FIRST CHARACTERIZATION OF TORRONTÉS RIOJANO IN LA RIOJA, ARGENTINA: IMPACT OF PRUNING INTENSITY ON VINE VIGOR AND GRAPE PRODUCTION

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Abstract:

Context and purpose of the study - Pruning is one essential vineyard management activity whose main purpose is to regulate plant growth and vigour, modulating berry size, and consequently, wine quality. In Chilecito, La Rioja Province, Argentina, Torrontés Riojano stands as the only autochthonous variety for winemaking, yielding golden and aromatic berries and distinctive muscatel-tasting wines. This white cultivar, resulting from the natural cross between Moscatel de Alejandría x Criolla Chica, is traditionally trained in "parral" (horizontal trellis system), aimed to manage vigorous canopies. This project constitutes the first study on the influence of pruning intensity on Torrontés Riojano growth habit and berry quality.

Material and methods - In Chilecito, Nonogasta and Colonias de Malligasta are two Torrontés Riojano growing sites with long productive traditions and contrasting edaphoclimatic conditions. In this context, three pruning intensities were tested in two vineyards per site, *i.e.* two properties in Nonogasta and two properties in Colonias de Malligasta. Treatments were: control (regular pruning), short (leaving 60% of buds with respect to control), and long (leaving 80% of buds with respect to control). Number of bunches, bunch weight, number of buds, pruning weight and yield were assessed in the 2021 and 2022 seasons. Preliminary data were analyzed by ANOVA and PCA. Berry and wine chemical and oenological analyses are still to be completed.

Results - Preliminary results from the 2021 season showed significant differences between sites and among pruning treatments for pruning weight. For number of bunches, significant differences were observed among long vs. short and long vs. control in one vineyard from Nonogasta. Average bunch weight and yield, showed no significant differences among pruning treatments. However, significant differences in yield were observed between sites. The second growing season and further analyses should confirm and complete our results. Berry and wine analyses will provide insight into metabolic, aromatic and oenological traits determining possible pruning and site effects on Torrontés Riojano. It might be possible that in Torrontés Riojano horizontally trained in "parral", contrasting sites result in stronger effects than the tested pruning intensities.

Keywords: Torrontés Riojano, Pruning, Horizontal trellis system, Vigor, Berry traits.

1. Introduction

Torrontés Riojano (TR) is one Argentinean traditional grapevine variety, and the only autochthonous wine grape variety, resulting from the cross of Criolla Chica x Muscat of Alexandria (Agüero et al., 2003). In La Rioja, Chilecito is a historically viticultural region. Soil and climate have consolidated this variety from colonial periods to the present day: In la Rioja, 79% of total TR corresponds to Chilecito (INV, 2020).

In Chilecito, Nonogasta and Colonias de Malligasta are two TR growing sites with long productive tradition and contrasting edaphoclimatic conditions. TR is traditionally trained horizontally (parral trellis system). This system allows for better vigour equilibrium, while also protecting bunches from solar radiation, climatic adversities (e.g., hail), and possible diseases (Dobrecky, 2014).

TR has significant productive and cultural importance in the region. However, we encounter conceptual limitations both in the production and winemaking contexts. The putative relationship between aromatic profiles and current pruning techniques is yet to be studied in relation to plant vigour and vegetative vs. productive ratios. Winemaking experience suggests that differently sized berries result in wines with particular organoleptic characteristics. This size paradigm postulates that smaller berries present higher oenological quality than larger berries according to solid-liquid relationship. In this sense, Cassasa reported that pruning is one agronomic factor that greatly impacts berry size. He observed that systems with long pruning tend to produce comparatively smaller berry sizes than systems with intense pruning (Casassa, 2014). This essential management activity is crucial for wine quality (Casassa, 2014).

In this context, this research studied TR in Chilecito, considering three pruning intensities and two contrasting sites, Nonogasta and Colonias de Malligasta.

2. Material and methods

Plant material and site:
The study was carried out in four plots located in two environmentally contrasting sites: Nonogasta (-29.31° S, -67.50° W) and Colonias de Malligasta (-29.20 ° S, -67.40° W). The climate of the valley is desert, dry and warm, with notable annual thermal amplitude. Nonogasta is located 16 km to the south of Chilecito, at 785 m.a.s.l., with average maximum and minimum temperatures of 25.5°C and 12°C respectively, 71 mm annual rainfall and sandy soils. Colonias de Malligasta is located 13 km southeast Chilecito, at 896 m.a.s.l. with average maximum and minimum temperatures of 24 and 10 respectively, 138 mm annual rainfall and loamy soils.
Plants were selected from vineyards located in Colonias de Malligasta and Nonogasta, in Chilecito.TR was horizontally trained in “parral”, the most used trellis system for high-vigour vines. This system allows greater root development, more efficient use of water, and lowers winter frost intensity. Initially, plants with obvious symptoms of systemic diseases caused by fungi and viruses were discarded. On asymptomatic plants, trunk diameter at breast height (DBH) determined vigour variability, and guided plant selection according to uniformity. Activities were carried out during the 2021 - 2022 and 2022 - 2023 seasons.

Variables analyzed:
Within the plots, selected plants were similarly pruned according to 3 different criteria: Short pruning (60% of buds vs. control), Long pruning (80% of buds vs. control) and Control plants (pruned in the usual way), with 3 replicates and 8 plants per treatment. The number of buds per plants was defined according to the control treatment and per plot. Harvest point was determined by refractometry at 22° Bx and grouped by pruning categories (short, long and control). Measured variables included bunch number and weight, number of buds, pruning weight and yield for each plant. From each pruning category, must and 200 berries were separated and stored at -80°C until analysis and processing. Subsequently, berries were classified by size into 5 groups: <12mm, 12-15 mm, 15-18 mm, 18-21

mm and >21mm to determine the prevailing size. Data will be subjected to ANOVA and PCA using JAMOVI software.

3. Results and discussion

Comparing each treatment to its counterpart, significant differences for pruning weight were found between sites (figure 1,a). Although pruning criteria were the same at both sites, the obtained pruning weights were different at Nonogasta and Colonias de Malligasta, probably related to important differences in vigor. Pruning treatments in Colonia de Malligasta resulted in significantly lower weights than their counterparts in Nonogasta, while Short pruning in Colonias resulted to be similar to Long and Control at Nonogasta. When considering each site, differences in pruning weight among treatments were related to the treatments *per se*: fewer buds per plant, after a more intense pruning, imply a major wood extraction, while more buds per plant after a less intense pruning, is related to lower pruning weights. At this point, since edaphoclimatic differences between sites were clearly expressed in plant pruning weight, the classic *terroir* concept and the *genotype x environment* paradigm, gain protagonism (Hugalde et al. 2014, 2019, 2020). It might be possible that for TR in "parral", contrasting sites generate stronger effects than the tested pruning intensities. According to Matthews and Nuzzo (2007) berries grow smaller under shaded environments and oenological parameters are consequently affected. These light effects on berry traits and wine composition will be further studied, especially considering how TR behaves under contrasting light conditions.

Following the criteria to compare each treatment with its counterpart, for number of bunches, significant differences were observed between treatments in both sites (figure1, b). This coincides with previous studies in cv Karaerik (Kalkan et al., 2022), cv Grenache (Raj Kumar, 2017; Savic and Petranovic, 2004 and Somkuwar and Ramteke, 2006), and Cabernet Sauvignon (Chalak, 2008) where number of bunches depended on pruning intensity.

Average bunch weight and yield resulted in significant differences between sites, but did not show differences among pruning treatments (figure 1, c & 1, d). In Nonogasta, this result coincides with studies on cv. Thompson seedless, Delight and Concord, where yield was higher in less severe pruning (Raj Kumar, 2017). However, for Colonias de Malligasta it coincides with previous studies where higher yield and number of bunches resulted after more severely pruned Black Prince plants.

Interestingly, several pruning intensities allowed achieving similar values of pruning weight, bunch number, and bunch weight at both sites (e.g., average bunch weight at Nonogasta with Long pruning is equivalent to Control pruning at Colonias de Malligasta). This confirms the strong influence this practice has on vine physiology.

4. Conclusions

Torrontés Riojano is an autochthonous variety with important oenological potential in Chilecito, La Rioja. Preliminary results show that pruning intensities and site would significantly influence pruning weight and number of bunches per plant. However, yield and average bunch weight were only influenced by site. Data analysis of the 2022 – 2023 season and the support of oenological analyzes of wines will provide more information on the real impact of pruning intensities on this emblematic Argentine variety, both at an agronomic and oenological level. Noteworthy is realizing how pruning constitutes a significant management strategy to modulate vineyard productivity. Pruning severity modulates vigour and productivity of both studied sites.

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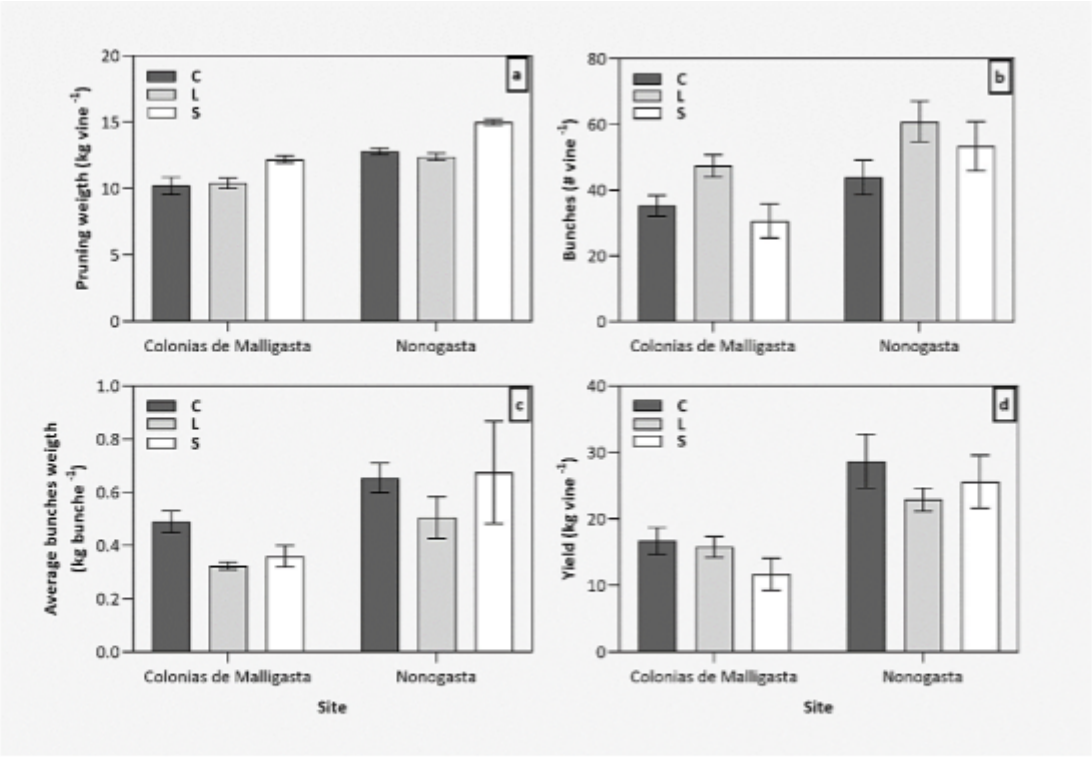

Figure SEQ Figure * ARABIC 1: a*:* pruning weight. Vine $^{-1}$ ***b:*** N° of bunches. Vine $^{-1}$. ***c:*** average bunch weight ***d:*** yield. Vine $^{-1}$, separated for pruning treatments in Colonias de Malligasta and Nonogasta. C: control pruning S: short pruning L: long pruning. The values and their level of significance were compared between counterparts, for example control Colonias de Malligasta vs. Nonogasta control.