vineyard at PARS, but some are different. In total we have data for 13 popular northern cultivars.