

Phenolic composition of Tempranillo Blanco grapes changes after foliar application of urea

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1. Introduction and Objective

- Foliar application of urea is efficiently assimilated by the plant. This fertilization technique reduces production costs and contributes to eco-friendly agriculture [1].
- Phenolic compounds contribute to the organoleptic characteristics of grapes and wines [colour and mouthfeel sensations (astringency sensation or bitterness)] [2].
- Health benefits of phenolic compounds are cardioprotective, anti-inflammatory, anti-carcinogenic and antimicrobial activities [3].
- This research aimed to study the effect and efficiency of foliar application of urea on the phenolic composition of Tempranillo Blanco grapes.

2. Materials and Methods

Vineyard (Figures 1a-c):

- Located in D.O.Ca. Rioja (North of Spain).
- Variety : Tempranillo Blanco
- Rootstocks: 110-Richter
- Vine-training system: double Royat cordon

Tempranillo Blanco variety (Figure 1d):

- Natural mutation of the Tempranillo variety
- There is only one clone of Tempranillo Blanco.
- Variety authorised in 2008 in the D.O.Ca. Rioja

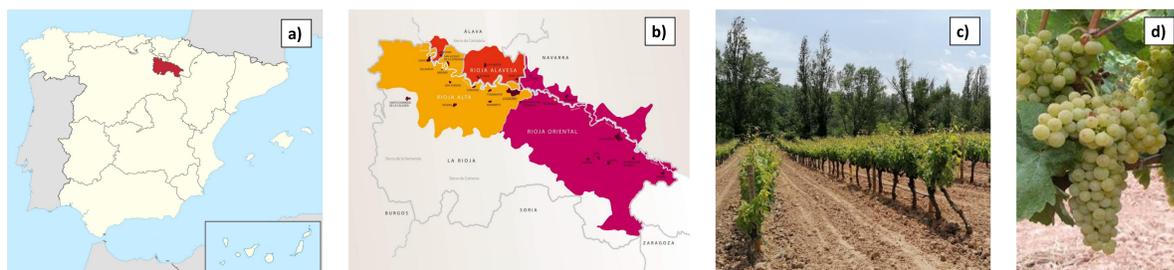


Figure 1. Vineyard located a) La Rioja, Spain. b) D.O.Ca. Rioja [4]. c) Vineyard. d) Tempranillo Blanco cluster.

Foliar application of urea (Figure 2):

- This experiment was carried out in 2019 and 2020 vintages.
- Three treatments of urea 3, 6 y 9 kg N/ha and control (only water). In all aqueous solutions 1 ml/l Tween® 80 (wetting agent) was added.
- Treatments were sprayed at two different phenological stages.
 - Pre-veraison (Pre): berry colour starts to change.
 - Veraison (Ver): 60-70% of berries changed colour.
- For each application, 200 ml/plant was sprayed over leaves.
- Treatments and control were carried out in triplicate and were repeated one week later.

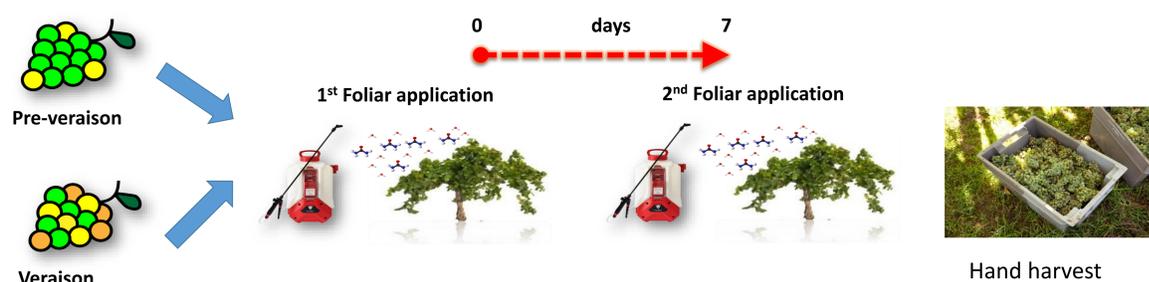


Figure 2. Diagram of urea foliar applications in the vineyard and harvest of Tempranillo Blanco grapes.

Methods (Figure 3):

- Phenolic compounds were extracted from grapes and then, they were quantified by high-performance liquid chromatography (HPLC) [5].
- These compounds were quantified individually, but only the totals of each groups are shown in the Figures 4a-j (flavonols, flavanols, hydroxybenzoic acids, hydroxycinnamic acids and stilbenes).
- The results were studied statistically by analysis of variance (ANOVA).

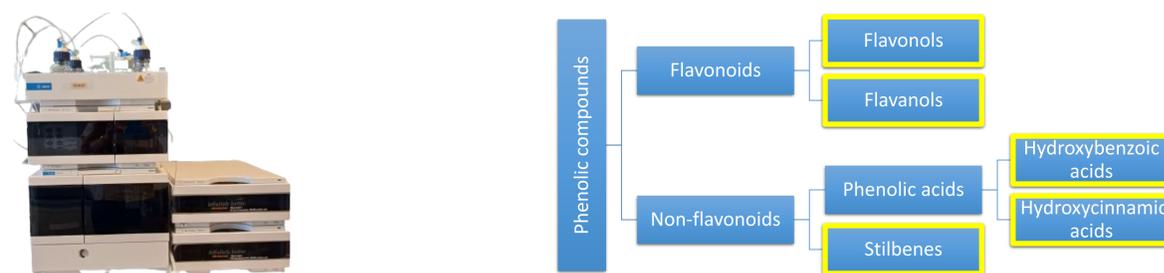


Figure 3. Liquid chromatography equipment and groups of phenolic compounds determined by HPLC (highlighted in yellow).

3. Results

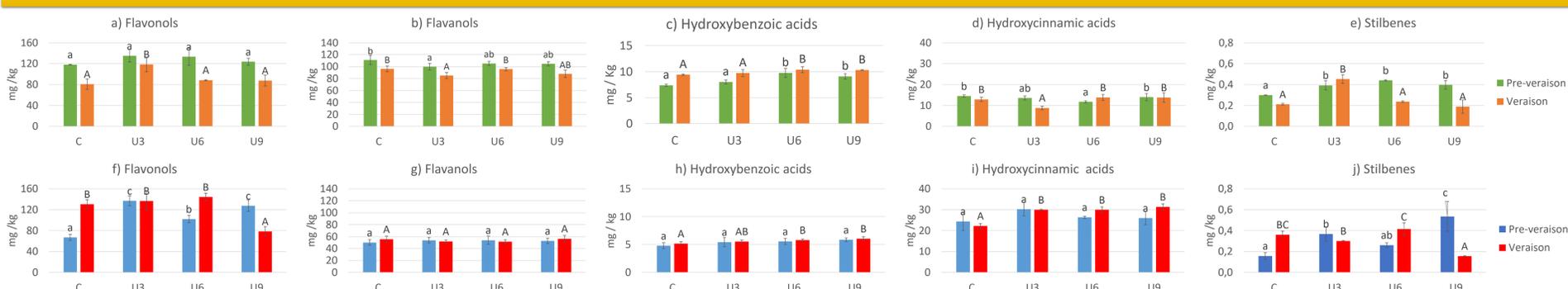
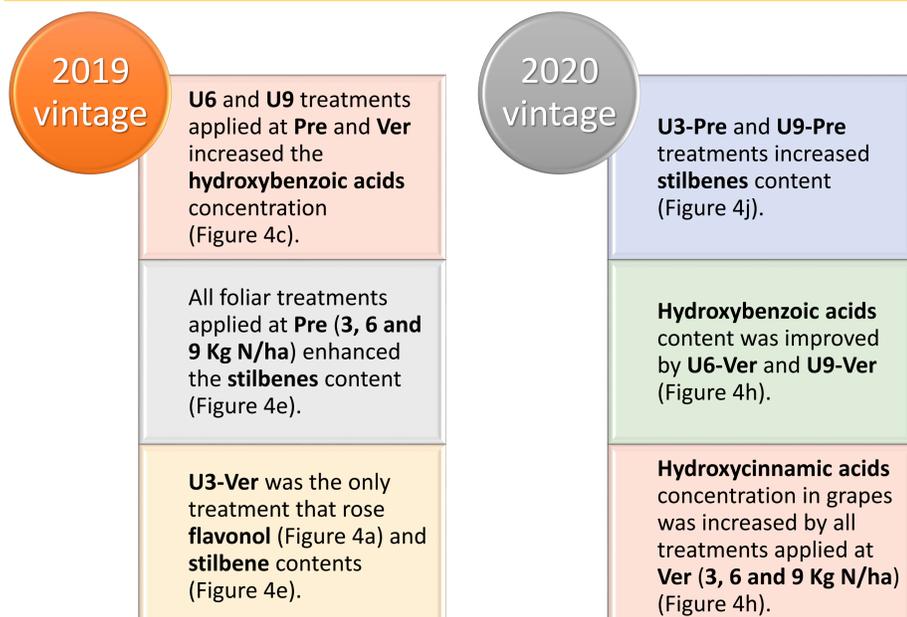


Figure 4. Grape phenolic compounds (mg/kg). Control (C) and urea treatments with 3 kg N/ha (U3), 6 kg N/ha (U6) and 9 kg N/ha (U9) applied at pre-veraison and veraison in the 2019 (a, b, c, d and e); and in 2020 (f, g, h, i and j). The treatments were carried out in triplicate (n = 3) and the results were expressed as the mean ± standard deviation. Different lowercase letters indicate significant differences between the treatments carried out at pre-veraison and capital letters expose significant differences between the treatments applied at veraison (Duncan's Test, p-value ≤ 0.05).

Content of phenolic compounds in Tempranillo Blanco grape samples



4. Conclusions

- The lowest and the highest dose of urea (U3 and U9), applied at pre-veraison, were the best treatments in order to improve the Tempranillo Blanco grape stilbenes composition.
- U6-Ver and U9-Ver were the best to rise the Tempranillo Blanco grape hydroxybenzoic acids content.

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