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## EFFECT OF THE GRAPE THINNING ON THE CONTENT OF TRANS-RESVERATROL IN SOME SYRAH CLONES

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### Abstract

Wine is a product obtained through fermentation process, the trans-resveratrol is a polyphenol derived from grapes and a natural antioxidant that passes into wine. The trans-resveratrol is a rare compound with the highest content in the red wine and a positive physiological effect on human organism. The present study was conducted in three years period from 2020 until 2022 at the Agricultural university-Plovdiv experimental vineyard, located near the village of Brestnik. Four Syrah wine variety clones were included and eight experimental wines have been made during the experimental period. In all tested wines, the presence of trans-resveratrol was detected but its amount was higher in clone 524 (V4) with non-reduced yield (3.35, 4.36, 7.02 mg/L), and in clone 100 (V5) with reduced yield (5.24, 3.75, 7.23 mg/L). Reducing the bunch numbers at the “pea size” stage did not significantly influence the content of trans-resveratrol. The wine antioxidant properties were directly affected by the clone and the grape harvest and was under the terroir influence. In today's conditions of overproduction and increased competition, the results of this study provide a valuable economic information and expand the portfolio of wineries.

**Keywords:** clones, Syrah, red wine, resveratrol, bunch thinning, canopy management

### INTRODUCTION

For centuries, the vine growers have continuously adapted, somewhat empirically, the local viticultural practices so they can suit best to the surrounding conditions (Jones, 2010). The soil-plant-atmosphere relationship determines the results in vineyard cultivation. In addition to climatic and biotic factors, the influence of pests and diseases also plays a role in the functional biodiversity of vineyards. The choice of graft and rootstock, pruning, topping, breaking or thinning, play a key role in the growth, development and quality of grapes (Winkler, 1974).

Globally, the branch selection is the most widely used method that expands the structure of grapevines within *Vitis vinifera* (Yoncheva & Nakov, 2020). This method aims to improve agrobiological, technological and

economic characteristics of plantations. The diversification of grapevine collections is achieved through a clone selection with high levels of realization of their potential, economic productivity and quality indicators for grapes and wine (Meneghetti et al., 2010).

The grape thinning is more often carried out in vineyards intended for production of premium wines (Silvestroni et al., 2016), since the overharvesting can be detrimental to ripening and therefore to the grape and wine quality (Bravdo et al., 1985). The timing varies from the pre-flowering period, but also from flowering to veraison and it often aims the presence of one bunch per shoot (Wolpert et al., 1983). Naor et al. (2002) suggested that the early thinning might increase the shoot growth due to the lack of competition among developing clusters. The bunch thinning negatively affects yield but during ripening

improves phenolic content, leading to changes in the volatile profile of wines (Condurso et al., 2016). The grapes obtained from plants where thinning has been applied enrich the wine with varietal aromas.

The phenolic compounds in grapes include anthocyanins, flavanols and tannins, which are considered as very important for human health. Numerous epidemiological studies have shown that the long-term moderate wine consumption is associated with a lower level of cardiovascular disease, cancer and suppress other diseases such as Alzheimer's disease. The concentration of these compounds in grapes depends on many factors, including variety, growing conditions, climate, harvest year and winemaking techniques (Gil, et al. 2017, Fernández-Marín et al., 2014).

A resveratrol is a dietary polyphenol derived from grapes, berries, peanuts and other plant sources that possesses a wide range of pharmacological properties, inhibiting the proliferation of different tumor cells. The increased interest on resveratrol emerged in the early 1990s, when it was first reported in red wine (Shukla & Singh, 2011).

At the present study was made a comparative assessment among the concentrations of trans-resveratrol in wine varieties obtained from several Syrah clones after applying the green pruning operation – bunch thinning in "pea size" phase.

## MATERIALS AND METHODS

The study was conducted in the period 2020-2022 with clones 100, 174, 470 and 524 of the French red wine variety Syrah, which are grown in the training and experimental vineyard of the Agrarian University-Plovdiv, located in the village of Brestnik.

The vineyard was in full fruition. The planting scheme was 3.0 m between the rows and 1.00 m between the vines in the row (333 vines/ha). The plants were trained on double-sided cordon with the corresponding trellis

structure. The applied pruning in all variants was done by leaving spurs with two buds, in total - 6 spurs (12 buds) per vine. The inter-rows were grass covered and the soil surface between the vines was kept clean by treating with herbicides.

The scheme of the experimental work included 8 options:

V1 - Syrah variety, clone 100 - non-reduced yield

V2 - Syrah variety, clone 174 - non-reduced yield

V3 - Syrah variety, clone 470 - non-reduced yield

V4 - Syrah variety, clone 524 - non-reduced yield

V5 - Syrah variety, clone 100 – reduced yield with 8 bunches per vine

V6 - Syrah variety, clone 174 - reduced yield with 8 bunches per vine

V7 - Syrah variety, clone 470 - reduced yield with 8 bunches per vine

V8 - Syrah variety, clone 524 - reduced yield with 8 bunches per vine

In each variant, 60 vines were included (4 repetitions x 15 vines).

The studied Syrah clones were distinguished by valuable economic and technological qualities (ENTAV-INRA-ENSA-M-ONIVINS, 1996).

The analyses for determining trans-resveratrol in the wine were carried out in an accredited testing laboratory at the "National Institute for the Study of Wine, Spirits and Essential Oils" EOOD - Sofia. The grape was extracted twice with methanol by the means of a high-pressure liquid chromatograph (HPLC). The internal laboratory method IL-11-B:2017 - modified according to Anli et al. (2006) was used.

## RESULTS AND DISCUSSION

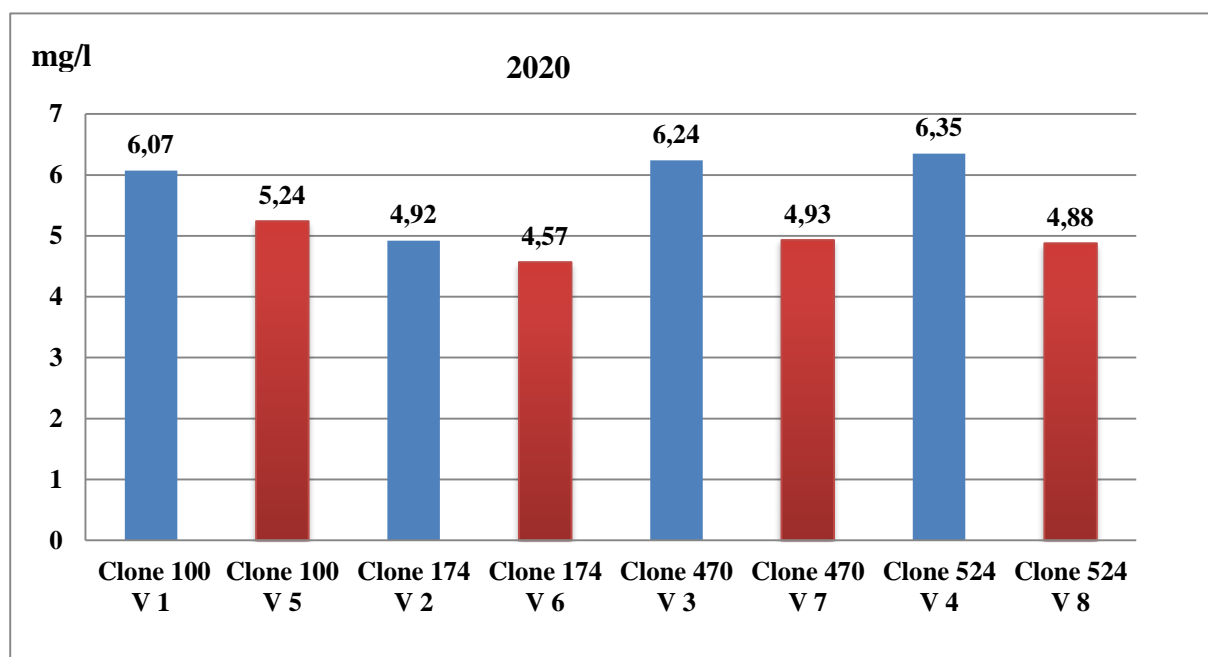
The trans-resveratrol is synthesized in the skins but not in the mesocarp of *Vitis vinifera* fruit. The richest sources are bark, seeds, stalks and wood. This is the reason why the red wine is richer in resveratrol compared to white wine, due to the solid parts which takes part in the fermentation process. The alcohol formation during grape fermentation facilitates solubility and extraction rates (Gambini et al., 2015). It is produced during times of stress caused by changes in environmental conditions, such as adverse weather or a damage caused by insects, animals or pathogens. The resveratrol (3,5,4-trihydroxystilbene) is a naturally occurring polyphenol with two isomers: trans and cis - resveratrol found in wine (Vian et al., 2005). A chronic ethanol ingestion causes oxidative damage to a number of organs, including brain, which is due in part to the ethanol's ability to enhance the production of free oxygen radicals and lipid peroxidation. An increase in oxidative stress is considered a major factor associated with a number of human health problems, including cardiovascular disease, aging, and many age-related

neurodegenerative diseases. In recent years, the understanding of the “French paradox” has stimulated a new research interest in polyphenolic antioxidants that may offer beneficial effects for human health (Sun et al., 2002).

During the study period, an average monthly air temperature of 14°C was measured, the active temperature sum was 2067°C, and the amount of precipitation was 633.40mm (Popova, 2023). The summer periods were characterized by prolonged droughts combined with low atmospheric humidity.

A higher concentration of resveratrol was found in the wine obtained from the vines with non-reduced yield (V1, V2, V3 and V4), compared to those with reduced yield (V5, V6, V7 and V8).

The analyses from 2020 year (Figure 1) showed that its content was highest in the wine of clone 524 - 6.35 mg/L (V4), and lowest in the clone 174 - 4.92 mg/L (V2). In the reduced variants, the values were lower, but with the highest indicators among them was the clone 100 - 5.24 mg/L (V5), while clone 174 has the lowest concentration - 4.57 mg/L (V6).

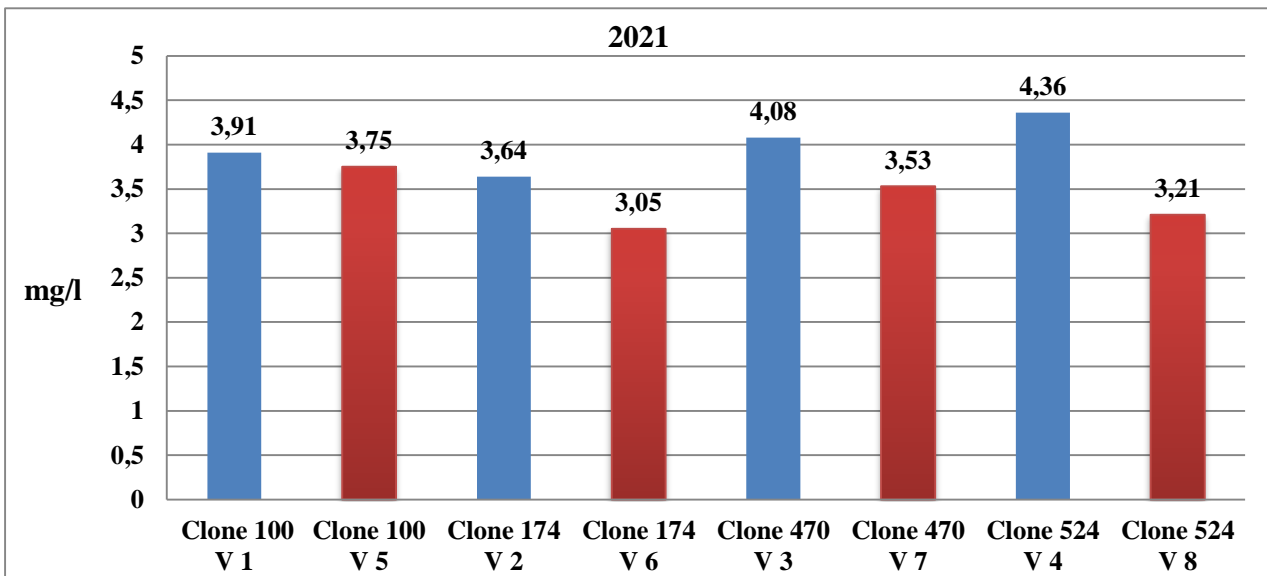


**Figure 1.** The content of trans-resveratrol in wines produced in 2020

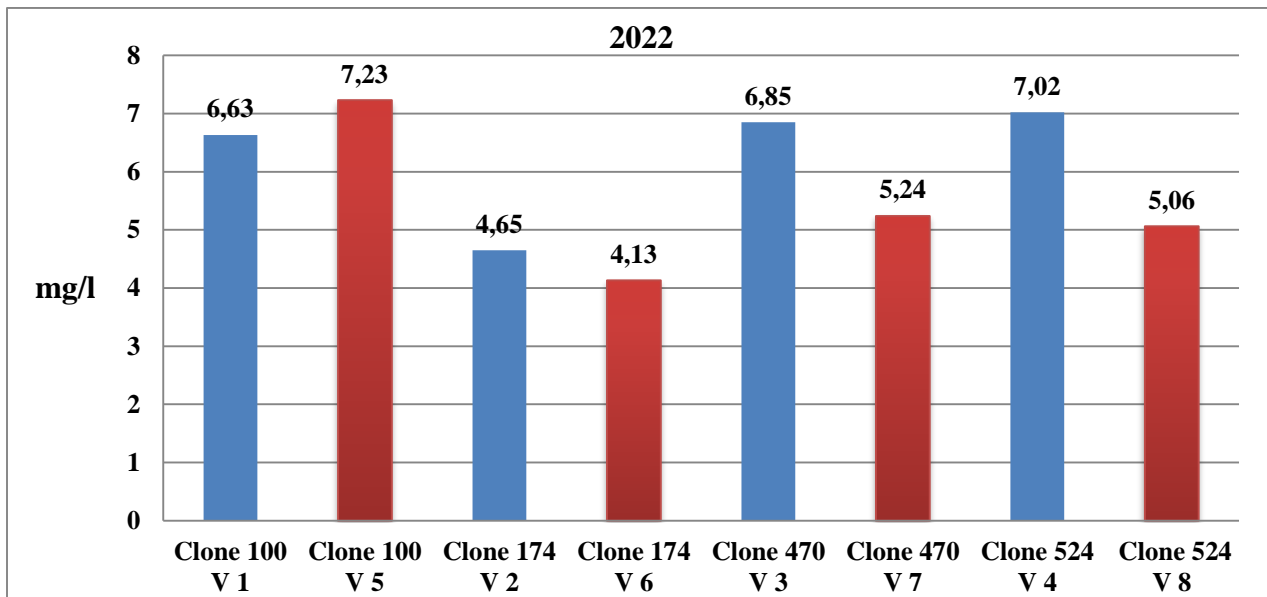
In the wine from the 2021 vintage (Figure 2), a similar trend was observed in the non-reduced variants, but the total concentration in the wine of all variants was lower compared to that measured in the previous year. The same chronological arrangement of the clones was also confirmed, with values ranging from 4.36mg/L (Clone 524 - V4) to 3.64 mg/L (Clone 174 - V2). Lower amounts of trans-resveratrol were again found in the reduced variants from 3.65 mg/L (Clone 100 - V5), to 3.05 mg/L (Clone 174 - V6).

The data from the third experimental year 2022 (Figure 3) were similar to those from the previous ones. The clones numbered 524 (V4) with non-reduced yield and the clone 100 (V5) with reduced yield, had the highest resveratrol concentration in the wine.

The grapes from clone 174 contained the least trans-resveratrol in the wine, both in the reduced yield variant (V2) and in the reduced yield variant (V6).



**Figure 2.** The content of trans-resveratrol in wines produced in 2021



**Figure 3.** The content of trans-resveratrol in wines produced in 2022

## CONCLUSION

The trans-resveratrol content in the wine depends to a greater extent on the terroir characteristics of the region and on the variety rather than on the application of the agrotechnical practice such as "bunch thinning" which is related to guiding the fruiting of the vine plant and regulating the grape quality. The highest content of trans-resveratrol was found in the wines obtained from clone 524 with non-reduced yield and clone 100 with reduced yield, which makes them suitable for use in the pharmaceutical industry for the production of drugs against cardiovascular, cancer, neurodegenerative and other diseases. The wines obtained from clone 174 with reduced and non-reduced yield had the lowest content of resveratrol.

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