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

The California wine industry presently is facing the following key issues: 1) limited water availability due to increasing demands from urban users and climate change, 2) disposal of winery wastewater, and 3) existing and anticipated legislation, such as AB2121, which regulates instream flows in California’s North Coast region. These issues underscore the need to utilize other water sources for irrigation in agricultural systems, such as treated wastewater from wine production. 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.

Globally and locally, a current trend in winery and other food processing operations (e.g., canneries, olive oil mills, milk production) involves switching from sodium-based cleaners (e.g., NaCO3, Na3PO4) to potassium-based (e.g., KOH) compounds to scour equipment used during production. This action shifts the chemical composition of winery wastewater that may be applied to agricultural lands.

Although the recycling and use of winery wastewater on agricultural fields is occurring, the full implications of both current (Na- and P-rich water) and emerging (K-rich) practices on soil fertility, soil physical and chemical properties, and grapevine nutrition and juice characteristics, and resulting wine is not known. Given the large contribution of winegrapes and wine production to the annual U.S. ($121.8 billion, 2009) and CA ($61.5 billion, 2009) economies, economically sound and environmentally sustainable winegrape production practices are essential.

We propose to address the aforementioned issues within CA winegrape production by analyzing effects of simulated winery wastewater application to a vineyard already in production. This study is unique within existing scientific literature as we will follow effects of winery wastewater application from the soil through grapevine growth and grape production, ending with evaluations of wine chemistry and sensory analysis.

Hypothesis. Winery wastewater will be composed of irrigation water with K, Na, and/or wine. Winery wastewater will shift soil physical attributes affecting fertility, infiltration, and nutrient availability, leading to changes in grapevine and fruit characteristics. Changes in fruit characteristics due to wastewater will be evident in wine chemistry and sensory analysis. Objectives. Evaluate effects of simulated winery wastewater on: 1) soil, grapevine nutrition and development, yield, and juice characteristics; 2) wine chemistry and sensory characteristics. Approach and Outcomes. Our interdisciplinary team will investigate the impact of recycling winery wastewater through field experiments of grape vines receiving irrigation waters of varied chemistries. This study will build on a field trial initiated by the investigators in 2010 to test the incipient effects of winery wastewater application on soil, grapevines, and grape juice. Infrastructure and methods have been implemented for two seasons, and associated soil, grapevine and juice samples have been collected. A third growth season will occur in summer 2012. Work thus far has
been completed without financial support. Incipient changes in some soil and juice characteristics were observed in the first two years, providing support to assess effects of winery wastewater application on the final product: wine. As grapes are a perennial crop, this field trial must occur over multiple years. Therefore, the initial pilot study must now be expanded in both duration and scope to fully assess the impact of this practice on wine quality. We will monitor grapevine nutrition and juice attributes at key growth stages. Soil characteristics and nutrient availability will be assessed at harvest. Wine made at the RMI winery (UCD) from the treated grapes will undergo sensory analysis. A workshop with UCCE personnel will focus on best practices related to wastewater, findings from the proposed study, and other relevant research on campus. Results also will be disseminated in regional grape grower meetings, CE bulletins, peer-reviewed publications, and at state and national meetings.

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