



Sustainable alternative to copper shows potential to improve grapevine growing conditions

FIELD EVIDENCE FROM ALCALÁ LA REAL, SOUTHERN SPAIN



Authors: Jaime Lechuga Puñal, José Liétor Gallego, Evangelina Pareja Sánchez and Roberto García Ruiz (AgroecoliveLab, University of Jaén, Spain)



Universidad
de Jaén



www.agroecolivelab.com



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FIELD DEMONSTRATION AND OBJECTIVE

Greener Solutions for Vineyard Protection

Grapevines are vulnerable to several fungal diseases, among which **downy mildew and powdery mildew** are two of the most widespread and damaging. These diseases can affect leaves, shoots and grapes, reducing plant performance and, in severe cases, compromising both yield and fruit quality. To keep them under control, winegrowers often rely on **plant protection products, including copper-based treatments for downy mildew and sulfur-based treatments for powdery mildew**, both of which are widely used in organic farming.

Copper is effective, but repeated applications over many years can lead to its accumulation in vineyard soils. For this reason, research is increasingly focused on finding **lower-impact alternatives** that can maintain effective crop protection while reducing potential environmental effects.

The SCALE-it approach

Within this context, the **SCALE-it project** is testing new nature-based and more sustainable solutions under real farming conditions.

In 2026, a field trial was established in a commercial Chardonnay vineyard at El Cascante, Alcalá la Real (Jaén, Spain), managed by Blanca Serrano (Bodega Marcelino Serrano).

The trial evaluated a product based on **trimethylaminoethanol pelargonate (TMAP; choline pelargonate)** as a potential ecological alternative that could help reduce reliance on copper-based protection. The product was applied on six occasions between 27 April and 10 July 2026, at a dose of **0.4 mL/m², equivalent to 4 L/ha.**

Throughout the growing season, researchers closely monitored the response of the vines. They **recorded plant development, leaf damage caused by herbivores, visible symptoms of downy and powdery mildew, and grape production**. This approach makes it possible to assess not only the protective potential of TMAP, but also whether its use is compatible with normal crop development and productivity.

Field trials allow us to see how new solutions perform under real farming conditions, helping to bridge the gap between scientific research and their practical use in the field.

By testing these solutions directly in a working vineyard, SCALE-it aims to generate practical evidence that can support the transition towards **more sustainable and environmentally friendly vineyard management**.



A LITTLE MORE DETAIL ABOUT OUR EXPERIMENT

HOW THE TRIAL WAS SET UP

To **compare TMAP with standard vineyard protection** under the same field conditions, the trial included two rows receiving the conventional copper-based treatment, used as the control, and two rows treated with TMAP. A total of **43 vines were monitored on six different dates** during the growing season.



ASSESSING PLANT HEALTH

For each vine, researchers examined **10 randomly selected leaves**, recording the development stage of the plants and looking for any **visible signs of damage or disease**. Vine development was tracked using the standard BBCH scale*, which describes the different growth stages of a crop.

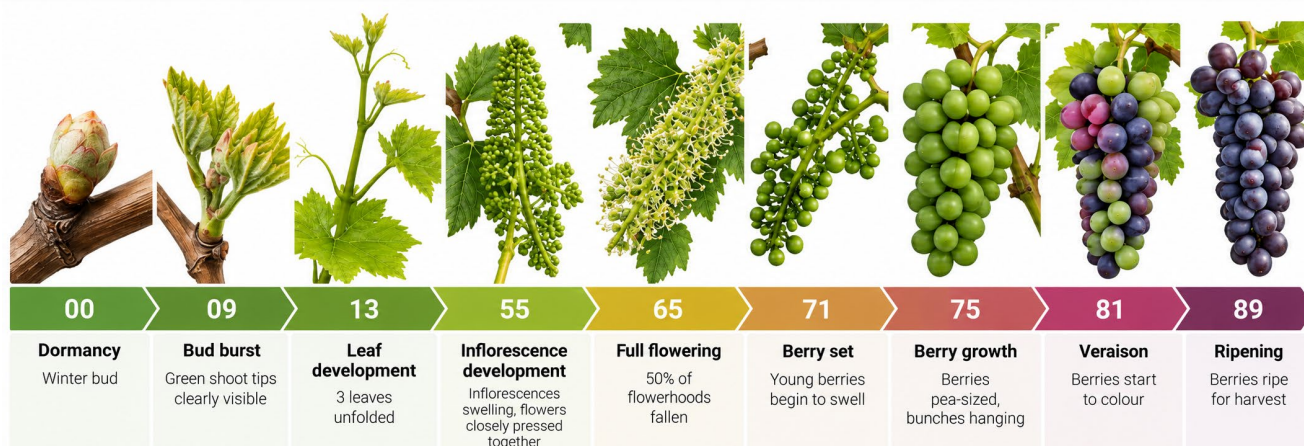


ASSESSING GRAPE YIELD

Finally, on 7 August, the researchers carried out a **harvest assessment** to evaluate grape production and compare yield between vines treated with TMAP and those treated with copper.



* The BBCH scale is a standardized system used to describe the main growth stages of plants, from bud development and flowering to fruit formation and ripening. It allows researchers and farmers to record crop development in a consistent and comparable way.

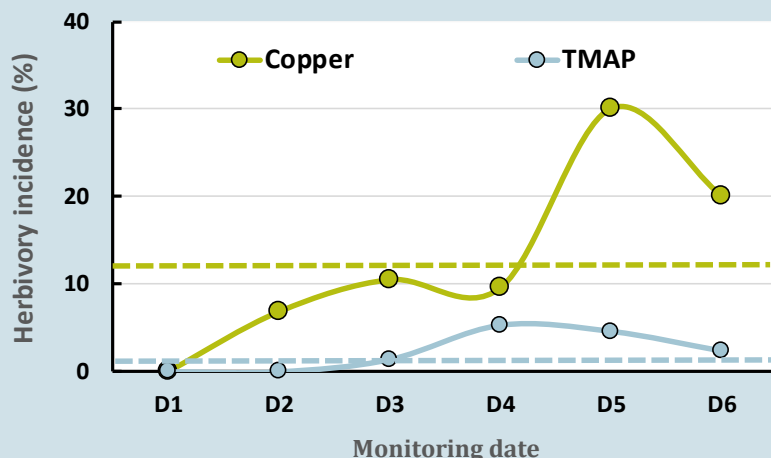
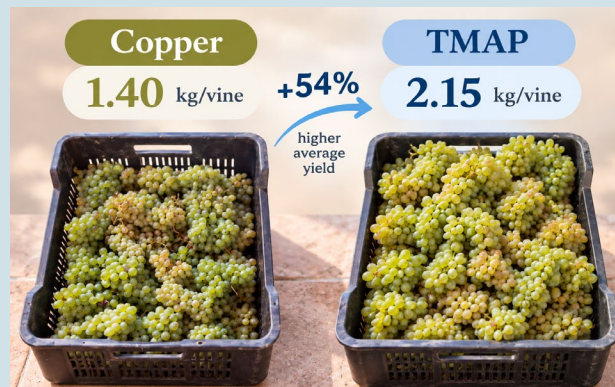


THE RESULTS

FUNGAL DISEASE INCIDENCE

- **No symptoms of downy mildew or powdery mildew were detected in either treatment group throughout the trial.** Although TMAP and the conventional copper-based treatment therefore showed the same observed disease outcome, further trials under sufficient disease pressure are needed to establish whether their disease-control efficacy is comparable.
- **No visible signs of phytotoxicity were observed in TMAP-treated vines** during the growing season, suggesting that the treatment was well tolerated under the conditions of this field trial.

At harvest, **vines treated with TMAP also showed higher grape production** than those receiving the conventional copper-based treatment. Average yield reached **2.15 kg of grapes per vine with TMAP, compared with 1.40 kg per vine with copper**, representing an increase of approximately 54%. This difference was statistically significant (Tukey's HSD test, $p = 0.037$), indicating a positive association between TMAP treatment and grape yield under the conditions of this field trial.



As an additional finding, vines treated with TMAP showed significantly lower levels of leaf herbivory than those receiving the conventional copper-based treatment. Across the monitoring period, mean herbivory incidence was **2.3% with TMAP, compared with 12.8% with copper**, as indicated by the dashed lines in the graph. This difference was statistically significant (one-way ANOVA followed by Tukey's HSD test, $p = 0.0034$), indicating a clear difference between treatments under the conditions of this trial.

These results should be interpreted within the specific conditions of this field trial. They cannot be directly extrapolated to other soil and climatic conditions, vineyard management systems or different periods of the growing season, where crop responses and treatment performance may differ.



