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Study Finds Fertilization and Soil Management Best Bolster Franciacorta Vineyard Resilience

Researchers used expert assessments across 32 seasonal scenarios to identify practices that protect yield, acidity and grape ripening.

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Researchers at the University of Brescia have used expert opinion from growers and advisers in Franciacorta to map which vineyard practices are most likely to help wine estates cope with drought, excess water and disease pressure, adding new detail to a

question that is becoming more urgent for European wine regions under climate stress.

The work, presented at the GreenWINE International Scientific Congress in Verona on May 19 and 20, 2025, focused on resilience in viticulture, or the ability of a vineyard system to absorb shocks, adapt to changing conditions and, when needed, change more deeply to remain viable. The study was later published by Infowine in Spanish translation from the original English text.

The research team, led by Isabella Ghiglieno and colleagues at the Agrofood Research Hub of the University of Brescia’s DiCATAM department, centered its case study on Franciacorta, the sparkling wine area in Lombardy known for traditional-method wines. The aim was practical: identify which combinations of vineyard management decisions can protect yield and grape quality within a single growing season when weather and plant health risks shift from one year to the next.

Rather than relying only on field trials, the researchers used a method known as Expert Knowledge Elicitation. That process gathers informed judgments from specialists and converts them into structured quantitative data. In this case, the team interviewed winegrowing experts from Franciacorta and asked them to evaluate how different management choices would affect Chardonnay vineyards trained to Guyot on morainic soils with balanced fertility, a profile meant to reflect a typical local setting.

The study built four vintage scenarios based on water availability and disease risk: optimal water conditions with no phytopathological risk, optimal water with disease risk, low water with no disease risk, and high water with disease risk. Within those year types, the researchers created eight management scenarios and, in total, 32 combinations of vineyard practices tied to soil and canopy management. They examined fertilization, inter-row tillage, under-vine management, leaf removal, shoot thinning and topping practices.

To keep the scenarios realistic, the team assumed that emergency irrigation would be available in dry conditions, in line with Franciacorta DOCG rules, and that plant protection treatments would be equally effective across all scenarios. That allowed the analysis to focus more directly on the management choices themselves.

The first round of interviews involved 11 experts and generated 352,000 data points on yield, probable alcohol and total acidity. A second round with seven additional experts added 96,000 more data points. The researchers then used linear regression models to separate the effect of each factor, including vintage conditions and each vineyard practice, and to reduce the risk that one variable would mask or exaggerate another.

One of the clearest findings was that the experts sharply distinguished among year types. Dry years were consistently associated with lower yields, higher probable alcohol and lower total acidity, even when supplemental irrigation was assumed. That pattern mirrors broader concerns in fine wine regions where hotter, drier seasons can push grapes toward faster sugar accumulation while weakening acid retention, changing both style and production balance.

Across the management options, fertilization and soil management stood out as the practices with the strongest influence on both yield and grape composition. Both mineral and organic fertilization were linked to higher yields in every scenario, although the gain was smaller under drought, likely because water stress limits nitrogen uptake. In years with adequate water, mineral fertilization appeared to lift yields more than organic inputs, which the authors suggested may reflect the slower release of nutrients from organic matter.

Those same fertilization strategies also affected ripening. Under optimal water conditions, fertilization was associated with lower sugar accumulation and better acidity retention at harvest, signs of slower ripening. The effect on acidity was more visible when disease pressure was absent. In wet conditions, the preservation of acidity appeared only with organic fertilization. In dry years, fertilization had only minor effects on quality, though it slightly lowered average acidity.

Soil management also showed a strong role. Subsoiling between rows and cultivation under the vine row both increased yields across the scenarios, though not to the same degree in every year type. In most cases, the practices were also linked to better acidity retention. The main exception came in dry years, when under-vine tillage slightly reduced acidity. In one dry-year scenario, repeated inter-row tillage with a harrow significantly increased yield while also limiting sugar buildup and helping

preserve acidity, another sign that management can slow ripening under stress.

Canopy practices had more selective effects. Early leaf removal raised yield significantly in years with good water supply and low disease pressure, and it moderately improved acidity retention. In high-water years, late leaf removal was the only leaf-pulling strategy with a notable effect. It increased yield, but it also reduced both sugar accumulation and acidity. Light shoot thinning, defined here as limited intervention around the head and bent portions of the cane, produced meaningful effects only under optimal water conditions. When disease risk was present, it increased yield, while its effects on quality remained modest but consistent.

Topping, a common canopy management tool in vigorous vineyards, showed weaker and more situational effects. Topping during flowering mattered mainly in wet years, when stronger vegetative growth may make that intervention more relevant. Variable topping height had a generally weak and mostly negative effect on yield, with only limited influence on grape quality indicators.

For Franciacorta producers, the study points to a more tailored view of resilience than a simple choice between traditional and innovative practice. The results suggest that vineyard response depends not just on one technique, but on how soil work, nutrition and canopy decisions interact inside a given season. That matters in a region where sparkling wine production depends on keeping fruit balance, especially acidity, within a narrow range.

The researchers framed the work as part of a broader effort to define what they call Technical Management Routes, combinations of short-, medium- and long-term choices that can help growers respond to climate variability without losing production continuity. In practical terms, that means seeing vineyard resilience not as a fixed trait of a site, but as the result of management paths that can be adjusted as weather risk changes.

The team said the findings create a basis for future research on medium-term effects, especially because some of the most influential practices, such as fertilization and soil management, can shape vine behavior over more than one season. That next step could be especially relevant for growers in Franciacorta and other premium regions

trying to protect both yield and style as warmer and less predictable vintages become more common.