Investigation of Spray Timing of Boron and Effects of Micro-nutrient Sprays on Yields of 'Blanc du Bois' Wine Grapes

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'Blanc du Bois' is the most widely planted Pierce's disease tolerant hybrid white wine grape in the Texas Gulf Coast and South Texas wine regions. Growers currently receive upwards of $1000 per ton for premium "Blanc du Bois" grapes, which is as much as half the current market value of European *Vitis vinifera* varieties. Typical yields of "Blanc du Bois" can range from 3 to 6 tons per acre, depending on training system, site vigor, and availability of water and nutrients. Within a defined training system and site, growers have little flexibility in improving annual yields in bearing vineyards. Retaining extra buds during dormant pruning and improving the fruitfulness of shoots via canopy management are yield improvement strategies currently applied by growers.

In recent years, growers have also experimented with micro-nutrients such as boron (B) and molybdenum (Mo) to improve fruit-set and increase fertilization of seeds, hence improving cluster fullness and increasing berry size. Many of the sandy soils in the Gulf Coast region are low in boron (<0.3 ppm) and those sites often have spring petiole samples with low boron levels (<20 ppm). A study in California by Christensen et al., found that boron was effectively taken in by vines when sprayed on foliage in either spring (pre-bloom) or fall (post-harvest) (Christensen, et al., 2006). Foliar sprays of boron resulted in a reduction of fruit-set deficiency symptoms in 'Thompson Seedless' grapes, with best symptom reduction achieved by the fall application. There are currently no studies showing the effects spray timing of boron or other micro-nutrient effects on yields of "Blanc du Bois".

The first objective of this study was to determine the best method and timing of boron applications in vineyards. The second objective was to determine the effect of micronutrient applications of boron and molybdenum on yields of 'Blanc du Bois' wine grapes.

Materials and Methods

The test vineyard was located in Austin County, Texas and consisted of bearing 'Blanc du Bois' vines of equal age, trained onto the Watson system. Foliar applied boron (Borosol™ 10, Nortrace Ltd.) was applied either once during the fall (BF) of September 2007, at a rate of 1.0 pounds B per acre in 100 gallons of water or once during the spring (BS) of 2008, four weeks before full bloom at a rate of 0.5 pounds B per acre. Ground applied boron (BG) was sprayed evenly onto the weed free strip in the vine row in September of 2007 at a rate of 2.0 pounds B per acre in 25 gallons of water. Molybdenum sulfate was applied to foliage at a rate of 0.25 pounds Mo per acre in 100 gallons of water and control vines received no nutrients. All of the above rates were determined based on the guidelines for safe B application rates set by other researchers (Christensen, et al., 2006). An additional treatment was included to test the effects of retaining extra buds during dormant pruning. All vines in the vineyard were pruned to 5 buds per linear foot of trellis. The extra bud treatment (Z) had approximately a 50% greater bud number than all other treatments (8 buds per linear foot of trellis) and received no nutrient treatments.

Petioles from the most recently matured leaves of each treatment were collected in the fall of 2007, just prior to the fall boron application. Petioles sub-tending the first cluster on shoots were also collected after spring foliar applications, at full bloom in 2008. Shoot tips from the C and BS treatments were also

collected immediately after fruit set to determine if boron was taken up by the vines and mobile in new plant tissue during bloom. Individual vines served as replicates for petiole sampling and blocks served as replicates for shoot tip sampling. All plant samples were washed in a solution of distilled water and Dreft detergent, then triple rinsed in distilled water, dried and analyzed for boron and other essential plant nutrients by A&L Eastern Laboratories, Inc., Richmond, VA. Soil from the area surrounding the test vines was collected in fall of 2007 and was analyzed for pH and essential plant nutrients by the Texas A&M Soil, Forage & Water Testing Laboratory, College Station, TX. Total vine yields, average clusters per vine, and average cluster weights were recorded in July of 2008.

Treatments were applied to a total of 8 vines, arranged in a complete randomized block design, 4 blocks containing 2 vines for each block (2 middle vines with 2 buffer vines on each side and buffer rows between treatment rows). All data was subject to analysis of variance, SAS mixed procedure, with confidence level of $P \leq 0.05$.

Results and Discussion

Boron application timing and uptake. Bloom petiole levels of B were highest in vines treated with a spring foliar spray (BS). Nutrient analysis of shoot tips in vines treated with the spring foliar spray applications showed that boron and molybdenum were significantly greater than in untreated vines. Thus, spring-applied boron and molybdenum (data not shown) were mobile in the new growth of vines, four weeks after the spring spray application (Figure 2). Christensen et al., found that 1.0 pounds of B applied to the soil in the fall did not increase B levels in spring petiole samples. This study showed that increasing the soil application rate to 2.0 pounds was not enough to improve petiole B in the following spring. Boron levels in bloom 2008 petiole samples of other treatments did not differ from untreated vines. Boron levels did not differ among treatments in either soil or petiole samples collected in fall of 2007 (data not shown).

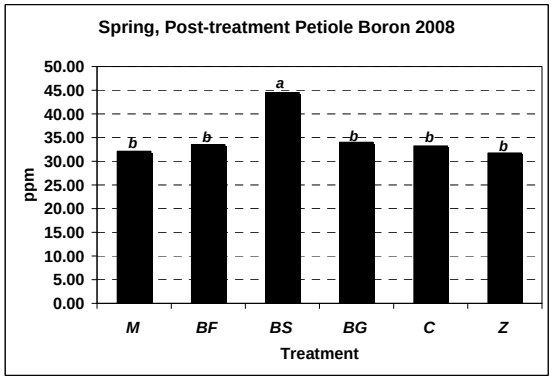

Figure 1. Boron levels in petioles at full bloom.

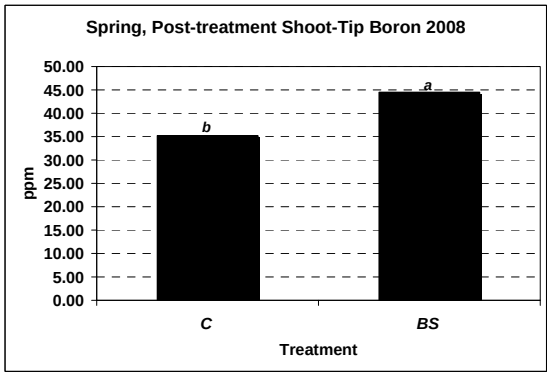

Figure 2. Boron levels in shoot tips at fruit-set.

Vine yield data. Total vine yield was significantly greater only in vines containing extra buds (Z). It can be presumed that leaving more buds will result in higher cluster number, thus greater yields. Negative effects of high shoot density may outweigh the short term yield gains observed in the first year of this study. The high bud count treatment will be continued for several more years in order to determine the long term effects of this treatment on vine vigor and fruit quality.

Total yields of vines treated with boron or molybdenum did not differ from untreated vines regardless of treatment timing (Figure 3). However, average cluster weights were greater in vines treated with spring foliar boron applications (BS) and ground applied boron in the fall (BG) (Figure 4). Cluster weights of vines containing extra buds (Z) were significantly less than vines treated with spring foliar boron (BS) or ground applied boron in the fall (BG). Reduced cluster size may explain why a 50% increase in bud number did not result in an equivalent yield increase. Fall foliar treatment with boron (BF) and spring foliar treatment with molybdenum (M) had no effect on average cluster weights in this study. The average

cluster number per vine was significantly greater only in vines containing extra buds (treatment Z, data not shown), thus increases in average cluster weight in BS and BG treated vines were not a result of having fewer clusters per vine. The increased average cluster weigh of BG treated vines cannot be explained in terms of increased B, as spring petiole levels of B were not increased by fall ground applications (Figure1).

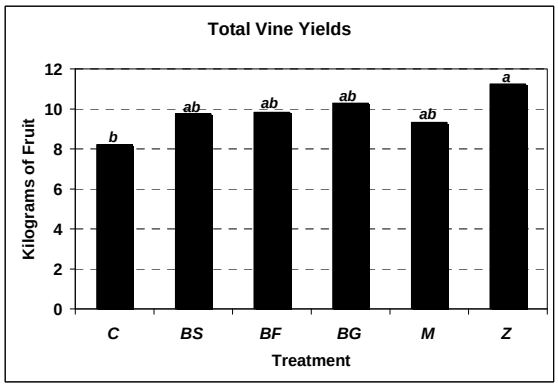

Figure 3. Total vine yields at harvest, July 2008.

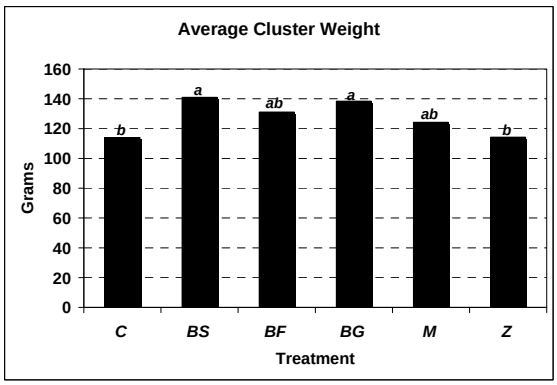

Figure 4. Average cluster weights at harvest, July 2008.

Potential Applications of Research

- Results from this study indicate that spring foliar applications of boron are an effective means of increasing B levels in 'Blanc du Bois' wine grapes. A rate of 0.5 pounds of actual B, applied in 100 gallons of water, effectively increased the level of mobile B in vines when treated 4 weeks before bloom.
- Yields may not significantly improve from B applications if levels of B in petioles is already in the range of sufficiency (>30 ppm), such as was the case in this study. However, average cluster size could potentially improve as a result of B applied to foliage, four weeks prior to bloom.
- Increasing Mo from 0.75% to over 2.0% in vines did not affect yields or average cluster weights of 'Blanc du Bois'.
- Leaving as much as 50% extra buds during dormant pruning may improve yield, however, such method has not been proven to work over the long-term. Yield increases incurred by allowing extra buds do not appear to be proportional to the number of extra buds retained. Further work is needed to determine the long term effects of leaving higher than normal bud numbers when dormant pruning (>6 buds per linear foot of canopy).

Acknowledgements

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