Extended Practice Abstract Nº 16

Measuring the effect of kaolin on vine development and wine quality in Mediterranean vineyards

Challenge

Climate change is causing tremendous damage to Mediterranean viticulture. The effect is seen not only in direct damage to the fruit and vine from heavy floods, but also in reduced grape quality. Extremely high temperatures in summer contribute to a quick accumulation of sugar content in berries, while tannin and anthocyanin production are blocked. As a result, wines are more alcoholic and poorer in structure and aromatic compounds.

Solution

The use of kaolin sprayed on the vineyard creates a layer that protects the vine from direct sun radiation. Several authors report a reduction of 5°C to 10°C in berries and vine leaves. This temperature reduction can reduce heat stress considerably, which will increase grape quality significantly.

Benefits

The project helps us to better understand the effect of kaolin on vine physiology and wine quality. Kaolin is particularly beneficial for increasing aromatic compounds in wines, but it does not affect other parameters of wine quality in heavy drought conditions.

Applicability box

Theme
Climate change
Grapes

Context
Climatic limitation

Application time
5% and 10% kaolin treatment at pre-veraison and post-veraison

Required implementation time
Early in the morning

Period of impact
The same year

Equipment
Airblast sprayer – Kaolin 95%

Practical recommendation

Although more years of trial would be needed to confirm these results, our practical recommendation is to monitor the effect of kaolin on a case-by-case basis because many authors report great benefits due to the use of kaolin.

It is important to consider that kaolin is only useful for high-quality vineyards because it has a particularly high cost, and its benefits are more related to overall wine quality and not to an increase in yield.

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Existing materials

Videos

https://www.youtube.com/watch?v=kz-h-LNcqeM&t=55s
https://www.youtube.com/watch?v=5Ivqa9gAbPc

Web links

https://bodegasenguera.com/protector-solar/

Contact information

Publisher: Juan Martínez Barberá
CV-590 Km 51,1, 46810, Enguera, Valencia
+34 664 613 791
Author(s): Juan Martínez Barberá
Contact: j.martinez@bodegasenguera.com
Project partners: Instituto Cavanilles de Biodiversidad y Biología Evolutiva (ICBIBE), AVA-ASAJA, Bodegas Enguera.

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Simplified cost/benefit analysis

Effect of kaolin on vine development and wine quality in the Mediterranean vineyards

Introduction – presentation of ex-ante and ex-post situation

Climate change is causing serious damage to Mediterranean viticulture. In terms of quality, aromatic compounds, tannin and anthocyanin concentration have been drastically reduced[(1)]. The use of water irrigation can adapt the crop to heat stress, but only 42% of the vineyards in Spain have water irrigation[(2)], and it is particularly difficult to find water supplies in the central and southern parts of the country.

Kaolin particle film can potentially adapt the vine to climate change by reflecting solar radiation, reducing the berry and leaf surface temperature by up to 10°C[(3)].

Economical costs and benefits

The project takes place in the southern part of the province of Valencia. In the ex-ante situation, kaolin was not used to reduce the effect of climate change in this vineyard. In the ex-post situation, two applications of kaolin were carried out with a dose of 50 kg/ha. The applications were made just before and after veraison, with a time lapse of 30 days between treatments.

	Ex-ante	Ex-post
Variable costs		
Input		
kaolin	No chemical application of product	€4.54/kg (dose: 50 kg/ha) → €227/ha 2 sprays: €227 × 2 = €454/ha
Labour (excluding installation)		€15/ha
Machine costs (fuel)		€2/ha
TOTAL	0	€244–€471/ha
COMPARISON	Global increase of 1-24% of the cost:  The increase in costs relies on the increase in the number of passes and in the amount of product required.	

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Environmental costs and benefits

Energy	Not measured, but a worsening of the impact can be considered: 
There is an increase in energy consumption due to the fuel required to spray the kaolin twice a year.	
Water	Indicator not affected: 
Although transpiration is reduced with the application of the product, no clear effects were found in the vineyard water status.	
Soil	Indicator not affected: 
Although the increase in tractor passes causes an increase in soil compaction, the 2 passes due to kaolin were not found to be significant enough to modify this indicator.	
Air	Unmeasured impact, but a worsening of the impact can be considered: 
No direct relationship between the practice and the indicator in question, but a worsening of it can be considered due to emissions from each pass to apply the product.	
Biodiversity	Indicator not affected: 
No direct relationship between the practice and the indicator in question.	

Bibliography and sources

(1) Caputi, L.; Carlin, S.; Ghiglieno, I.; Stefanini, M.; Valenti, L. y Vrhovsek, U. 2011. Relationship of changes in rotundone content during grape ripening and winemaking to manipulation of the 'peppery' character of wine. *J. Agric. Food Chem*. 59, 5565_5571.

(2) ESRYCE 2023. Encuesta sobre Superficies y Rendimientos Cultivos (ESYRCE). Encuesta de Marco de Áreas de España. https://www.mapa.gob.es/es/estadistica/temas/estadisticas-agrarias/agricultura/esyrce/

(3) Frioni, T., Tombesi, S., Luciani, E., Sabbatini, P., Berrios, J. and Palliotti, A. 2019. Kaolin treatments on Pinot Noir grapevines for the control of heat stress damages. *Bio Web of Conferences 13*, 04004 (2019).

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Project to study the use of kaolin in Mediterranean vineyards

Short description of the project

The general objective of the project is to study the effect of kaolin particle film on climate change adaptation of Mediterranean viticulture. The specific objectives are to:

- Determine the effect of kaolin on vine physiology.
- Determine the effect of kaolin on yield and grape composition.
- Determine the effect of kaolin on wine quality.

Benefits

The project has identified that kaolin sprayed three weeks before the beginning of the major peak of the pest is an effective treatment to control leafhoppers.

The results show that kaolin has no effect on the main parameters of grape and wine quality, although it helps increase some aromatic compounds.

Stage of implementation

2022–2023

Key data box

Theme
Grapes

Context
Climatic limitation

Duration
2022–2023

Partners involved
Centro de Investigación sobre Desertificación (CIDE-CSIC-UV), La Baronía de Turís CoopV., Federació de Cooperatives (FECOAV), Bodegas Enguera

Budget
€100,000

Particularity
Innovative way to adapt viticulture to climate change

Main achieved or expected results

1. Although many authors report on the effect of kaolin on stomatal conductance and water potential, in this project there are no differences in these parameters.

2. Kaolin does not affect yield or grape quality. The product did not affect ºBrix, pH or total acidity, among other parameters.

3. Wines made with grapes treated with kaolin did not have higher or lower levels of tannins, but they did have higher amounts of some aromatic compounds such as volatile phenols and vanillin.

4. Extremely severe drought and high temperatures during summer 2023 may reduce the potential effect of kaolin on plant development.

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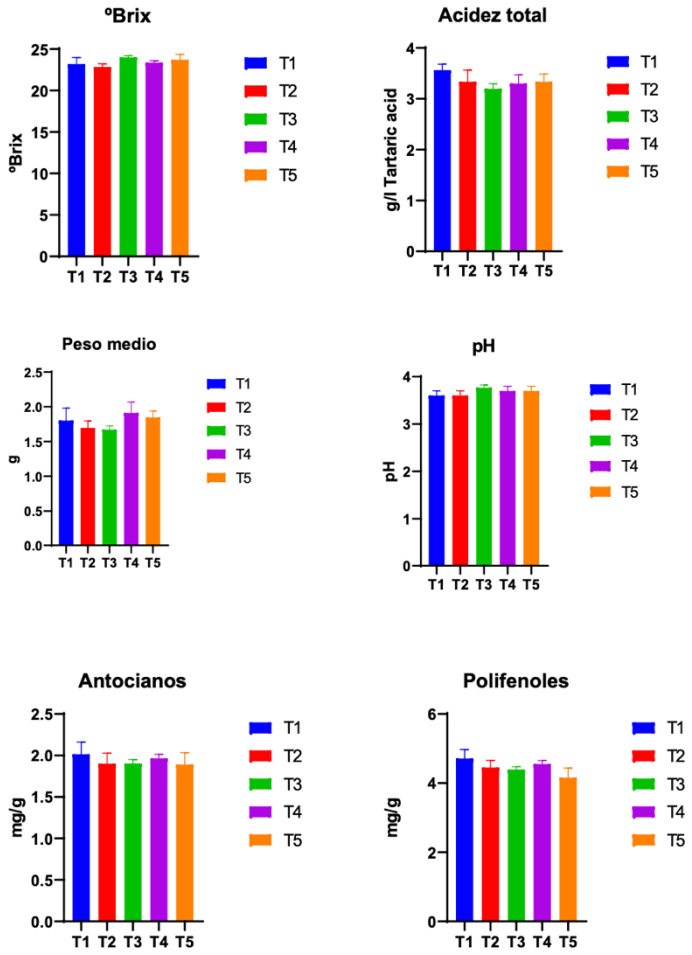

Figure 1: *Effect of kaolin on the main grape ripening parameters of the Tempranillo variety*

Table 1: *Effect of kaolin on the means of the main parameters analysed in Tempranillo wines*

General parameters	Control	Kaolin 10%	F-Ratio	p-Value
Alcoholic degree	12,76 ± 0,82 a	12,78 ± 0,37 a	0,01	0,93
pH	4,08 ± 0,20 a	3,84 ± 0,06 a	4,09	0,11
Total Acidity	3,48 ± 0,27 a	3,98 ± 0,17 a	7,5	0,05
Volatile Acidity	0,69 ± 0,04 a	0,64 ± 0,03 a	2,88	0,17
Glucose/Fructose	021 ± 0,04 a	0,25 ± 0,05 a	2,47	0,19

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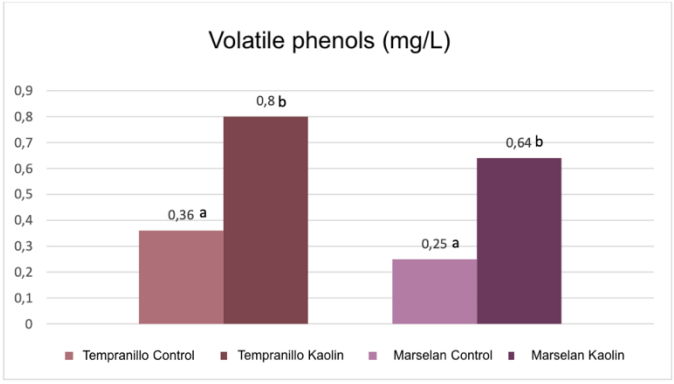

Figure 2: *Volatile phenols in wines made from grapes with and without kaolin*

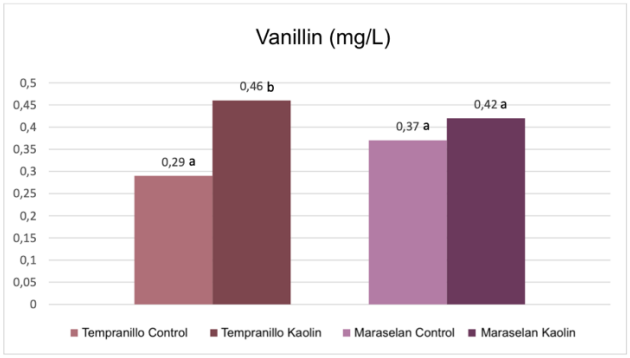

Figure 3: *Vanillin in wines made from grapes with and without kaolin*

Existing materials

Videos

https://www.youtube.com/watch?v=kz-h-LNcqeM&t=55s
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