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Influence of deficit irrigation on nutrient indices in wine grape (*Vitis vinifera* L.)

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ABSTRACT

Deficit irrigation is widely used in wine grape production (*Vitis vinifera* L.) to meet wine quality goals yet its influence on tissue nutrient indices has not been well studied. The objective of this research was to determine whether response to water deficit compromised the prescriptive usefulness of tissue nutrient analyses. Tissue macro and micronutrient composition at bloom and veraison were evaluated over multiple seasons in nine wine grape cultivars grown under well-watered or deficit-irrigated conditions. Deficit-irrigated vines sampled at veraison had 2 to 12-fold higher petiole nitrate-nitrogen concentration, 6% lower blade nitrogen concentration and 13% lower blade copper concentration compared to well-watered vines. Water deficit influenced blade potassium concentration at veraison differently according to cultivar and was lower (cv. Malbec, Petite syrah, Viognier, Lemberger and Sangiovese), higher (cv. Merlot, Cabernet franc and Cabernet Sauvignon) or similar (cv. Grenache) to well-watered vines. Results from this study indicate that nutrient analysis of petiole or blade tissue sampled at veraison has limited diagnostic and prescriptive usefulness when vines are grown under a water deficit.

KEYWORDS

Nitrate Nitrogen; Potassium; Plant Water Status; Leaf Water Potential; Evapotranspiration

Cite this paper

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References

[1] During, H. (1987) Stomatal responses to alterations in soil and air humidity in grapevines. Vitis, 26, 9-18.

[2] Jackson, D.I. and Lombard, P.B. (1993) Environmental and management practices affecting grape composition and wine quality—A review. American Journal of Enology and Viticulture, 44, 409-430.

[3] Padgett-Johnson, M., Williams, L.E. and Walker, M.A. (2003) Vine water relations, gas exchange, and vegetative growth of seventeen Vitis species grown under irrigated and nonirrigated conditions in California. Journal of the American Society for Horticultural Science, 128, 269-276.

[4] Shellie, K.C. (2006) Vine and berry response of Merlot (Vitis vinifera) to differential water stress. American Journal of Enology and Viticulture, 57, 514-518.

[5] Castellarin, S.D., Pfeiffer, A., Sivilotti, P., Degan, M., Peterlunger, E. and Di Gaspero, G. (2007) Transcriptional regulation of anthocyanin biosynthesis in ripening fruits of grapevine under seasonal water deficit. Plant, Cell & Environment, 30, 1381-1399. doi:10.1111/j.1365-3040.2007.01716.x

[6] Bravdo, B.A. (2007) Effect of irrigation and fertilization on fruit and wine quality. Acta Horticulturae, 754, 265- 274.

[7] Davenport, J.R., Stevens, R.G. and Whitley, K.M. (2008) Spatial and temporal distribution of soil moisture in drip-irrigated vineyards. HortScience, 43, 229-235.

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[8] Keller, M. (2005) Deficit irrigation and vine mineral status. American Journal of Enology and Viticulture, 56, 267-283.

[9] Robinson, J.B. (1999) Grape nutrition. In: Coombe, B.G. and Dry, P.R. Eds., Viticulture, volume 2, Practices, Hyde Park Press, Adelaide, 178-208.

[10] Robinson, J.B. (2004). Critical plant tissue values and application of nutritional standards for practical use in vineyards. In: Christensen, L.P. and Smart D.R., Eds., Proceedings of the Soil Environment and Vine Mineral Nutrition Symposium, American Society for Enology and Viticulture, Davis, 61-68.

[11] Christensen, P. (2005) Use of tissue analysis in viticulture. Cooperative Extension Pub. NG10-00. University of California, Tulare County, Visalia,.

[12] Cook, J.A. and Lider, L.A. (1964) Mineral composition of blooming grape petiole in relation to rootstock and scion variety behavior. American Society for Horticultural Science, 84, 243-254.

[13] Christensen, P. (1984) Nutrient level comparison of leaf petioles and blades in twenty-six grape cultivars over three years. American Journal of Enology and Viticulture, 35, 124-133.

[14] Fallahi, E., Shaffi, B., Stark, J.C., and Fallahi, B. (2005) Cane and leaf growth and leaf mineral nutrients in various cultivars of wine grapes. Journal of the American Pomological Society, 59, 182-191.

[15] Fallahi, E., Shafii, B., Stark, J.C., Fallahi, B. and Hafez, S.I. (2005) Influence of wine grape cultivars on growth and leaf blade and petiole mineral nutrients. HortTechnology, 15, 825-830.

[16] Perez, J.R. and Kliewer, W.M. (1982), Influence of light regime and nitrate fertilization on nitrate reductase activity and concentrations of nitrate and arginine in tissues of three cultivars of grapevines. American Journal of Enology and Viticulture, 33, 86-93.

[17] Watson, J. (1999) Washington viticulture—The basics. In: Watson, J. Ed., Growing Grapes in Eastern Washington. Proceedings from a Washington State University Short-course on Establishing a Vineyard and Producing Grapes, Good Fruit Grower, Yakima, 13-20.

[18] USDA-NRCS (2009) Official soil series descriptions. http://ortho.ftw.nrcs.usda.gov/cgi-bin/osd/osdname.cgi

[19] Coombe, B.G. (1995) Growth stages of the grapevine— The modified E-L system. Australian Journal of Grape and Wine Research, 1, 100-110.

[20] Allen, R.G., Pereira, L.S., Raes, D. and Smith, M. (1998) Crop Evapotranspiration. Guidelines for Computing Crop Water Requirements. Irrigation and Drainage Paper 56. FAO Rome.

[21] Evans, R.G., Spayd, S.E., Wample, R.L., Kroeger, M.W., and Mahan, M.O. (1993) Water use of Vitis vinifera grapes in Washington. Agricultural Water Management, 23, 109-124. doi:10.1016/0378-3774(93)90035-9

[22] Hanson, D., Kotuby-Amacher, J., Miller, R.O. (1998) Soil analysis: Western states proficiency testing program for 1996. Analytical Chemistry, 360, 348-350.

[23] Nelson, D.W. and Sommers, L.E. (1996) Total carbon, organic carbon and organic matter. In: Sparks, D.I. Ed., Methods of Soil Analysis, Part 3-Chemical Methods. Soil Science Society of America, Madison, 975-977.

[24] Turner, N.C. (1988) Measurement of plant water status by the pressure chamber technique. Irrigation Science, 9, 289-308. doi:10.1007/BF00296704

[25] Shellie, K.C. and Glenn, D.M. (2008) Wine grape response to foliar particle film under differing levels of preveraison water stress. HortScience, 43, 1392-1397.

[26] Cook, J.A. (1961) Some problems in determining nitrogen needs in California vineyards. Wine and Vines, 42, 30.