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Study Finds Grape Variety Shapes Red Wine Chemistry More Than Nearby Vineyard Sites

Researchers found Artaban kept a distinct chemical signature across three sites, with location shifting pH, color and polyphenols

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A study published Tuesday in OENO One found that grape variety had a stronger role than harvest location in shaping the chemical identity of red wines made from three cultivars grown in nearby vineyards in southern France, while the vineyard site still

changed key measures such as pH, color and total polyphenol levels.

The research, led by Andréa Cesson and colleagues, examined wines made from Artaban, a disease-resistant hybrid, and the Vitis vinifera varieties Cabernet Sauvignon and Syrah. The grapes were harvested in 2022 from three sites in the Aude department of Occitanie: Domaine de Cazes, La Clape and Ouveillan. To reduce winemaking variables, the team used standardized microvinification methods, fermenting all lots under the same conditions and then comparing a wide range of chemical markers.

The question is important for viticulture because growers and winemakers have long tried to separate the effect of variety from the effect of terroir, a term that includes soil, climate, topography and vineyard practices. The issue has become more pressing as producers test disease-resistant grapes that may need fewer treatments and may respond differently to local growing conditions than traditional wine grapes.

The researchers analyzed nine variety-location combinations, with biological replicates for each, and measured classical wine chemistry along with anthocyanins, tannins, polysaccharides, varietal thiols and aroma precursors. Their statistical analysis showed that differences in wine color and polyphenolic composition explained most of the variation between wines. A second layer of variation came from the balance between polysaccharides and anthocyanins.

Artaban stood out most clearly. According to the study, its wines were marked by an anthocyanin diglucoside profile that distinguished them from Cabernet Sauvignon and Syrah across all sites. That pattern suggested a strong varietal signature and a relatively limited effect from harvest location, at least within the narrow geographic area covered by the study.

Cabernet Sauvignon and Syrah behaved differently. Their wines showed a more noticeable effect from harvest location, with wines from Ouveillan separating more clearly from those grown at the other two sites. The study found that variety mainly influenced anthocyanin composition and the expression of 3-sulfanylhexan-1-ol, or 3SH, a volatile thiol linked to aroma. Harvest location, by contrast, had a significant effect on pH, chromatic parameters and the total polyphenol index.

The work also found that tannin composition was only weakly affected overall, except for dimers and short-chain tannins. Another result was that harvest location changed absolute concentrations more than the relative proportions within chemical families. In practical terms, that means the site seemed to adjust the intensity of certain compositional features more than it changed the broad chemical framework defined by the grape itself.

The study focused on a close subregional area rather than widely separated wine regions. The authors said that, within that kind of limited geographic range, grape variety appears to define the biochemical identity of the wine, while harvest location fine-tunes how strongly that identity is expressed. The paper stops short of claiming the same balance would hold across other regions, climates or commercial cellar conditions.

That distinction matters for the wine business. Producers weighing whether to plant resistant grapes such as Artaban may see the findings as a sign that some varieties can retain a stable chemical signature across nearby sites, while more established grapes may show greater site sensitivity. That could help growers think about vineyard placement, varietal selection and how to preserve a recognizable style, though any commercial application would need caution because the results come from one vintage, three cultivars and a limited part of Occitanie.

The paper also adds new information on Artaban at a time when resistant varieties are drawing more attention. The authors noted that Artaban was the first resistant variety planted in France in 2021 and said little had been published on how different terroirs affect its composition. By including Artaban alongside two well-known southern French varieties, the team aimed to test whether hybrid grapes respond to place in the same way as traditional vinifera cultivars.

To isolate those effects, the researchers harvested grapes at technological maturity, adjusted must nitrogen to the same target level and fermented the wines with the same yeast strain at 23°C. Maceration lasted 14 days, and the wines were sampled after fermentation reached dryness. The study then compared standard enological parameters with more detailed measures of color, pigment forms, tannin size

distribution, polysaccharide composition and sulfur-containing aroma compounds.

The authors place the work within a broader debate in wine science. Environmental conditions are known to affect markers linked to wine quality, including polyphenols, anthocyanins and aroma precursors, even when vineyards are relatively close together. But those effects do not fall evenly across all traits. In this study, pH, color and total polyphenols responded more clearly to harvest location than anthocyanin identity did, especially for Artaban.

For growers in regions facing climate stress and disease pressure, the results may offer a more precise way to think about typicity. A variety may set the broad chemical profile of a wine, while the site influences how dark, acidic or phenolically rich that wine becomes. For wineries, that kind of distinction could be useful when evaluating new plantings, managing subregional sourcing or deciding how much a resistant variety might alter a house style.