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Effects of Application of Winery Wastewater on Soil, Grape Nutrition, and Juice and Wine Quality

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Project Summary

The California wine industry is presently facing key issues such as limited water availability due to increasing demands from urban users and climate change, and the disposal of winery wastewater (WWW). Applying wastewater to vineyards has the potential economic, legal, and marketing advantages of reducing water input, retaining wastes, and recycling on the winery's own property. Although the recycling and use of WWW on agricultural fields is occurring, the full implications of both current (sodium- and phosphorus-rich water) and emerging (potassium-rich) practices on soil fertility, soil physical and chemical properties, and grapevine nutrition and juice characteristics, and resulting wine is not known. In addition, because the impact of WWW irrigation on vines are not known most wineries will use WWW for irrigation of landscaping and frost and heat protection of their vines but not actually for irrigation purposes. We are addressing these issues by analyzing effects of both sodium and potassium enriched WWW on grapevine and grape development, nutrition and chemistry as well as evaluating the chemical composition and sensory characteristics of the resulting wines.

The objectives of this study are to evaluate the effects of WWW on: 1) grapevine development, yield, and nutrition; 2) juice and wine chemistry, and wine sensory characteristics, and 3) soil properties. Two commercial vineyards in California, one in the Napa valley (Vineyard A in 2013) and the other in Sonoma (Vineyard B in 2014) will be used. The Control treatments from vineyards A and B will be vines which received source water only (no WWW) whereas the WWW treatments will be Na-enriched (Vineyard A, 2013) and K-enriched (Vineyard B, 2014). Leaf, petiole and grape samples are taken at 50% véraison and at harvest and the Na^+ , K^+ , Ca^{2+} , Mg^{2+} content determined by ICP-MS together with water and soil samples taken before and after the harvest period. Additionally, the basic chemical (pH, titratable acidity, residual sugar, nitrogen) and phenol composition of grape and wine samples will be determined.

Findings so far for the 2013 investigation comparing control vines with those irrigated with WWW enriched with Na^+ (Na^+ , 310 mg/L; K^+ , 100 mg/L; Ca^{2+} , 6 mg/L and Mg^{2+} , 17 mg/L) indicate no significant differences between the two treatments. ICP-MS analyses to determine the Na^+ , K^+ , Ca^{2+} , Mg^{2+} content of the different control and Na-enriched WWW irrigation treatment samples are still underway, however basic chemical parameters and phenol composition of the grapes show small differences at véraison between the control and WWW treatments, which disappears for the harvest samples and respective wines. Triangle sensory testing was performed on the wine replicates to determine whether there are any perceptible sensory differences among the wine treatments and replicates.

Results indicate that there were no significant sensory differences between wines made from grapes sourced from vines receiving well-water or Na-enriched WWW. Initial results indicate that irrigation of grapevines with Na-enriched WWW has no adverse effects on the composition quality of the grapes and wines. It has to be noted however that the Napa winery only performed limited on-demand irrigation with the Na-enriched WWW and that the WWW was pretreated with a Lyve treatment system.

In the 2014 season, grapevines irrigated with untreated K-enriched WWW will be investigated. If the proposed study demonstrates that no negative grapevine impacts occur with winery wastewater (WWW) application, then wastewater recycling within a vineyard/winery operation is a sustainable option that demonstrates commitment to lowering on- and off-site environmental impact. Reducing water usage and waste water flow to water treatment plants.

Information Transfer/Outreach Program

Most dissemination activities (Wine Flavor 101 and Grape Day workshops, Annual American Society of Enology and Viticulture Conference) are planned in 2015 after completion of the project. However the project has been discussed at several meetings such as the Water and Energy Efficiency across Food Systems symposium and Outreach Tech Transfer meeting.