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EFFECT OF DIFFERENT PHYTOTECHNOLOGICAL FACTORS ON THE QUALITATIVE AND QUANTITATIVE PARAMETERS OF THE ITALIAN RIESLING GRAPE VARIETY

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Abstract
Grapes are one of the most widely cultivated plants in the world. Grapes and wine have great cultural importance in many religions. The transformation of grapes into wine is a complex process. Our experiment was carried out at Sapientia Hungarian University, with the following objectives: to examine the content and quality values of some Transylvanian grape varieties, to determine the conditions necessary for the best yield, and to observe the development of shoot growth. Regarding the "Italian Riesling" content values, the 25% bud load achieved the highest sugar and acid content, despite the lack of significant differences between the treatments. The largest shoot lengths were also grown at the 25% bud load. However, most must be given by the 50% bud load, which is almost three times the control. Based on the data, it can be concluded from the experiment that in the case of the 'Italian Riesling' variety, increasing the bud load influenced the quantity and quality of the must in a positive way, and in addition, vegetative development was stimulated more in certain treatments.

Keywords: bud load, Italian Riesling, phytotechnology, white wine.

1. INTRODUCTION

A key component of viticulture is managing bud load, which involves selecting carefully how many buds to leave on a grapevine. Grape yield, cluster formation, and canopy density are all directly impacted by this method. Viticulturists control the bud load, which allocates the vine's resources to either vegetative growth or reproductive development, hence controlling the amount of grape must that can be harvested. (Cangi et al., 2011).

The physiological processes of the grapevine are also tightly linked to the relationship between bud load and sugar build-up. Grapevines absorb carbon dioxide from the atmosphere and use a series of intricate metabolic processes to transform it into glucose during photosynthesis. The distribution of these sugars depends on how many buds are present on the vine (Omar et al., 2000).

A higher bud load produces more clusters and grape berries, increasing competition for limited resources including water, minerals, and carbohydrates. The sugar content of each berry may decrease if resources are divided throughout larger berries. On the other hand, fewer buds allow for a more effective distribution of resources, which may improve the sugar content of the berries (El-Baz et al., 2002).

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Numerous internal regulatory mechanisms in the grapevine further regulate the impact of bud load on sugar build-up. Auxins and cytokinins, in particular, are key players in hormonal signaling that controls how resources are distributed between vegetative and reproductive organs. Due to increased auxin production, a larger bud load may promote vegetative development at the expense of the developing grape berries (Singh et al., 2014).

Titratable acids, such as tartaric, malic, and citric acids, are necessary parts of grape must, an important step in making wine. The overall flavour, harmony, and stability of the finished wine are influenced by these acids. 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 resulting wine. (Fawzi et al., 2010).

The relationship between bud load and titratable acid content is based on the grapevine's metabolic processes. The citric acid cycle and the glycolytic pathway are just two of the metabolic mechanisms used to create titratable acids. The ability of the grapevine to produce these acids is strongly impacted by the availability of resources like nutrients and carbohydrates (Zhuang et al., 2014; Fawzi et al., 2015).

It is possible that a higher bud load, which results in more grape clusters, will take resources away from the manufacture of titratable acids. The production of titratable acids could be hampered if more resources are devoted to vegetative growth and more grape clusters. The ability of the grapevine to direct resources more efficiently towards fruit development in the event that fewer buds are present may enhance the generation of titratable acids in grape berries. (Calugar et al., 2010).

The basic tenet of resource distribution inside the grapevine is the basis for the correlation between bud load and grape must yield. A greater potential production of grape must, results from a higher bud load, which produces more grape clusters (Almanza-Merchan et al., 2014). But this rise in output is closely related to the accessibility of necessary resources like water, minerals, and carbohydrates. The final amount of grape must, is greatly influenced by the grapevine's ability to provide these materials to the growing grape clusters (Khamis et al., 2017).

A decreased bud load, on the other hand, focuses the vine's energy toward a smaller number of grape clusters. While the overall output of grape must may be reduced as a result, the grapes that are produced may use resources more effectively, which could result in grapes with higher concentrations of sugars, acids, and other components (Khamis et al., 2008).

In addition, the concept of source-sinking dynamics, which considers the balance between the tissues that create resources (leaf) and the tissues that consume them (fruit), is also important. More bud may tilt the source-sinking balance in favour of the vegetative tissues, which in turn reduces the resources available for the development of the grape cluster and, in turn, reduces the grape must yield. (Khamis et al., 2017; Naor et al., 2002).

The relationship between vegetative growth and reproductive activities is intricately balanced, as seen by the impact of bud load on cluster weight (Mahfouz, 2007).

Cluster formation and weight are significantly influenced by how nutrients, water, and other resources are distributed throughout the grapevine. More potential clusters emerge as a result of a larger bud load, fighting for limited resources (Abd El-Wahab, 1997). While having more clusters can seem desirable, this could result in resource shortages for specific clusters, which could hinder their growth and weight.

The relationship between vegetative growth and reproductive activities is intricately balanced, as seen by the impact of bud load on cluster weight (Uyak et al., 2016).

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The formation and weight of clusters are highly dependent on the distribution of nutrients, water and other resources throughout the entire grapevine. A larger bud load results in more potential clusters forming as they compete for limited resources. Having more clusters may seem like a good thing, but this can lead to a shortage of resources for particular clusters, which can impede their growth and weight (Ahmad et al., 2004; Abd El-Wahab, 2006).

2. MATERIALS AND METHODS

The viticultural panorama is replete with grape varieties that bestow unique expressions upon wines, enriching the world of oenology with diverse flavours and aromas. Among these, the 'Italian Riesling' grape variety emerges as a compelling subject of study. This scientific analysis aims to delve into the intricacies of the 'Italian Riesling' grape, shedding light on its origin, genetic characteristics, viticultural attributes, and the sensory nuances it imparts upon wines.

'Italian Riesling', scientifically classified as *Vitis vinifera*, is a member of the Riesling family, renowned for its ability to thrive in diverse climates while producing wines of distinctive character. While its name suggests an Italian lineage, the origins of Italian Riesling trace back to the Riesling family's ancestral home in the Rhine region of Germany. Despite its moniker, Italian Riesling flourishes predominantly in the northeastern Italian regions of Trentino-Alto Adige and Friuli-Venezia Giulia.

'Italian Riesling' vines exhibit a robust vigour, characterized by medium to large clusters bearing small, round berries. Its adaptability to diverse terroirs and climates is a defining feature, as it gracefully accommodates varying elevations and microclimates. Notably, the variety thrives in the Alpine foothills of Trentino-Alto Adige, where the diurnal temperature variation imbues the grapes with a distinct balance of sugars and acids.

The oenological potential of 'Italian Riesling' is a compelling narrative that beckons exploration. The grapes possess a naturally high acidity, lending an elegant structure and ageing potential to the resulting wines. Winemakers harness this acidity to craft a spectrum of styles, from dry to off-dry and even late-harvest sweet wines. The aromatic profile of 'Italian Riesling' is notable for its floral and fruity character, with aromatic compounds such as terpenes contributing to its bouquet.

'Italian Riesling' wines are renowned for their aromatic finesse and harmonious balance. The nose offers a tapestry of floral notes, ranging from elderflower and acacia to subtle citrus blossoms. On the palate, these wines often exhibit a captivating interplay of vibrant acidity and fruit-driven flavours. Green apple, peach, and citrus elements are frequently encountered, with mineral undertones adding complexity. These sensory attributes converge to create wines that are refreshing, expressive, and capable of ageing with grace.

The 'Italian Riesling' grape variety embodies the fusion of genetic heritage and terroir, reflecting the intricate dance between nature and human intervention. Its journey from the Rhine to Italian vineyards has bestowed the oenological world with wines that captivate the senses and celebrate the artistry of winemaking. This scientific exploration sheds light on the genetic identity, viticultural nuances, oenological potential, and sensory characteristics of 'Italian Riesling', contributing to a deeper appreciation of its role in the rich tapestry of grape diversity (Csepregi et al., 1998).

During the experiment, we used a control and three different loads. Six vines for each treatment made up a total of 72 vines in all.

The amount of bud load was established on April 8, following the onset of sap circulation. Guyot-training was used to nurture every vine. The control was reduced to a cane with 12 buds and a 2-bud short spur (12 + 2). This determined the bud load. When the first load was 25% higher than the

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control, just a short cane with 4 buds remained (12 + 2 + 4). The second had a 50% load with a 7-bud cane remaining as opposed to the control (12 + 2 + 7). One more cane with 10 buds was added for the final 75% load in comparison to the control.
A refractometer was used to quantify the sugar concentration, and the samples were titrated to determine the titratable acid content.

3. RESULTS AND DISCUSSIONS

In Figure 1, in the case of sugar content, the measurements show an increase between the control (212 g/L) and the loaded treatments. We measured the highest sugar level at the 25% load (219.9 g/L), but the 50 and 75% loads also showed very similar results (217.3 g/L). The data show that the sugar content was higher in all loads compared to the control.

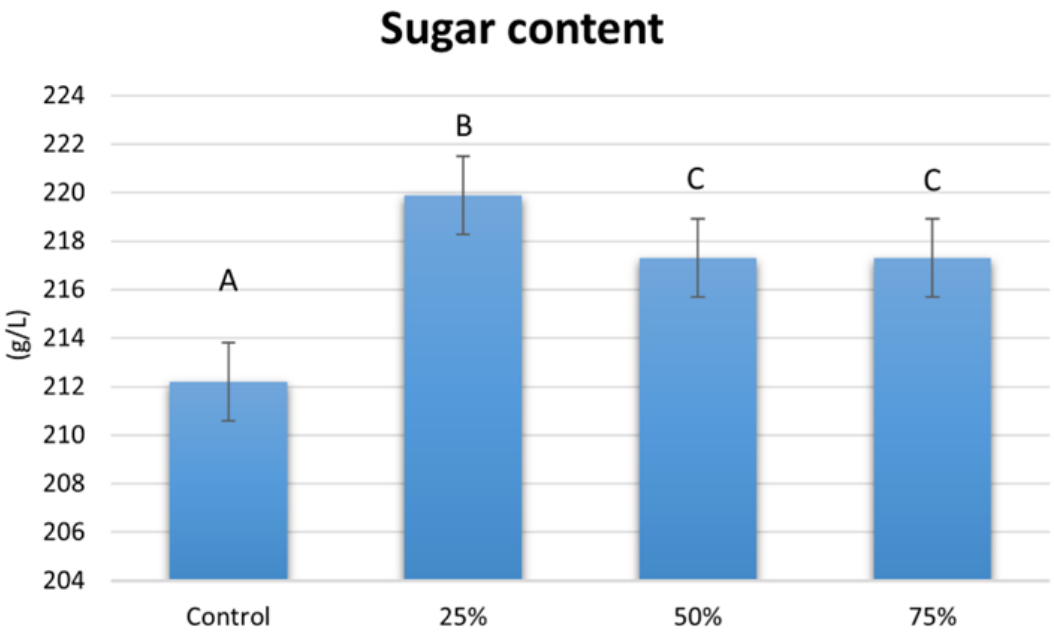

Figure 1. Effect of different bud load levels on the sugar content ($p < 0.05$)

Regarding the titratable acid content, could be observed in Figure 2 that based on the measurements, the highest acid content was reached at the 25% load level (9.4 g/L), and the lowest at 75% (9 g/L). The control and 50% treatments reached the same value (9.2 g/L). The loads had a significant influence on the formation of acidity.
Figure 3 shows that 1.27 kg of must was pressed from the control group. In the treatments where load levels were modified, we obtained 2.82 kg of juice from the 25%, 3.52 kg at the 50% load level and finally 2.35 kg of juice in the case of the 75% load. Compared to the control, a significant increase can be observed in each case. The 50% treatment performed best, followed by the 25 and finally the 75% load. Based on the measurements, it can be stated that the load had a positive effect.

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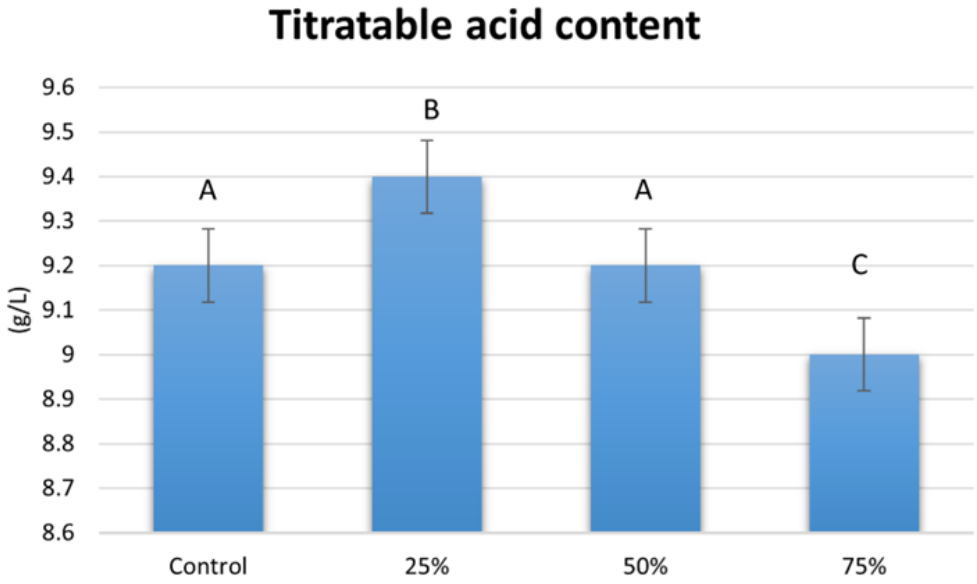

Figure 2. Effect of different bud load levels on the titratable acid content ($p < 0.05$).

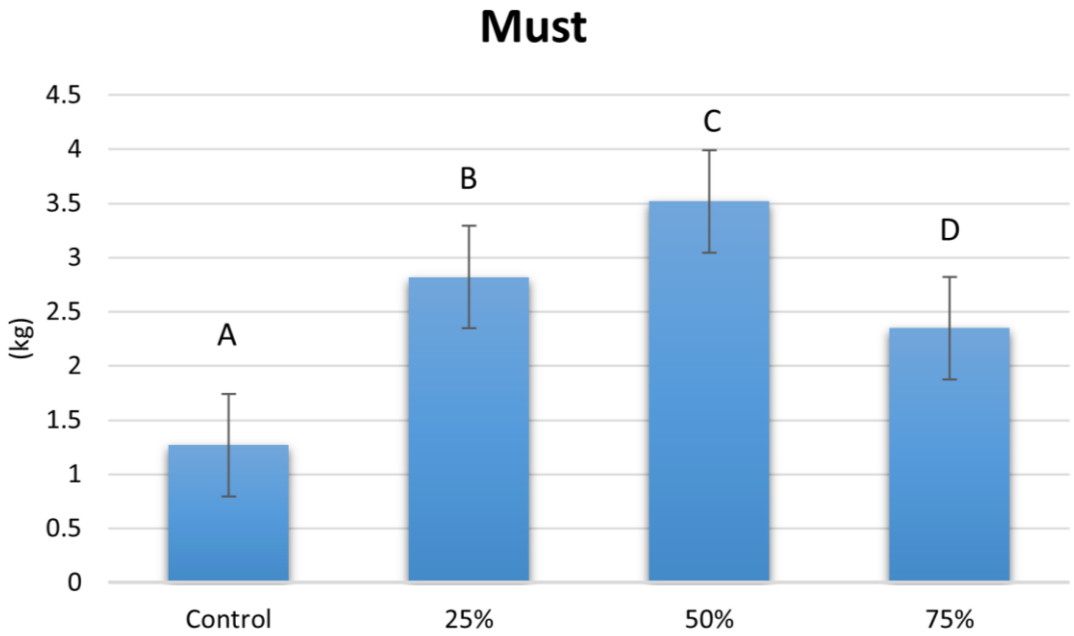

Figure 3. Effect of different bud load levels on the must quantity ($p < 0.05$).

The average weight of the clusters in the case of the control was 47.6 g. In the case of the 25% load, the weight increased (54.5 g), and the average weight of the 50% load treatment (38.9 g) decreased compared to the control, similarly, the 75% load level (42.6 g), produced a smaller average cluster weight than the control. These weights are all below the cluster weight typical for the variety, as the entire plantation suffered significant downy mildew damage (Figure 4).

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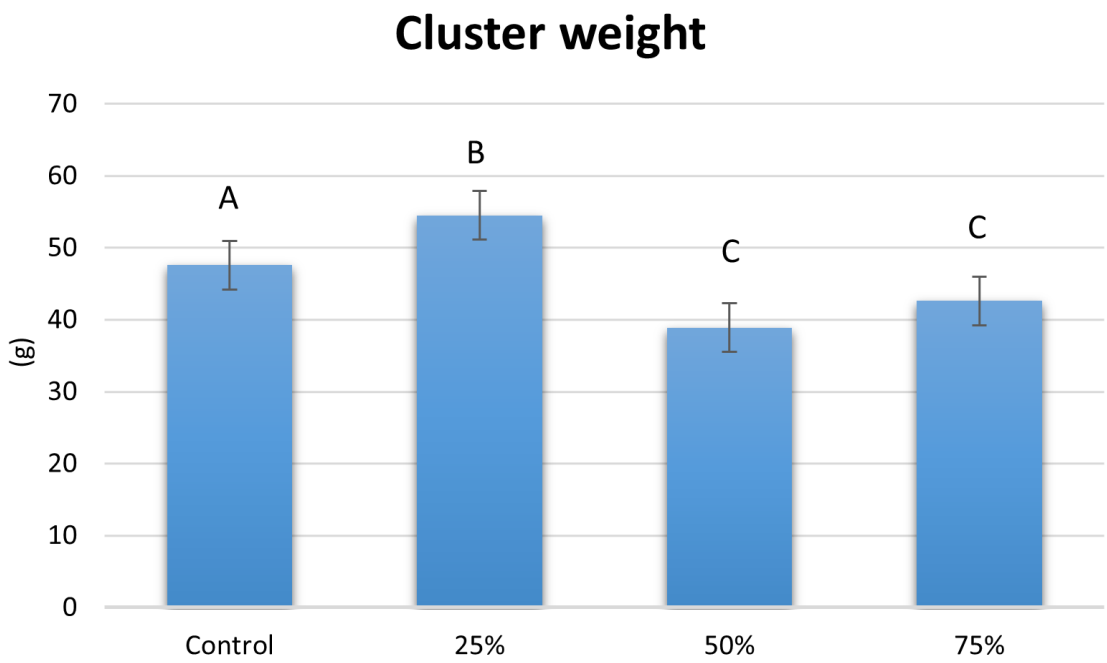

Figure 4. Effect of different bud load levels on the cluster weight (p < 0.05).

4. CONCLUSIONS

When it comes to the content values, while there were no significant differences between the treatments, the 25% load was the highest in terms of sugar and acid content. The 50% load gives the most must, which is almost 3 times that of the control. From the above, we can conclude that in the experiment, in the case of 'Italian Riesling', increasing the bud load has a positive impact on the must quantity and quality, and vegetative development is stimulated more in some treatments.

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