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Researchers urge vineyards to use genomics to reduce pesticide use

A new paper says climate stress and rising disease pressure demand cultivar-specific pest management, broader breeding tools and supportive regulation.

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A team of researchers is calling for a broader use of genomics and integrated pest management in vineyards, arguing that grape production will need more than gradual changes as climate stress and disease pressure increase.

The case is set out in a paper published Aug. 4 in npj Science of Plants and now listed in the Digital Archive of the Technical University of Madrid, or UPM. The article, “Transforming viticulture through genomic innovation and integrated pest management for sustainable grape production,” says many grape-growing regions remain heavily dependent on repeated pesticide applications and that this model is becoming harder to sustain.

According to the paper, climate change is reshaping the risks faced by vineyards. Higher temperatures, shifting weather patterns and mounting biological pressure are affecting how grapevines grow and how diseases spread. In that setting, the authors argue, reducing chemical inputs will require a combined strategy rather than a single technical fix.

That strategy starts with a wider use of genetic diversity in grapevines. The researchers say growers and breeders should draw on a broader range of plant material and combine conventional breeding with genomic-assisted breeding. They also point to new genomic techniques, along with somaclonal and clonal variation, as additional ways to identify or develop vines better suited to disease resistance and changing environmental conditions. The paper presents those tools as part of a larger effort to match vine varieties more closely to local disease risks and management needs.

The authors tie that genetic work directly to integrated pest management, or IPM, which seeks to limit crop losses while reducing reliance on chemical controls. In the vineyard context, that means adjusting pest and disease control to the characteristics of specific cultivars instead of relying on repeated pesticide use across the board. The paper argues that cultivar-tailored IPM could help cut chemical inputs while supporting more durable disease control.

The research does not present a single new field product or a single new grape variety. Instead, it offers a framework for how viticulture could change over time. The authors say the transition must connect genetics, agronomy, economics and policy if it is to work in practice. They also stress that adoption will depend on governance, stewardship and what they describe as proportionate regulation, a point that places public policy alongside scientific development in the future of vineyard management.

Two Horizon Europe projects are presented as examples of how that approach is being put into operation. The paper says Shield4Grape and GrapeBreed4IPM are working across multiple fields to support the shift toward more sustainable grape production. According to the UPM archive record, GrapeBreed4IPM is linked to Komlan Avia, one of the paper's coauthors. The repository also links the work to Mario de la Fuente Lloreda at UPM's School of Agricultural, Food and Biosystems Engineering and its Department of Agricultural Production.

The author list reflects a broad collaboration. The paper is credited to Giorgio Gambino, Lara Agnoli, Walter Chitarra, Marc Dressler, Andreia Figueiredo, Mario de la Fuente Lloreda, Gabriele Di Gaspero, Ludger Hausmann, Christos Karatzas, Benoit Laurent, Pere Mestre, Irene Perrone and Komlan Avia. That range of contributors matches the paper's message that vineyard sustainability is not only a plant science issue, but also an economic and regulatory one.

The article appears in volume 2, issue 23 of the journal and spans nine pages, according to the UPM record. The repository classifies the work under agriculture and genetics and links it to the U.N. Sustainable Development Goals on zero hunger and climate action. Its abstract states that the pressure on viticulture has moved beyond what can be addressed through incremental adaptation alone, especially in production systems where disease control still depends on frequent pesticide spraying.

That message carries direct relevance for the beverage business, even when the paper is framed as an agricultural and scientific study. Grapes are the foundation of wine production and also matter for grape juice and some distilled products. If the methods described in the paper help vineyards control disease with fewer chemical treatments while maintaining yields and resilience, they could eventually affect how producers manage costs, secure supply and respond to consumer and regulatory pressure for more sustainable farming.

The paper also points to a practical tension facing the sector. Growers are being pushed to lower inputs and adapt to climate stress, but they also need varieties that meet market expectations for quality and regional identity. In viticulture, those expectations are especially strong because many wine regions are tied to established

grape varieties and production rules. The authors’ emphasis on combining breeding, genetic innovation and cultivar-specific pest management suggests that they see sustainability gains coming not from replacing the existing system overnight, but from reshaping it in stages.

The UPM archive record shows the paper was deposited on Oct. 2 and provides a link to the official publication in Nature’s journal platform. While the work is framed as a research perspective rather than a policy document, its central argument is clear: future grape production will depend on linking advances in plant genetics with more targeted, less chemical-intensive pest management, and doing so under rules and governance systems that allow those tools to be used responsibly.