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Cold Maceration and the Quality of Žilavka Wine

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Abstract

Controlling skin contact conditions is vital to obtain high quality white wines and it has become a standard procedure in many white wine-production areas. The aim of this work was to investigate the changes in composition and sensory properties of Žilavka wines obtained with different cold skin contact time. Results indicate that cold maceration positively influence the quality of Žilavka wines. The results pointed out significant increase in dry extract, ash, total phenol and decrease in tartaric acid content in Žilavka wines obtained by 10 or 20 hours cold maceration period. Best organoleptic quality of Žilavka wines was obtained by cold maceration at 10 ˚C during 20 hours period.

Key words: cold maceration, Žilavka, sensory properties

Utjecaj hladne maceracije na kvalitetu vina Žilavka

Sažetak

Postupak kontrolirane maceracije grožđa uvelike može utjecati na poboljšanje kvalitete bijelog vina te je u nekim zemljama postao standardni tehnološki postupak u procesu proizvodnje. Cilj ovoga rada bio je istražiti utjecaj različite duljine maceracije na kemijski sastav i senzorna svojstva vina Žilavka. Rezultati ukazuju da je hladna maceracija pozitivno utjecala na kvalitetu vina Žilavka. Kod vina dobivenih hladnom maceracijom utvrđeno je signifikantno povećanje sadržaja suhog ekstrakta, pepela i ukupnih fenola te smanjenje vinske kiseline u odnosu na kontrolu. Najbolju senzornu ocjenu je dobilo vino Žilavka dobiveno hladnom maceracijom na 10 °C u duljini od 20 sati.

Ključne riječi: hladna maceracija, Žilavka, senzorna svojstva

Introduction

Skin contact can be defined as a prefermentative process applied to wine elaboration: the skin of crushed and destemmed white grapes are macerated in their own juice at controlled conditions (time and temperature). Controlling skin contact conditions is vital to obtain high quality white wines (Darias-Martin et al., 2004). In this sense, maceration has been widely investigated and it has even become a standard procedure in many white wine-production areas (Ramey et al., 1986). In practice, the most frequently applied are "classic" (skin contact at 20 – 25 °C) and cold (skin contact at 5 – 10 °C) maceration treatments (Jackson, 2000; Ribéreau-Gayon, 2000). Classic maceration can increase extraction of phenolic compounds connected with increase wine astringency and bitterness (Singleton et al., 1980; Ramey et al., 1986). On the contrary, cold maceration leads to increased extraction of aromatic compounds from berry skin cells while undesirable additional extraction of phenolic fraction is reduced to the highest possible degree (De Rosa, 1999; Gerbi et al., 1991).

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The low maceration temperature inhibit the activity of oxidative enzymes, what is of crucial importance since cold maceration treatment can be performed without the addition of sulphur dioxide which increases solubility, and as a consequence, extraction of undesirable phenols from the berry (Singleton et al., 1980; Gerbi et al., 1991). In white wine studies, increased pH, color and phenolic compounds and decreased titrable acidity were reported to result from longer skin contact times (Ough, 1969, Ough and Berg, 1971). In several reports quality was inferior in wines of pomace contact longer than 12 hours (Ough, 1969, Ough and Berg, 1971). Singleton and co-workers (1980) concluded that fruitiness and general quality were generally harmed by appreciable skin contact. Arnold and Noble (1979) found that the skin maceration of Chardonnay significantly improves aroma quality and wine structure without increasing bitterness and astringency. On the contrary, Test et al. (1986) found no significant increase in fruity aroma of Chardonnay wine due to the skin contact. The aim of this work was to investigate the changes in wine composition and sensory properties of Žilavka wine obtained with different cold skin contact time.

Material and methods

Žilavka white wine grapes from the wine region of Herzegovina, vineyard Blizanci, were harvested during 2006 season, destemmed and crushed. Must obtained by separation of liquid fraction from solid cluster parts right after grape crashing (without maceration) was used as a first, control treatment. Second treatment was cold maceration at 10 °C in duration of 10 hours while third treatment was cold maceration at 10 °C in duration of 20 hours. Each of mentioned treatments was performed in 3 repetitions. Must from control treatment was treated with 80 mg/L SO_2 and sedimented for 24 hours at 12°C. Grape mashes cold maceration treatments were treated with 80 mg/L SO_2 after the maceration process finished (right before pressing). Alcoholic fermentation of all treatments was performed in controlled temperature conditions of 18°C with the addition of selected wine yeast Uvaferm CEG. Two rackings were carried out to clarify the wines before bottling. The samples of all treatments were chemically analysed just after second racking and two months afterwards tested by sensorial evaluation. The common analyses of basic wine components were analyzed by O.I.V. methods (1990). Total phenols were determined spectrophotometrically with Folin – Ciocalteu reagent (Folin and Denis, 1912.) following the method of Slinkard and Singleton (1977) using UV/VIS spectrophotometer at wavelength of 280 nm. Organic acids were determined by HPLC method (Zotou et al. 2004). The wines were subjected to sensory evaluation by the 100-point O.I.V. / U.I.O.E method, and by ranking method with a panel of 7 judges. The determination of statistical significance was done according to Amerine and Roessler 1976. One-way analysis of variance and Least Significant Difference (LSD) comparison test were used to statistically interpret mean differences in mean values if any, at 95 % and 99% accuracy level.

Results and discussion

Results in Table 1,2 confirm previous study by Herjavec et al. (2002) that skin maceration resulted in a decrease of total acidity and an increase in pH values in both musts and wines.

According to Ribéreau-Gayon et al. (2000) and numerous other authors these changes are linked to the liberation of potassium from the skins and the resulting partial salification of tartaric acid what is also confirmed in our study where only tartaric acid concentration in the both cold maceration treatments was significantly lower compared to the control treatment. The majority of phenolic compounds in wine originates from the grapes (mostly from seed, skin and stems, while less from juice), and only a small part is produced as a yeasts metabolism product (volatile phenols). Consequently, maceration duration and temperature can significantly influence the final total phenol concentration in obtained wines (Radeka, 2005). Results presented in Table 2. show that control treatment wines have the lowest total phenol concentrations and, moreover, that concentration in wines obtained by cold maceration is increasing proportionally to maceration time what is in accordance to literature data (Gerbi, 1991; Jackson, 2000). Significant increase in dry extract and ash concentrations in both cold maceration treatment wines was noted compared to control wine. Between cold maceration treatment longer skin contact time significantly influenced the dry extract and total phenol concentrations (table 2).

Sensory evaluation by the ranking method and the 100 point method shown, that significantly the best general quality had the wines obtained by cold maceration at 10 °C during 20 hours time period. These wines were characterised by the more pronounced varietal flavours (odor quality), and intensity and complexity of

the taste. This is probably conected with increase mouthfeel/palate fullness likely due to increased phenol and polysacharrides concentrations (Watson et al., 1994). However, it is important to notice that cold maceration during 10 hours time period didn´t have much effect on Žilavka wines what is shown in Tables 4,5,6.

Table 1. Chemical composition of Žilavka must

	Control treatment	Cold maceration 10 °C/10 hours	Cold maceration 10 °C/20 hours
Sugar (g/l)	218	215	215
Total acidity (g/l)*	6,5	6,2	6,2
pH	3,1	3,2	3,2

*as tartaric acid

Table 2. Mean values of basic chemical composition and total phenols concentrations of Žilavka wines

Compounds	Control treatment	Cold maceration 10 °C/10 hours	Cold maceration 10 °C/20 hours	LSD
Alcohol (vol%)	13,2	13,1	13,1	n.s.
Residual sugar (g/l)	1,4	2,0	2,0	n.s.
Dry extract (g/l)	17,6^{Aa}	19,8^{Bb}	20,4^{Cc}	5%=0,11 1%=0,16
Total acidity (g/l)*	5,7 ^{Aa}	5,5 ^{Bb}	5,5 ^{Bb}	5%=0.08 1%=0,12
Tartaric acid (g/l)	2,2 ^{Aa}	1,7 ^{Bb}	1.6 ^{Bb}	5%=0,22 1%=0,41
Malic acid (g/l)	2,5	2,4	2,4	n.s.
Citric acid (g/l)	0,27	0,30	0,30	n.s.
Lactic acid (g/l)	0,1	0,1	0,1	n.s.
Succinic acid (g/l)	0,5	0,5	0,5	n.s.
Volatile acidity (g/l)**	0,36	0,40	0.39	n.s.
pH	3,2	3,3	3,3	n.s.
Ash (g/l)	1,9 ^{Aa}	2,1 ^{Bb}	2,2 ^{Cb}	5%=0,09 1%=0,13
Total phenols (mg/l)	289,14 ^{Aa}	316,13 ^{Bb}	365,11 ^{Cc}	5%=17,32 1%=24,29

Note: Different letters beside the mean of a compound denote a significant difference among treatments (A, B, C for 5 %; a, b, c for 1 %), n.s.: not significant *as tartaric acid **as acetic acid

Conclusion

Results of this study indicate that cold maceration positively influence the quality of Žilavka wines and confirmed the compatibility of on tested treatments with this grape variety. The results pointed out significant increase in dry extract, ash and total phenol and decrease in tartaric acid content in Žilavka wines obtained by 10 or 20 hours cold maceration tretment period. Best organoleptic quality of Žilavka wines was obtained by cold maceration at 10 ˚C during 20 hours time period.

Table 3. Mean values of higher alcohols, acetaldehyde and ethyl acetate concentrations of Žilavka wines

Compounds (mg/l)	Control treatment	Cold maceration 10 °C/10 hours	Cold maceration 10 °C/20 hours	LSD
Methanol	86,6	123,3	169,4	
1- Propanol	26,8	27,4	27,1	n.s.
2-methyl propanol	54,7	55,0	35,4	5%=0,11 1%=0,16
2-methyl butanol	53,6	45,3	29,6	5%=0.08 1%=0,12
3-methyl butanol	225,4	170,2	110,1	5%=0,22 1%=0,41
Σ Higher alcohol	447,1	421,2	371,6	
Acetaldehyde	110,8	106,1	108,6	n.s.
Ethyl acetate	50,2	51,5	53,1	n.s.

Note: Different letters beside the mean of a compound denote a significant difference among treatments (A, B, C for 5 %; a, b, c for 1 %), n.s.- not significant

Table 4. Sensory evaluation of Žilavka wine by 100 point method (O.I.V./U.I.O.E)

	Control	Cold maceration 10 °C/10 hours	Cold maceration 10 °C/20 hours
Total score	82,0	81,2	84,4

Table 5. Sensory evaluation of Žilavka wine by ranking method (odor quality)

Treatments	Order	Rank rotal
Cold maceration 10 °C/20 hours	1	7**
Control	2	17
Cold maceration 10 °C/10 hours	3	18

Note:any rank total outside 10-18 range is significant at the P< 5 %; 8-20 at P< 1 %.

Table 6. Sensory evaluation of Žilavka wine by ranking method (taste quality)

Treatments	Order	Rank rotal
Cold maceration 10 °C/20 hours	1	8*
Control	2	16
Cold maceration 10 °C/10 hours	3	18

Note:any rank total outside 10-18 range is significant at the P< 5 %; 8-20 at P< 1 %.

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