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CHARACTERISTICS OF FUNGUS-TOLERANT GRAPEVINE CULTIVAR 'MORAVA' GROWN UNDER ORGANIC AND CONVENTIONAL MANAGEMENT

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SUMMARY

The Serbian fungus-tolerant grapevine cultivar 'Morava' has been recognized by both wine producers and consumers, resulting in increased areas devoted to the cultivar. 'Morava' ('SK 77-7/4' x 'Bianca', released in Sremski Karlovci) is a popular cultivar for white wines, particularly in the central part of Serbia, because of the interesting aroma profile of its wine. The objective of this research was to investigate the yield, grape quality and wine sensory characteristics of the 'Morava' grapevine cultivar grown under organic and conventional management. The experiment was conducted at an experimental field for viticulture in Sremski Karlovci (Faculty of Agriculture, University of Novi Sad) during the period 2015-2018. The grape yields produced under organic management were found lower than those under conventional management. The chemical composition of organic grapes was on par with that of conventional grapes, whereas the wine sensory characteristics of organic grapes were scored higher than those of conventional grapes.

Key words: organic viticulture, 'Morava', yield, grape quality

INTRODUCTION

Intensive conventional agriculture has more than doubled the overall agricultural yields in the last century. However, organic agriculture promotes biodiversity (Ljevnaić-Mašić et al., 2014) and reduces the inputs of synthetic pesticides and mineral fertilizers.

Experiments comparing organic and conventional management have been conducted in different types of crop production such as fruits (Ekinci et al., 2020), grapes (Döring et al., 2015), vegetables (Mitchell et al., 2007), and other crops (Džigurski et al., 2015).

Döring et al. (2015) observed superior grape quality in organic production compared to that achieved under conventional management. Organically produced tomatoes also exhibited higher fruit quality values and concentration of flavonoids compared to conventionally produced tomatoes (Mitchell et al., 2007).

Grapevine cultivars grown all over the world ('Chardonnay', 'Merlot' and others) are sensitive to main fungal diseases. Therefore, organic production of these cultivars is very risky, which can lead to significant reductions in grape yield and quality.

Grapevine breeding programs have been conducted in a number of countries with the aim of improving the tolerance of grape cultivars to main fungal pathogens (*Botrytis* sp., *Oidium tuckeri*, *Plasmopara viticola*). Therefore, several grapevine cultivars suitable for organic production have been created as a result of the breeding programs carried out in Sremski Karlovci (Serbia). The fungus-tolerant cultivar 'Morava' has already found its place in the Serbian vineyards due to its high grape quality.

The objective of the present study was to investigate the effects of organic and conventional production systems on the yield, grape chemical composition and wine sensory properties of grapevine cultivar ‘Morava’ in the period 2015-2018.

MATERIAL AND METHODS

The experiment was conducted at the experimental field for viticulture of the Faculty of Agriculture, the University of Novi Sad, in Sremski Karlovci (45°10' N, 20°10' E). The ‘Morava’ cultivar was grown under organic and conventional management during the period 2015-2018. ‘Morava’ (‘SK 77-7/4’ x ‘Bianca’, released in Sremski Karlovci) is a popular cultivar for white wines, particularly in the central part of Serbia, because of the interesting aroma profile of its wine. ‘Morava’ is tolerant to main fungal pathogens such as *Botrytis* sp. and *Plasmopara viticola*, and moderately tolerant to *Oidium tuckeri*.

The vineyard was planted in 2000, with a 2.8 m spacing between rows and a 1.6 m separation between pair of vines in a row. The vines were *Karlovac* pruned (modified *Guyot*) with 14 buds per vine. A total of 24 vines were included in each treatment (production), with 8 vines per replicate. Grape yields (kg/m²) were determined at harvest by weighing all the grapes of each replicate. The average cluster weight (g) was obtained by weighing ten clusters per replicate. Sugar (%) in the grape juice was measured using the *Oelche* hydrometer. Titratable acidity (g/l) of the grape juice was analyzed by adding 10 % NaOH drop-by-drop until the acids were neutralized. *Botrytis* sp. incidence was detected as a percentage by visual assessment of the cluster health status (% of clusters infected) at harvest.

The grapes harvested were crushed and destemmed immediately after harvest. The liquid phase was separated and 10 mg l⁻¹ SO₂ was added. Subsequently, the liquid phase was left for 24 h and then racked before being inoculated with *Saccharomyces cerevisiae* (Uvaferm BDX). Fermentation was conducted in 5 l glass balloons. Upon fermentation, the wines were racked in the bottles.

A wine sensory analysis was conducted five months after the end of vinification by five trained academic staff members of the Institute of Food Technology and the Faculty of Agriculture in Novi Sad. A 0–20 scale was used to score the samples, assessing their appearance (maximum 2 points), color (2), aroma and bouquet (4), and other characteristics such as sugar, acidity and astringency (maximum 12 points). All the samples were presented to each assessor at the same time.

A two-factor analysis of variance (ANOVA) was performed to determine the effects of organic and conventional production systems and weather conditions in the years considered on the yield and quality of grapes. The Duncan’s test was used to estimate the difference ($p < 0.05$) between the mean values of the parameters measured. Figure 1 was prepared using the *R* software and the *ggplot2* package.

RESULTS AND DISCUSSION

The weather conditions varied in the seasons considered (Fig. 1). During ripening, i.e. the period from veraison to harvest (which usually occurs in August and September), high temperatures were observed in 2015.

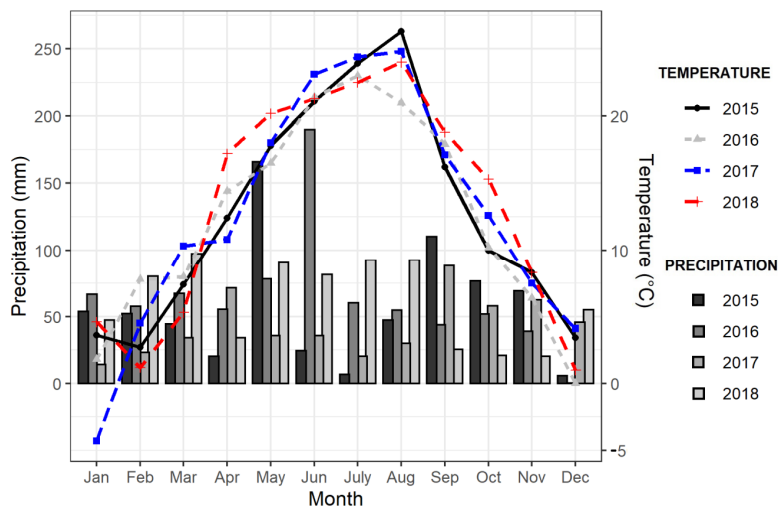


Figure 1. Average monthly weather conditions (January 2015 - December 2018)

The lowest average temperature in August during the experiment was observed in 2016. High temperatures recorded in April and May 2018 prompted the onset of flowering earlier in the season. The cumulative precipitation recorded in May and June was the highest in 2016, which could increase the incidence of *Botrytis cinerea*. On average, the onset of main phenological stages, i.e. budburst, flowering and veraison, occurred on 6th April, 19th May and 25th July, respectively. Grapes were harvested each year on 20th September in the period 2015-2018.

The grape yields obtained varied according to the years and production systems considered (Tab. 1). In 2015 and 2016, the yields of conventional grapes were significantly higher than those of organic grapes, whereas no differences were observed in 2017 and 2018.

Table 1. Yield and grape quality of 'Morava' in organic and conventional production systems (2015-2018)

Year	Type of production	Yield (kg/m ²)	Cluster weight (g)	Sugar (%)	Titrateable acidity (g/l)	<i>Botrytis</i> sp. incidence (%)
2015	Organic	0.97	157	20.13	5.97	0.33
	Conventional	1.49	267	18.87	8.07	3
2016	Organic	1.41	157	20.92	9.10	1
	Conventional	2.57	240	20.54	9.67	4.33
2017	Organic	0.96	187	21.12	4.73	0.00
	Conventional	1.05	210	22.75	4.60	0.00
2018	Organic	1.08	167	19.41	7.27	0.00
	Conventional	0.90	210	20.39	7.03	0.00
2015-2018	Organic	1.11 B	167 B	20.42 A	6.77 B	0.33 B
	Conventional	1.50 A	232 A	20.54 A	7.34 A	1.83 A
Statistical significance						
Year		*	ns	*	*	*
Type of production		*	*	ns	*	*
Year x Type of production		*	ns	*	*	*
Legend: * indicates significant at $p < 0.05$, whereas ns indicates non-significant						

The cluster weight of 'Morava' was 28% greater under conventional management than that grown in the organic production system. Variations in grape cluster weight were not-significant between the years considered. The lower yields of organic grapes could be associated with the lower cluster weight under organic management, which is consistent with Corvers et al. (1994). Moreover, Merot & Smits (2020) found a lower number of flowers per cluster in the vineyard converting to organic production than in its conventional counterpart.

The must sugar content was not affected by the production system. These results are congruent with Döring et al. (2015) and Tassoni et al. (2013), who did not observe any difference in sugar contents of grape juice obtained in organic and integrated grape production.

On average, the titrateable acidity of the must was significantly lower in organic grapes than in conventional grapes. However, Döring et al. (2015) found no difference in titrateable acidity between the organic and conventional grape production systems.

A lower incidence of *Botrytis* sp. was observed in the organic grape production than under conventional management. Lower growth (Döring et al., 2015) and cluster compactness in organic production (Merot & Smits, 2020) could result in better aeration. Improved aeration around clusters may prevent the *Botrytis* sp. incidence as it was the case after leaf removal in the vineyard of 'Probus' (Ivanišević et al., 2020). The highest incidence of *Botrytis* sp. was in 2016, whereas no incidence was observed in 2017 and 2018.

All the wines produced achieved high scores (≥ 18), with the exception of those made from the 2015 vintage and the 2016 conventional vintage (Tab. 2). The wine made from the 2017 organic vintage achieved the highest scores.

Table 2. Total 'Morava' wine scores in organic and conventional production systems (2015-2018)

Production	Year	Color	Clarity	Aroma	Taste	Total
Organic	2015	2.0	2.0	3.3	10.5	17.8
Conventional	2015	2.0	2.0	3.3	10.2	17.5
Organic	2016	2.0	2.0	3.4	10.6	18.0
Conventional	2016	2.0	2.0	3.4	10.5	17.9
Organic	2017	2.0	2.0	3.6	11.2	18.8
Conventional	2017	2.0	2.0	3.5	11.0	18.5
Organic	2018	2.0	2.0	3.5	10.9	18.4
Conventional	2018	2.0	2.0	3.5	10.8	18.3

All the wines produced achieved maximum scores for the color and clarity. The taste of organic wines was more appreciated by the wine sensory panelists than the taste of conventional wines. This finding is consistent with the results of Beni & Rossi (2009), who stated that organic wines achieved higher scores than conventional wines. Further experiments should investigate the wine chemical composition of 'Morava'.

CONCLUSION

The fungus-tolerant grapevine cultivar 'Morava' yielded high grape quality in both organic and conventional production. The organic 'Morava' wine achieved higher scores in a wine sensory analysis than the conventional 'Morava' wine. Therefore, 'Morava' is a grapevine cultivar suitable for the organic grape production in Serbia.

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Conflict of interest: The authors declare that they have no conflict of interest.

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