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Evaluation of the 'Leányka' ('Fetească Albă') white wine grape variety's qualitative and quantitative parameters in the context of different bud loads

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Abstract: Wine is a product of human creativity, culture, and nature, and therefore it is an intriguing subject for scientific research and admiration. Among its many kinds, white wine stands out oenologically because of its diverse flavours, aromatic attributes, and capacity to mature. In this experiment, we established 3 different bud load levels (25%, 50%, and 75%) on the well-known white wine grape variety 'Fetească Albă'. The sugar content significantly increased in the 50% and 76% groups, whereas there were no significant changes regarding titratable acid content, must quantity, and cluster weight.

Keywords: bud load, sugar content, titratable acid content, 'Leányka', 'Fetească Albă'

1. Introduction

Wine is a fascinating topic for scientific studies because it is a product of nature, culture, and workmanship. White wine is one of the many varieties, and it stands out oenologically thanks to its complex flavours, aromatic qualities, and ability to age [1].

White wine is a beverage with significant scientific interest because of its diverse sensory qualities and complex winemaking processes. The key to appreciating the complexity of this libation is to understand the complicated biochemistry that underlies the emergence of aromas and flavours, the impact of terroir on grape development, and the fermentation processes that give rise to white wine's distinctive finesse [2, 3].

Romania is situated in Southeastern Europe and has a long history of viticulture extending back for millennia. Its varied areas, which range from low plateaus to rolling hills, provide a variety of microclimates and soil compositions. These characteristics, along with the regional grape types, have produced a specific winemaking culture that is still open to scientific study [1, 4].

Making thoughtful decisions about how many buds to leave on a grapevine is called "bud load management", a vital component of viticulture. This strategy has a direct effect on grape yield, cluster formation, and canopy density. Viticulturists can control the amount of grape must that can be harvested by altering the bud load, which allocates the resources of the vine to either vegetative growth or reproductive development [5].

The relationship between bud load and sugar build-up is closely related to the physiological functions of the grapevine. During photosynthesis, grapevines take in carbon dioxide from the atmosphere and use several complex metabolic processes to convert it into glucose. The number of buds on the vine will determine how these sugars are distributed [6, 7].

More clusters and grape berries are produced as a result of a larger bud load, which raises the competition for limited resources, including water, minerals, and carbohydrates. If resources are distributed among larger berries, the sugar content of each berry can drop. Contrarily, fewer buds enable a more efficient allocation of resources, which can enhance the sugar content of the berries.

Grapevine has numerous internal regulatory mechanisms that further control how bud load affects sugar build-up. Particularly important in the hormonal signalling, which regulates the allocation of resources between vegetative and reproductive organs, are auxins and cytokinins. A greater bud load may encourage vegetative development at the expense of the developing grape berries due to increased auxin production [8].

The production of grape must, a crucial step in the production of wine, requires the presence of titratable acids, including tartaric, malic, and citric acids. These acids have an impact on the final wine's flavour, harmony, and stability. The concentration of titratable acids in grape must has a significant impact on acidity levels, pH, and taste perception. These three parameters also have a significant impact on the sensory profile of the finished wine [6, 9].

The metabolic activities of the grapevine constitute the basis for the interaction between bud load and titratable acid content, which affects acid production. The glycolytic pathway and the citric acid cycle are just two of the metabolic processes that produce titratable acids. The availability of resources, such as minerals and carbohydrates, has a significant impact on the grapevine's capacity to synthesise these acids [10, 11].

More grape clusters produced by a larger bud load will likely deplete the resources needed to produce titratable acids. If more resources are allocated to vegetative development and more grape clusters are produced, the generation of titratable acids may be impeded. The ability of the grapevine to allocate resources more efficiently to fruit development if there are fewer buds present may boost the synthesis of titratable acids in grape berries.

The relationship between bud load and grape must yield is based on the fundamental principle of resource distribution inside the grapevine. A higher bud load, which leads to more grape clusters, increases the potential yield of grape must. However, the availability of essential resources, such as water, minerals, and carbohydrates, has a direct impact on this increase in output. The grapevine's capacity to supply these components to the developing grape clusters has a significant impact on the eventual volume of grape must [12, 13].

On the other hand, a reduced bud load concentrates the vine's energy on a fewer number of grape clusters. The number of grapes produced may be decreased overall, but they may use resources more efficiently, producing grapes with higher concentrations of sugars, acids, and other ingredients [2].

Source–sink dynamics is a concept that examines the balance between tissues that create resources (like leaves) and those that consume them (like fruit), and it is also crucial. Increased bud load may tip the source–sink balance in favour of vegetative tissues, limiting the resources available for the growth of grape clusters and, as a result, lowering grape must output [2, 14].

The effect of bud load on cluster weight demonstrates the delicate balance between vegetative growth and reproductive processes.

The distribution of resources like nutrients, water, and other resources throughout the grapevine has a substantial impact on cluster formation and weight. A higher bud load causes more potential clusters to develop, competing for few resources. While having more clusters could seem advantageous, it could lead to resource shortages for some clusters, which might limit their ability to grow and gain weight [6].

2. Materials and methods

At the heart of Romania's viticultural heritage lies 'Leányka' ('Fetească Albă'), a grape variety that embodies the mystique of indigenous viticulture. It is known for its resilience in the face of various climatic challenges, adaptability to different terroirs, and the production of wines ranging from dry to sweet. Yet, the genetic and oenological intricacies of 'Leányka' ('Fetească Albă') remain a captivating enigma.

When completely ripe, 'Leányka' grapes are small to medium size and have a greenish-yellow to golden skin. Due to the grapes' high acidity, a well-known feature, a variety of white wines – from dry to sweet – can be made from them. The adaptability of this cultivar in winemaking makes it highly regarded. The variety of white wines it may produce includes dry, semi-sweet, sweet, and sparkling wines.

Grape is excellent for a variety of winemaking techniques due to its inherent acidity and aromatic flavour. The characteristics of the wine could substantially change depending on the particular vineyard and area where it is cultivated because it is very responsive to terroir. It is a fascinating grape for examining the subtleties of various wine-producing regions because of its terroir responsiveness [1, 2].

Three different loads and a control during the experiment were used for the current experiment. There were six vines for each bud load, amounting to a total of 72 vines. Following the start of sap circulation on 8 April, the amount of bud load was determined. Every vine underwent the Guyot training method. A cane with 12 buds and a 2-bud short spur (12 + 2) served as the control. The bud load was determined by this. Only a short cane with 4 buds remained after the first load was 25% higher than the control (12 + 2 + 4). Compared to the control (12 + 2 + 7), the second one had a 50% load and a 7-bud cane left. For the final 75% load compared to the control, one more cane with 10 buds was added.

The samples were titrated to ascertain the titratable acid content, and the sugar concentration was measured using a refractometer.

3. Results and discussions

Considering the sugar content measurements, an increase was detected between the control (217.3 g/L) and the other bud loads. The value of the 25% load is almost the same as the control (218.6 g/L), but there is a significant increase at the 50% (245.8 g/L) and 75% load (243.2 g/L) compared to the control. It can be concluded that the highest sugar content was achieved at the 50% load, with an outstanding value compared to the control (245.8 g/L) (*Fig. 1*).

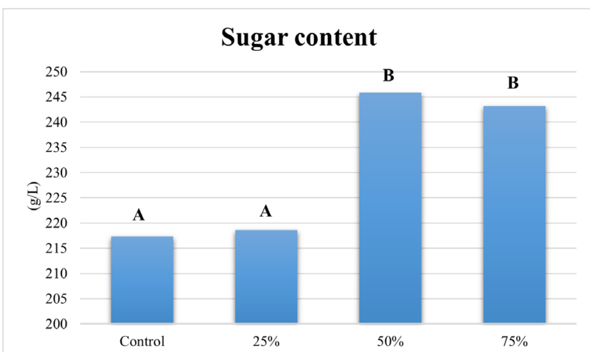

Figure 1. Differences in sugar content with different load levels ($p < 0.05$)

The acid content of the control was 7.7 g/L. The samples of vines with a 25% load were 8.3 g/L, the samples with a 50% load were 8.1 g/L, and the acid content of individuals with a 75% load was 7.6 g/L. The results show that the load mostly had a positive effect on the formation of acidity, which could be observed at 25% and 50%. In the case of the 75% load, a decrease was recorded compared to the control (*Fig. 2*).

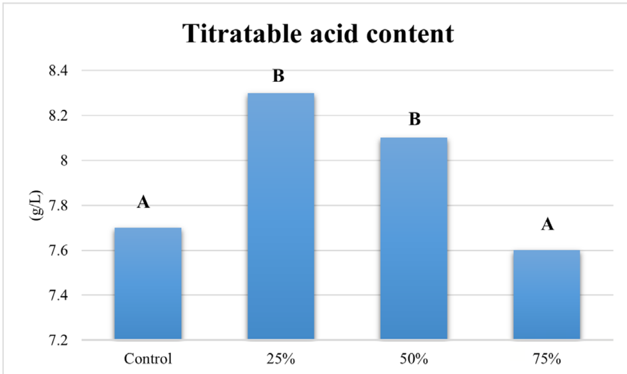

Figure 2. Differences in titratable acid content with different load levels ($p < 0.05$)

The loaded groups mostly show an increase compared to the control (1.78 kg) although there are no particularly large differences. The largest juice quantity was pressed out of the 25% load group (1.98 kg), leaving the 50% load group (1.9 kg) behind by just 0.1 kg. The smallest value was given by the 75% load (1.3 kg), which is almost 0.4 kg less than the control. Based on the results, we drew the conclusion that in the case of 'Leányka', increasing the bud load mostly had a positive effect on the must yield up to a certain level since too much load was already associated with a decrease (*Fig. 3*).

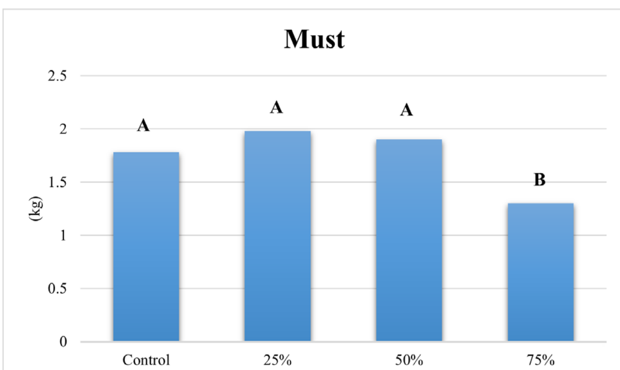

Figure 3. Differences in must quantity with different load levels ($p < 0.05$)

The clusters measured in the control had an average weight of 43.7 g. Among the bud loads, the 25% load level (36.6 g) resulted in a decrease in cluster weight, the average cluster weight of the 50% load (35 g) gave an even smaller value, and, finally, the 75% bud load (30 g) had the smallest average cluster mass. It can be concluded that in the case of this variety, the load was inversely proportional to the weight of the curls (*Fig. 4*).

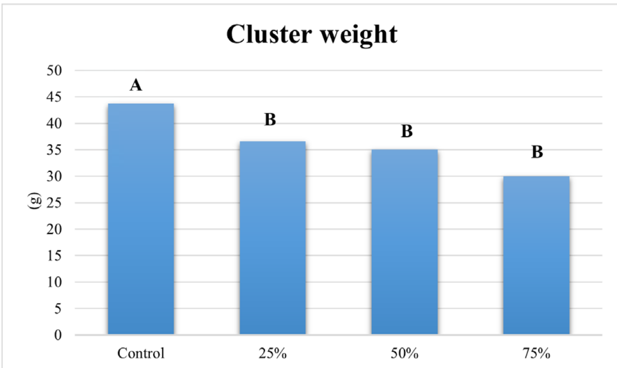

Figure 4. Differences in cluster weight with different load levels ($p < 0.05$)

4. Conclusions

From the present study, it can be concluded that in terms of sugar content, there was a significant increase in the 50% and 75% bud load. With the exception of sugar formation, no significant differences were reported between the control and the loads. It was observed concerning the 'Leányka' ('Feteascǎ Albǎ') variety – since it is also a grape variety with a strong growth power – that too much bud load results in a too dense foliage, which hinders the performance of phytotechnical operations.

Acknowledgements

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