Trakia Journal of Sciences, No 3, pp 226-230, 2025
Available online at:
https://trakia-uni.bg

ISSN 1313-3551 (online) doi:10.15547/tjs.2025.03.007

Original Contribution

INFLUENCE OF SOME SUMMER PRUNING ON THE DYNAMICS OF GROWTH OF SHOOTS IN THE VARIETY SHIROKA MELNISHKA LOZA

M. Mihaylov*

Faculty of Agronomy, University of Forestry, Sofia, Bulgaria

ABSTRACT

The present study aim is to evaluate the influence of different summer (green) prunings on the shoot growth dynamics of the Shiroka melnishka loza variety grown under non-irrigated conditions.

Four variants were tested – control (V_0), thinning (V_1), thinning and secondary shoot removal (V_2), and combined summer pruning – thinning, secondary shoot removal and bunch removal (V_3). Observations were conducted in 2023–2024 in the area of the village of Harsovo through monthly measurements of shoot length and correlation analysis with temperature and precipitation.

The results show that variant V_3 leads to the most significant shoot growth, with the average length at the end of the vegetation reaching 209.3 cm in 2024. There is a strong positive correlation between temperature and growth in all variants ($R > 0.90$), with the highest being in V_3. Whereas, precipitation has a lesser effect, especially in vines with reduced yield.

The conclusion confirms that the application of combined summer pruning is an effective strategy for stimulating vegetative growth under limited water resources and elevated temperature.

Keywords: summer pruning, canopy management, shoot dynamics, Shiroka melnishka loza

INTRODUCTION

The vegetative growth of grapevine (*Vitis vinifera L.*) is directly dependent on climatic conditions, agronomic practices and variety specificity. Some of the major agronomic practices are summer pruning – including thinning, secondary shoot removal and bunch removal, which affect photosynthetic activity, the microenvironment in the bunch area, grape load and shoot length (1-4). The effect of summer pruning is particularly important in the context of a changing climate, when temperature increases and droughts are observed more frequently (5, 6).

Studies have shown that summer pruning improves the leaf/yield ratio and leads to a redistribution of assimilates to reproductive and vegetative organs, depending on the developmental phase and the degree of stress (7, 8). The application of summer pruning also affects photosynthesis and nutrient use efficiency (9, 10), as well as future bud set (11). The influence of summer operations on the accumulation of phenolic compounds in grapes has also been confirmed (12).

Despite numerous studies in an international context, the impact of different summer pruning methods on the vegetative growth of Bulgarian wine varieties is still poorly studied (13-15). This is particularly true for the variety Shiroka melnishka loza, which is characterized by good adaptability to the agro-ecological conditions of the Struma Valley, but at the same time is sensitive to water deficit during the summer months. This requires optimization of pruning practices in order to increase the physiological resistance and yield potential of the vines.

The aim of this study is to investigate the influence of summer pruning on the dynamics of growth and development of the Shiroka Melnishka vine variety under non-irrigated conditions in the area of the village of Harsovo, Blagoevgrad district. The main hypothesis is that the application of combined summer

***Correspondence to**: *Marko Mihaylov, University of Forestry - Sofia, Faculty of Agronomy, 10 Kliment Ohridsky Blvd,1797 Sofia, Bulgaria, E-mail: marko.mihaylovltu@gmail.com*

pruning (thinning, secondary shoot removal and bunch removal) increases shoot growth by reducing internal competition and improves nutrient distribution, even under limited water availability (16, 17).

MATERIAL AND METHODS

The study was conducted in 2023 and 2024 in a vineyard located in the area of the village of Harsovo, on the variety Shiroka melnishka loza, grafted on the rootstock 110 Richter. The vines were grown on the Goblet training system under non-irrigated conditions. The planting distances were 2.40 × 1.50 m. The vines were loaded with 4 spurs.

The experiment was set up in four variants with three replications. Each variant included 20 vines, subjected to different methods of green pruning, as follows:
V_0 – control variant, without summer pruning;
V_1 – thinning on the stems, arms and spurs;
V_2 – thinning and secondary shoot removal;
V_3 – thinning, secondary shoot removal and bunch thinning in phase pea size berry – 8 bunches are left per vine.

Observations were conducted monthly from May to August, measuring the length of the shoots (in cm) using a tape measure. Growth dynamics are presented as mean values ($\bar{X}$) and standard deviation (SD). Meteorological data (average monthly temperature and precipitation) were obtained from an agrometeorological station located in the plantation.

Correlation analysis was used to determine the influence of temperature and rainfalls on shoot growth dynamics.

RESULTS AND DISCUSSION

Table 1 presents average monthly temperatures in the area of the village of Harsovo for 2023 and 2024. The data cover the period from January to December, with the main interest for the study being the months of May, June, July and August, when summer pruning takes place and intensive shoot growth is observed.

Table 1. *Average monthly air temperature (°C) in Hursovo village for the period 2023-2024*

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.
2023	6.6	8.5	11.4	16.6	18.4	26.7	29.1	27.8	21.6	16.3	8.4	6.0
2024	6.8	8.7	10.6	17.0	18.6	26.8	29.3	28.2	22.2	15.4	7.6	5.9

Similar temperature dynamics are observed during the two analyzed seasons, with a slight increase in 2024. During the summer months, temperatures exceed 26–29°C, with 2024 being slightly warmer in each of the three months, especially in August (+0.4°C). This favours the accumulation of vegetative mass, but may also increase the risk of drought.

Temperatures above 25°C are optimal for rapid vegetative growth in the vine. Such values are observed in July and August in both years. The small increase in temperatures in 2024 coincides with higher average values for shoot length, especially in the variants with combined summer pruning (V_2 and V_3). The warm weather in August (above 28°C) contributes to extending the growing season and reaching maximum shoot lengths.

Table 2 provides data on monthly precipitation amounts in mm for each calendar year – 2023 and 2024. The analysis focuses on the months of May, June, July and August, which are critical for shoot growth and the effectiveness of summer pruning. Significantly wetter in 2024 (+20.1 mm), which favored the initial growth of shoots. Conversely, in 2024, a significant decrease in precipitation was observed (–23 mm). However, shoot length continued to grow intensively, probably due to accumulated moisture from May and the resistance of the variety.

Table 2. *Amount of rainfalls (mm) in Hursovo village for the period 2023-2024*

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	July	Aug.	Sept.	Oct.	Nov.	Dec.
2023	85.1	13.9	47.4	90.6	60.3	48.8	12.3	14.4	6.0	20.6	98.4	45.8
2024	94.5	28.9	28.8	32.5	80.4	25.8	10.5	12.2	17.8	13.8	85.4	68.4

In both years, July and August were characterized by extremely low rainfall – below 15 mm/month. This created conditions for soil water deficit, a particularly important factor during the period of shoot growth and bunch formation and growth. In these conditions, summer pruning (especially bunch thinning – V_3) probably helped to reduce competition for water.

Precipitation in May has a significant impact on the start of shoot growth. Higher values in 2024 correlate with higher initial growth values in all variants **(Table 3).**

Despite lower precipitation in June–August 2024, shoot lengths remain higher compared to 2023, especially in V_2 and V_3, which indicates good adaptation capabilities of the vines and effective implementation of summer pruning.

Correlation analysis shows how average monthly temperature and precipitation affect shoot length during the growing season **(Table 3).** All variants show a very strong linear positive relationship between temperature and shoot growth.

Table 3. *Correlation between temperature and precipitation on shoot length for the period 2023-2024 during the months of May-August*

Variant	Correlation (R) between temperature and shoot length	Correlation (R) between rainfall and shoot length
V_0	0.8977241864968497	-0.9225099324683142
V_1	0.9131590496216472	-0.9420754650486017
V_2	0.9086223353137121	-0.9310477688034244
V_3	0.9071687661284475	-0.9279016049501333

The length of the shoots in variant V_0 increases linearly with increasing temperature. Since there is no summer pruning here, the response is entirely determined by climatic conditions.

With each additional pruning operation (thinning and secondary shoot removal), the vine becomes more sensitive to positive temperature changes – the correlation increases. This shows that the plant can use thermal energy more efficiently when competition between shoots is reduced.

The strongest relationship between temperature and growth is observed in variant V_3. When removing part of the bunches, nutrients are redirected to the vegetative mass, which makes maximum use of thermal conditions. This is especially pronounced in warm years (e.g. 2024).

The highest correlation between precipitation and growth was recorded in variant V_0. The application of summer pruning in variants V_1 and V_2 reduces the dependence on precipitation. During thinning and secondary shoot removal, the vines direct more resources to the shoots left after pruning, thus partially compensating for the water deficit. In variant V_3, the weakest correlation is observed - vines with reduced yield and smaller vegetative mass optimize their water consumption, and growth is maintained even with low precipitation (especially in July and August). This guarantees good adaptability of the vines to drought.

The high amount of precipitation coincides with accelerated growth in all variants. The development of shoots strongly depends on moisture.

Despite the decrease in precipitation during the period June-August, growth remains high in V_2 and V_3.

Table 4 presents the average values (± standard deviation) for the shoot length of the Shiroka melnishka loza variety, measured during the months of May, June, July and August.

In each month, a clear increase in shoot length is recorded with the application of summer pruning, with variant V_3 showing the highest values. From May to August, V_0 increases by 132.3 cm, while V_3 – by about 159.6 cm. The difference between V_0 and V_3 reaches 50.8 cm in August, which proves the effect of combined summer pruning on growth stimulation. Shoot development in May is more intense, especially for V_3 (+103.8 cm) compared to the control. In all variants, greater growth is observed in 2024, especially pronounced in V_2 and V_3. This can be explained by the higher amount of precipitation in May (80.4 mm in 2024 vs 60.3 mm in 2023) and slightly higher temperatures in June–August.

Table 4. *Shoot growth dynamics in cm during the period 2023-2024, (Xcp±SD)*

Year	Month	Variant			
		V_0	V_1	V_2	V_3
2023	May	70.9±4.078	79.8±3.866	84.2±4.759	87.2±5.650
	June	121.1±3.290	134.2±3.843	142.0±4.845	154.7±5.444
	July	148.3±4.964	153.4±4.238	159.9±4.932	178.2±5.866
	August	183.4±5.753	184.4±3.879	187.4±5.005	192.7±4.436
2024	May	74.2±3.995	82.9±4.824	87.3±4.302	94.0±4.933
	June	129.8±5.090	139.8±5.903	155.4±4.963	163.1±3.993
	July	154.5±4.841	167.3±3.808	174.9±5.334	185.5±5.073
	August	189.0±4.465	190.6±5.655	196.4±4.382	209.3±4.888

CONCLUSION

The application of summer pruning has a significant impact on the growth dynamics of shoots in the variety Shiroka melnishka loza. The greatest elongation of shoots was recorded in variant V_3, which proves the effectiveness of combined summer pruning in stimulating vegetative growth.

A very strong positive correlation between temperature and shoot length ($R > 0.90$) was found for all variants. This indicates that elevated temperatures during the active growing season (May–August) favor shoot elongation, especially when summer pruning is applied.

The correlation between rainfall and shoot length is weaker and decreases with increasing summer pruning intensity. The strongest dependence on rainfall is observed in the control (V_0), while in V_3 the vines show better adaptation to water deficit.

In 2024, more intensive shoot growth is reported in all variants compared to 2023, which coincides with the higher amount of precipitation in May and slightly higher temperatures in the summer months. This emphasizes the importance of spring moisture for the beginning of the vegetation.

The results obtained support the hypothesis that the appropriate combination of summer operations can compensate for adverse climatic conditions, improve the allocation of physiological resources and increase the physiological resistance of vines when grown without irrigation.

REFERENCES

1. Intrieri, C., and Filippetti, I., Shoot positioning effects on the grapevine canopy microclimate and vegetative growth. *Acta Horticulturae*, 512:59–69, 2000.
2. Smart, R., and Robinson, M., Sunlight into Wine: A Handbook for Winegrape Canopy Management. Winetitles, USA, 1991.
3. Palliotti, A., Gardi, T., Berrios, J. G., Civardi, S., and Poni, S., Early leaf removal to improve vineyard efficiency: Gas exchange, source–sink balance, and canopy structure. *American Journal of Enology and Viticulture*, 65:462–471, 2014.
4. Gatti, M., Garavani, A., Cantatore, A., Parisi, M. G., and Poni, S., Management of vine vigor through summer pruning techniques: effects on growth, yield and grape composition. *American Journal of Enology and Viticulture*, 63:325–332, 2012.
5. Risco, D., Pérez, D., Yeves, A., and Lissarrague, J. R., Effect of green pruning techniques on the vegetative and reproductive balance of Vitis vinifera L. cv. Tempranillo in warm areas. *South African Journal of Enology and Viticulture*, 35:171–181, 2014.
6. Kliewer, W. M., and Dokoozlian, N. K., Leaf area/crop weight ratios of grapevines: influence on fruit composition and wine quality. *American Journal of Enology and Viticulture*, 56:170–181, 2005.
7. Keller, M., The Science of Grapevines: Anatomy and Physiology. Academic Press, USA, 2020.
8. Candolfi-Vasconcelos, M. C. and Koblet, W., Influence of partial defoliation on gas exchange parameters and chlorophyll content of field-grown grapevines. *Photosynthetica*, 25:111–120, 1991.
9. Poni, S., Casalini, L., Bernizzoni, F., Civardi, S., and Intrieri, C., Effects of early defoliation on shoot photosynthesis, yield components, and grape composition. *American Journal of Enology and Viticulture*, 57:397–407, 2006.
10. Main, G. L., and Morris, J. R., Impact of canopy management practices on yield and fruit composition of 'Cynthiana'grapes. *HortTechnology*, 14:565–570, 2004.

11. Emurlova, F., and Ivanov, A., Effect of green pruning on the fruitfulness of winter buds, quantity and quality of yield in Cabernet Franc cultivar. *Agricultural Science and Technology,* 15:61–67, 2023.
12. Emurlova, F., and Yoncheva, T., Impact of summer green pruning on the phenolic content of grapes from Cabernet Franc cultivar. *Bulgarian Journal of Agricultural Science,* 29:703–708, 2023.
13. Popova, A., and Angelov, L., Effect of bunch thinning on the grapes quality in clones 174 and 470 from Syrah variety. Scientific Papers. *Series B, Horticulture*, 68:353–358, 2024.
14. Yanakieva, I., Topalov, T., and Terziev, V., Phenological development and technological characteristics of grapevine varieties grown in South Bulgaria. *Journal of Mountain Agriculture on the Balkans*, 24:213–221, 2021.
15. Lichev, V., Ivanova, A., and Penchev, E., Viticultural and oenological characteristics of Mavrud clone selection in South Bulgaria. *Bulgarian Journal of Agricultural Science*, 21:1232–1238, 2015.
16. Stalev, B., Angelov, L., and Bambalov, V., Influence of grape thinning on the wine quality from Muscat Otonel grape variety grown in the village of Grozden. *Management and Sustainable Development*, 3:100–110, 2023.
17. Reynolds, A. G., and Vanden Heuvel, J. E., Influence of grapevine training systems on vine growth and fruit composition: A review. *American Journal of Enology and Viticulture,* 60: 251–268, 2009.