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EXAMINATION OF THE QUALITATIVE AND QUANTITATIVE PARAMETERS OF THE WHITE WINE GRAPE VARIETY KIRÁLYLEÁNYKA (FETEASCĂ REGALĂ) IN THE CASE OF DIFFERENT BUD LOADS

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Abstract
Grapes are grown on an area of 8.5 million hectares on Earth. Most of the world's grape production (60%) is located in the regions of Europe. The largest grape and wine-producing countries include France, Italy, and Spain. Viticulture in the Carpathian basin has a history of 2,000 years. The control of the Fetească regală variety which is a traditional Hungarian variety, the control reached the highest sugar content, with an exceptionally high value, and all three loaded treatments were significantly below this. The evolution of the acid content was exactly the opposite, the control reached the lowest value. In terms of survival, all load levels outperformed the control. In conclusion, in the case of Fetească regală, the bud load had both positive and negative effects on the content values, but it had only a positive influence in terms of yield. On the other hand, based on our observation, a high shoot density developed on the high-stressed stems in the plantation, which prevented the phytotechnical operations from being carried out.

Keywords: bud load, Fetească regală, phytotechnology, white wine.

1. INTRODUCTION

With its complex aromas and deep history, wine has captivated palates and inspired the senses for millennia. It is a timeless elixir that has been ingrained in human civilization. Romania is a fascinating chapter in the great fabric of the world's winemaking traditions, giving a distinctive and varied viticultural setting that is gaining popularity on a global scale (Wessner et al., 2013). Bud load management is a critical viticultural practice that involves strategic decisions about the number of buds to retain on a grapevine. This practice directly influences factors such as canopy density, cluster formation, and grape yield. By adjusting the bud load, viticulturists can steer the vine's resources towards either vegetative growth or reproductive development, thereby modulating the quantity of grape must that can be harvested (Korpas et al., 1994).

The interaction between bud load and sugar accumulation is also intricately linked to the grapevine's physiological processes. During photosynthesis, grapevines assimilate carbon dioxide from the atmosphere and convert it into glucose through a series of complex biochemical reactions. The number of buds on the vine influences the allocate ion of these sugars (Stanescu, 1993). A

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higher bud load translates to a greater number of clusters and grape berries, which compete for limited resources such as water, nutrients, and carbohydrates. When resources are distributed over larger berries, the sugar concentration within each berry may be reduced. Conversely, a lower bud load allows for a more efficient distribution of resources, potentially leading to increased sugar concentration in the berries. This occurrence emphasises how grapevines must maintain a careful balance between vegetative growth and reproductive development. (Haggag et al., 1996).

The influence of bud load on sugar accumulation is further modulated by various regulatory mechanisms within the grapevine. Hormonal signalling, particularly involving auxins and cytokinin's, plays a pivotal role in resource allocation between vegetative and reproductive tissues. A higher bud load can enhance vegetative growth due to increased auxin production, potentially diverting resources away from the maturing grape berries (Kilewer, 1981).

Titratable acids, including tartaric, malic, and citric acids, are important components of grape juice, an important precursor to winemaking. These acids contribute to the final wine's overall flavour, balance, and stability. The concentration of titratable acids in the grapes must influence acidity, pH and flavor perception, all of which can significantly affect the sensory characteristics of the resulting wine (Stanescu, 1993).

The interaction between titratable acid content and bud load is rooted in the grapevine's metabolic processes. Titratable acids are synthesized through various metabolic pathways, including the citric acid cycle and the glycolytic pathway. The availability of resources, such as carbohydrates and nutrients, directly affects the grapevine's capacity to synthesize these acids (Marwad, 1969).

A higher bud load, which leads to an increased number of grape clusters, can potentially divert resources away from the biosynthesis of titratable acids (Philips, 1969). As more resources are allocated to support vegetative growth and a larger number of grape clusters, the synthesis of titratable acids may be compromised. Conversely, lower bud load may allow the vine to allocate resources more efficiently to fruit development, thereby improving titratable acid biosynthesis in grape berries (Sarıkaya et al., 2016).

The link between bud load and must production is based on basic principles of resource allocation within the vine. A higher bud load, leading to an increased number of grape clusters, translates into a larger potential yield of grape must (Antcliff et al., 1956). However, this increase in yield is intricately tied to the availability of essential resources such as water, nutrients, and carbohydrates. The final volume of grape must is greatly influenced by the grapevine's ability to provide these materials to the maturing clusters of grapes. (Barócsi, 2018).

Conversely, a lower bud load directs the vine's resources towards a reduced number of grape clusters. While this may result in a lower overall yield of grape must, the grapes that are produced may experience more efficient resource utilization, potentially leading to higher concentrations of sugars, acids, and other compounds (Fawzi et al., 1984).

Moreover, the concept of source-sink dynamics, which examines the balance between resource-producing source tissues (leaves) and resource-consuming sink tissues (fruit), is pertinent. A higher bud load can shift the source-sink balance towards vegetative tissues, affecting the availability of resources for grape cluster development and, consequently, grape must yield (Fawzi et al., 2010).

The bud load's influence on cluster weight reflects the complex balance between vegetative growth and reproductive processes.

The allocation of resources, such as carbohydrates, water, and nutrients, within the grapevine profoundly affects cluster formation and weight. A higher bud load results in a greater number of potential clusters, competing for finite resources. While the increased number of clusters may seem

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advantageous, it can lead to resource scarcity for individual clusters, potentially compromising their growth and weight (Kurtural, 2013).
Conversely, a lower bud load allows for a more efficient distribution of resources among a reduced number of clusters. This can result in enhanced resource availability for individual clusters, contributing to their development and potentially yielding larger cluster weights. The intricate resource allocation dynamics within the grapevine thus underscore the connection between bud load and cluster weight (Farag, 1981; Christensen et al., 1994).

2. MATERIALS AND METHODS

The experiment was carried out in Targu Mures, at Sapientia Hungarian University of Transylvania. The variety used in this experiment was ‘Királyleányka’ (‘Fetească regală’). This variety can be found in many places throughout Transylvania but is also widely distributed in the rest of Romania. Can be harvested at the end of September, and has strong growth. It grows dense foliage, which is why it is prone to self-shading and requires more green work compared to other, weaker-growing varieties. High-yielding, it can even reach 10 t/ha. The buds survive the winter well, but their frost tolerance is average. Its berries are prone to rotting and are especially susceptible to downy mildew and powdery mildew.
‘Királyleányka’ stands out among the several grape varieties that adorn Romanian vineyards as a truly regal gem. ‘Királyleányka’, a white grape variety whose name translates to "Royal Maiden," has come to represent the viticultural revival in Romania. ‘Királyleányka’, known for its outstanding ability to adapt to varied terroirs and climates, displays a stunning variety of aromas and flavours that enthral wine fans and connoisseurs alike.
‘Királyleányka’ has an aromatic profile that is a symphony of elegance, with floral notes that are reminiscent of lemon flowers, elderflower, and acacia blooms. The drinker is taken on a sensory tour of the sun-kissed regions where the grapes bloom thanks to these subtle and alluring fragrances.
The wines from ‘Királyleányka’ have a crisp, captivating palate that provides a revitalizing, energetic experience. This grape variety is known for its sharp acidity, which adds to the wine's lively structure and balance. Green apple, pear, and hints of tropical fruit flavours dance on the palate, making you want to take another drink.
The terroir of Romania, which gives the wines specific qualities, is intricately linked with the allure of ‘Királyleányka’. From the warm breezes of Transylvania to the sun-drenched hills of Moldova, the grape demonstrates an exceptional capacity to capture the character of its surroundings. The intricate interactions between soil, climate, and location influence how the grape expresses itself, producing a wide range of styles that reflect Romania's diverse viticultural heritage (Csepregi et al., 1988).
In the experiment, we set 3 different loads and a control. Each treatment contained 6 vines, which included a total of 72 vines.
On the vines, after the start of sap circulation, the level of bud load was set on April 8. All the vines were cultivated using the Guyot-training. The amount of bud load was set:
• The control was pruned back to a 12-bud stem and a 2-bud short spur (12 + 2).
• The first load was increased by 25%, compared to the control, a short cane with 4 buds was still left (12 + 2 + 4).
• The second, the 50% load, on which a 7-bud cane was left compared to the control (12 + 2 + 7).

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• Finally, for the 75% load, compared to the control, one more cane with 10 buds was left (12 + 2 + 10).

The sugar content was measured with a refractometer and the titratable acid content was by titrating the samples.

3. RESULTS AND DISCUSSIONS

Figure 1 shows that the measurements regarding the sugar content showed a decrease compared to the control (230 g/L). Among the three loads, we measured the highest value at the 50% treatment (212.2 g/L), followed by the 75% load (209.6 g/L) and finally the 25% load level (207 g/L). There was no significant difference in the evolution of sugar content between the three load treatments.

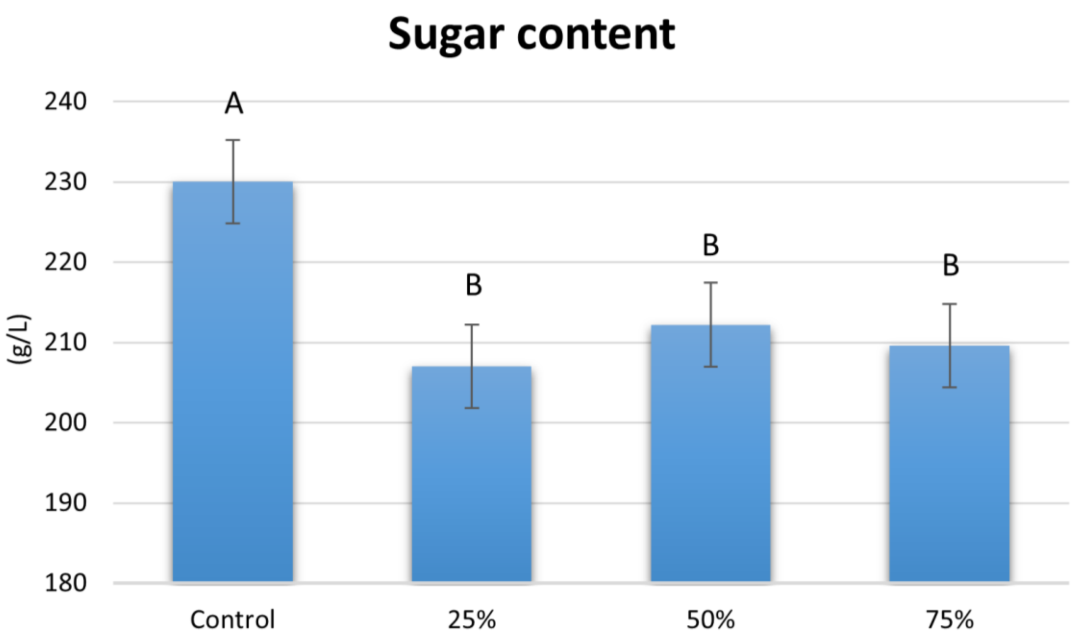

Figure 1. Sugar content according to load levels ($p < 0.05$)

On Figure 2 could be observed that the control had the lowest acidity level (9 g/L). This was followed by the load of 25% (10.5 g/L), at 50% the value was even higher (11 g/L), finally at a load of 75% the highest value was measured (11.1 g/L). Based on the samples, it can be concluded that due to the loads, a linear increase compared to the control can be observed for the 25 and 50% samples, and the highest load level is almost the same as the 50%.

In terms of must quantity could be determined that the control group achieved the lowest value (1.27 kg) for the 'Királyleányka' variety (Figure 3). Among the loaded treatments, the 25% load produced more than twice as much (2.82 kg) compared to the control. The highest value was obtained by the 50% load (3.52 kg), which is almost three times the control. Only 2.35 kg of must was extracted from the 75% load group, which is the lowest of the three load groups, but significantly more compared to the control. Based on the data, it can be concluded that the 'Királyleányka' variety reacted positively to the loads, as a significant increase in the amount of must can be observed for all load levels.

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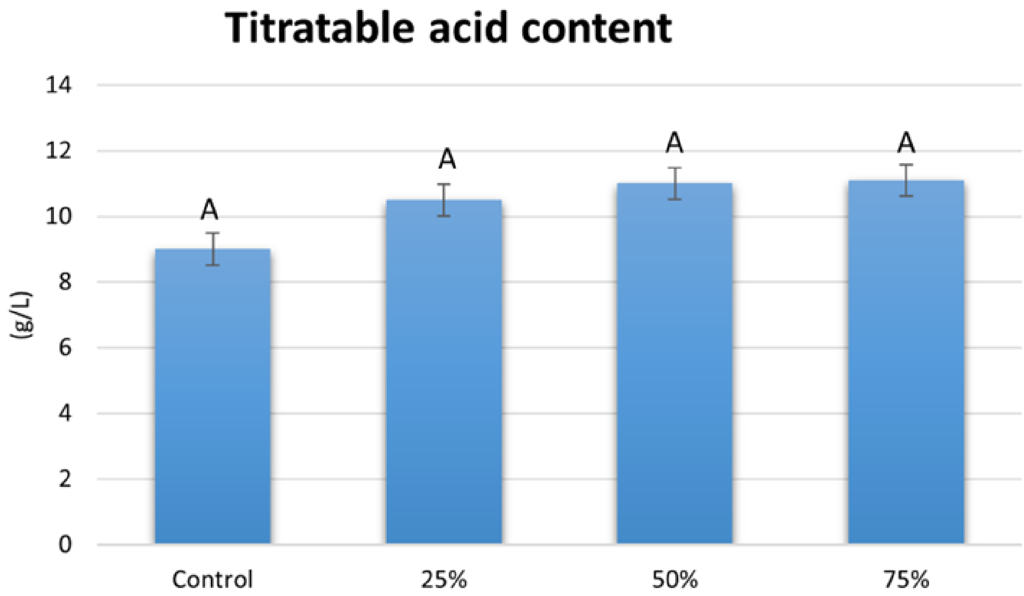

Figure 2. Titratable acid content according to load levels ($p < 0.05$).

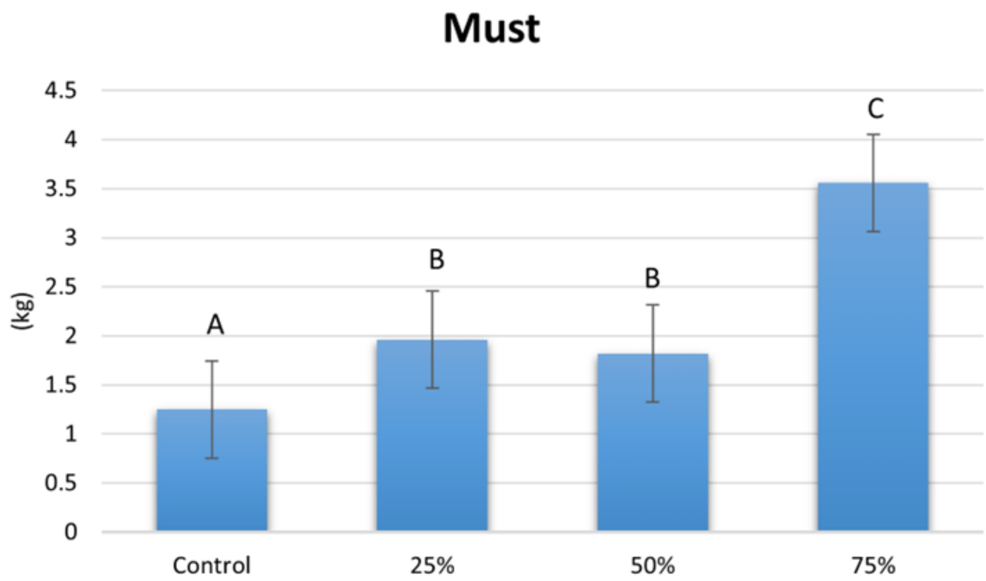

Figure 3. Must quantity according to load levels ($p < 0.05$).

Figure 4 shows that the average cluster weight in the case of the control is 35.7 g. Compared to this, an increase can be observed at the 25% load (46.5 g), the average cluster weight also increased in the case of the 50% load (42.3 g), and at the 75% load (46.8 g) also showed an increase compared to the control. The loads had a favourable influence on the development of the cluster mass, and the largest cluster mass was achieved by the largest load.

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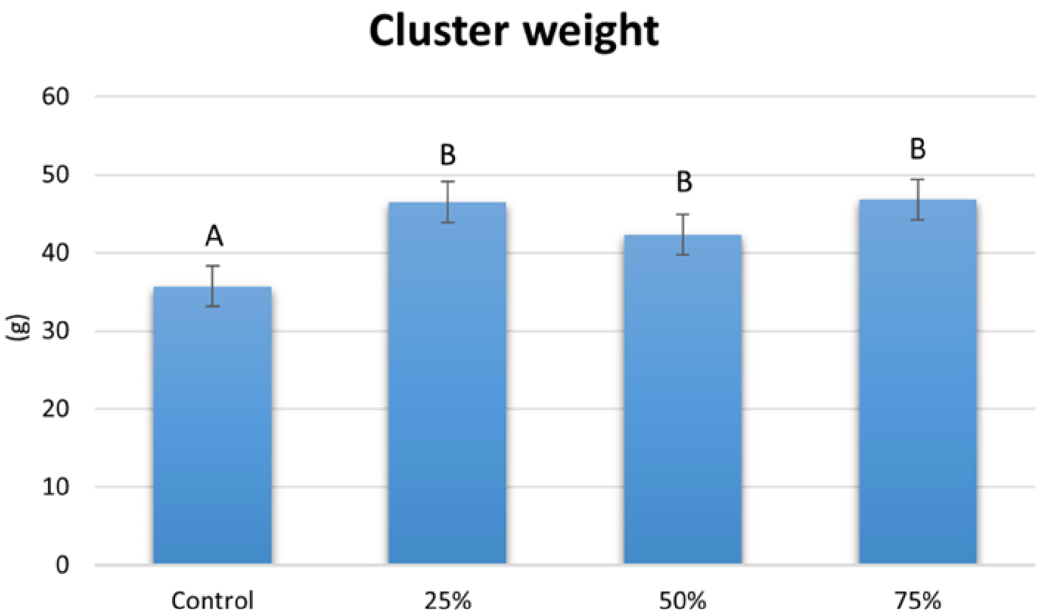

Figure 4: Cluster weight according to load levels ($p < 0.05$).

4. CONCLUSIONS

From the results of the present study could be concluded that the control reached the highest sugar content, with an exceptionally high value, and all three loaded treatments were significantly below this. The evolution of the acid content was exactly the opposite, the control reached the lowest value. In terms of survival, all load levels outperformed the control. The bud load had both positive and negative effects on the content values, but it had only a positive influence in terms of yield. On the other hand, based on the observations, a high shoot density developed on the high-stressed stems in the plantation, which prevented the phytotechnical operations from being carried out.

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