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Swiss Study Finds Water Stress Changes Pinot Noir Wine Character

Seven years of vineyard data showed moderate drought deepened color and structure, even as repeated deficits weakened vine vigor

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A seven-year study in Switzerland has found that water stress in Pinot Noir vines can reshape both grape chemistry and the character of the finished wine, offering new evidence for growers weighing how much irrigation to use in dry vineyard conditions.

The research, published by IVES OpenScience on July 7 as an extended abstract from the GiESCO 2017 conference series, followed Pinot Noir vines from 2009 to 2015 in the upper Rhone valley in the canton of Wallis, also known as Valais. The work was led by researchers from Agroscope, with contributions from the University of Lausanne and the Service de l’agriculture et de la viticulture in Morges.

The team studied Vitis vinifera L. cv. Pinot Noir, clone 9-18 grafted onto 5BB rootstock, under different irrigation regimes during the growing season. The site was described as relatively dry, making it a useful setting for examining how repeated water deficits affect vine function, berry development and wine quality over time.

According to the abstract, a progressively increasing water deficit through the season reduced leaf gas exchange in non-irrigated vines. Photosynthesis, transpiration and stomatal conductance all declined when vines were exposed to less water. At the same time, intrinsic water use efficiency increased during the growing season and was higher in water-stressed vines than in irrigated vines.

Researchers tracked vine water status using leaf and stem water potential measurements and by analyzing carbon isotope composition, or δ13C, in must sugars. They reported that the rise in water use efficiency was correlated with higher δ13C values at harvest, suggesting that this marker could help reflect how strongly vines experienced drought during ripening.

The study also found that drought reduced hydraulic conductivity in petioles, along with transpiration and sap flow in stems. Over several years, vines exposed repeatedly to water deficits showed lower vigor, indicating that the effects were not limited to one season’s fruit but also touched longer-term plant growth.

Changes in berry composition were especially relevant for winemaking. Moderate water stress during ripening favored sugar accumulation in berries, while reducing total acidity, malic acid and yeast assimilable nitrogen, or YAN, in the must. Those shifts matter because they can influence fermentation management as well as alcohol balance, freshness and texture in the final wine.

The wines made from water-stressed vines were reported to have deeper color and higher levels of anthocyanins and phenolic compounds than wines from well-watered vines. The researchers also said vine water status significantly influenced organoleptic quality. In sensory evaluation, wines from non-irrigated vines with water deficit were judged to have more structure, better tannin quality and a fuller, softer mouthfeel than wines made from irrigated vines.

The findings add detail to a question that has become more urgent for wine producers as hotter and drier growing seasons affect vineyard decisions across many regions. For the beverage sector, the study offers practical support for deficit-irrigation strategies by linking plant physiology directly to grape composition and sensory outcomes in wine. That does not mean less water is always better. The results point instead to a narrow balance: moderate stress may improve some quality traits, while repeated or stronger deficits can reduce vine vigor and alter must chemistry in ways that require trade-offs in the cellar.

Because the work covered multiple vintages rather than a single season, it gives growers a broader view of how irrigation choices may play out over time under dry conditions. In Pinot Noir especially, where small shifts in ripening and phenolic development can change style and market positioning, those differences can carry economic weight from vineyard management through bottle sales.

The authors were Vivian Zufferey, Jean-Laurent Spring, Thibaut Verdenal, Agnès Dienes, Sandrine Belcher, Fabrice Lorenzini, Carole Koestel, Johannes Roesti, Katia Gindro, Jorge Spangenberg, Christophe Carlen and Olivier Viret. Their report adds to a growing body of viticulture research examining how drought affects not only yield and plant health but also the sensory profile that consumers ultimately experience in the glass.