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SENSORY CHARACTERISTICS OF CHARDONNAY WINES DURING BOTTLE AGING

SENZORNA SVOJSTVA VINA CHARDONNAY TIJEKOM STARENJA U BOCI

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ABSTRACT

A five-year study was conducted on the influence of bottle aging on sensory evolution of Chardonnay wines. In the year 1993, 1994 and 1995 the grapes of Chardonnay, provenance of Kutjevo, continental Croatia, were harvested in a normal harvest and a late harvest (overripe grapes). Grapes were separately vinificated. All obtained wine was bottled separately and stored in an underground cellar. The conditions in the cellar were the same for all bottles: temperature was 12 °C and humidity 75%. The sensory evaluation was carried out by means of 3 different tests and by five highly educated judges. Sensory evaluation of wine took place after bottling, then after 12, 24 and 36 months of bottle aging. The results of tests showed that the wine of "normal" vintage 1993 and 1994 was well preserved. However, the best was the wine of "normal" vintage 1995 after 12 months of bottle aging. Late harvest Chardonnay wine, especially vintage 1993 developed a better balance between strong body and a nice touch of maturation bouquet at 24 and 36 months of storage time. The other two vintages (1994 and 1995) were too young and they were yet to come.

Key words: sensory evaluation, bottle aging, white wine, Chardonnay

SAŽETAK

Provedena su istraživanja o razvoju senzornih svojstava bijelog vina Chardonnay tijekom starenja u boci. Godine 1993.,1994. i 1995. obavljena je

"normalna" i "predikatna" berba grožđa Chardonnay, kutjevačke provenijence (kontinentalna Hrvatska). Pobrano grožđe odvojeno je vinificirano. Dobivena vina buteljirana su i pospremljena u podrum pod jednakim uvjetima temperature 12 °C i 75% vlažnosti zraka. Ispitivanje senzornih svojstava vina provedena su pomoću tri metode s pet visokoškolovanih degustatora. Senzorno ocjenjivanje vina provedeno je po buteljiranju, nakon 12, 24 i 36 mjeseci starenja vina u boci. Dobiveni rezultati pokazuju kako su bijela vina Chardonnay "normalne" berbe 1993. i 1994. godišta dobro sačuvana. Međutim, najbolje su ocijenjena bijela vina Chardonnay "normalne" berbe 1995. nakon 12 mjeseci starenja u boci. Glede "predikatnih" bijelih vina Chardonnay najbolje je ocijenjeno ono berbe 1993. godine nakon 24 i 36 mjeseci starenja u boci. U ovim vinima isticala se sljubljenost "jakog tijela" i dodira "plemenitog" bouqueta starenja u boci. "Predikatna" bijela vina Chardonnay berbi 1994. i 1995. godine ocijenjena su kao premlada nakon 12 i 24 mjeseca starenja u boci i ona tek trebaju pokazati svoju ljepotu i plemenitost.

Ključne riječi: sezonsko dozrijevanje, vino, Chardonnay, boca

INTRODUCTION

No food product has a longer history of quality evaluation than wine. With increasing consumer demand for better wines, great competition among wine producers, and development of appropriate statistical procedures for analysis of sensory data, many wine professionals have concluded that it is unsound to rely on the quality and standards-of-identity judgments of only one or two individuals.

It is a well-known fact that wines do not all age well (2,3,6,7,8,12,15). Especially white wines are very sensitive (1,5,13). The period between bottling and attainment of the desired character may differ drastically from wine to wine, even when they are stored under identical conditions (4,10,11,17).

Chardonnay is a vine-grape variety that is spread all over the World unlike other white varieties of *Vitis vinifer, L.* It is known that all great wines like wine from Chablis are products from this cultivar (9,16,18).

This study was conducted to try and answer the question: how to determine the optimal period of bottle aging for wine of different harvest-time in certain production conditions.

MATERIAL AND METHODS

Harvest:

Chardonnay grapes from the vineyards Vetovo of Kutjevo d.d. - Slavonia, a continental region of Croatia, were of normal harvest when the concentration of sugar stopped rising and the concentration of acids was not falling. The rest of Chardonnay grapes were harvested when the concentration of sugar was high enough for late harvest wine.

Vinification:

The grapes of normal and late harvest were separately vinificated in the winary Kutjevo d.d. After fermentation, settlement and clarification, young wines were bottled. Normal harvest in January and late harvest wines in April-May. The bottles were stored in an underground cellar at 12°C and 75% of humidity in Kutjevo.

Sensory protocol:

The sensory evaluation was carried out four times (after bottling, after 12, 24 and 36 months of bottle aging) in 1996 and 1997. As detailed in Table 1. seven judges were present. Chardonnay wine was evaluated by 3 sensory methods (1). Ethanol, pH and titratable acidity of wine, determined by standard procedures described by Amerine et al and OIV (14), are also given in Table 2.

All results were statistically analyzed, as suggested by Amerine et al (1).

a) Paired sample test

In this test the judge is presented with two samples and asked to identify the one with well-defined characteristic. The test was run two times with the group of judges.

b) Rank total test

In the ranking procedure the judges are asked to arrange a series of more samples in decreasing order with respect to the characteristics. The test was run twice with the group of judges.

c) Buxbaum method

This is a 20-point method that requires detailed evaluation of each wine. In this test the judge gives scores for color 0 - 2; appearance 0 - 2; odor 0 - 4 and taste 0 - 12.

RESULTS AND DISCUSSION

Table 1. Terms of sensory evaluation for normal and late harvest Chardonnay wine
Tablica 1. Vrijeme senzornog ocjenjivanja "normalne" i "predikatne" berbe vina Chardonnay

Year of sensory evaluation	Harvest year		
	1993	1994	1995
	Months of bottle aging		
1996	24	12	After bottling
1997	36	24	12

Table 2. Identification and composition of wine
Tablica 2. Oznake vina i sastav vina

Substance	Vintage	Harvest	0 months in bottle	12 months in bottle	24 months in bottle	36 months in bottle
Ethanol	1993	A_1	11,34	11,32	11,32	11,32
		B_1	10,21	10,21	10,21	10,21
	1994	A_2	12,63	12,60	12,60	12,60
		B_2	10,84	10,84	10,84	10,84
	1995	A_3	11,36	11,36	11,34	--
		B_3	10,83	10,83	10,83	--

Substance	Vintage	Harvest	0 months in bottle	12 months in bottle	24 months in bottle	36 months in bottle
pH	1993	A_1	3,7	3,8	3,8	3,8
		B_1	3,4	3,4	3,4	3,5
	1994	A_2	3,7	3,7	3,8	3,8
		B_2	3,5	3,5	3,5	3,5
	1995	A_3	3,2	3,4	3,8	--
		B_3	3,4	3,4	3,4	--
TA[a]	1993	A_1	7,71	7,37	6,13	5,95
		B_1	6,88	6,78	6,00	5,40
	1994	A_2	6,78	6,18	5,46	5,11
		B_2	6,30	6,00	5,78	5,37
	1995	A_3	7,10	6,70	6,38	--
		B_3	6,60	6,30	6,15	--

A = normal harvest, B = late harvest, Ethanol in vol.%, [a]Titratable acidity (g/L as tartaric acid)
A = normalna berba, B = predikatna berba, Etanol u vol.%, [a]Ukupna kiselost (g/L kao vinska kiselina)

The results of sensory evaluation of **normal harvest** Chardonnay wine by means of:

a) *Paired sample test*

Question: Which of the two presented wines is better evaluated?

Table 3. Results of sensory evaluation in 1996
Tablica 3. Rezultati degustacije vina 1996. g.

Number of judges	Harvest year 95	Harvest year 94	Harvest year 95	Harvest year 93	Harvest year 94	Harvest year 93
1	+	-	+	-	-	-
2	+	-	+	-	-	-
3	+	-	+	-	-	-
4	+	-	+	-	-	-
5	+	-	+	-	-	-
Total	5	0	5	0	0	0

LSD 5% = 5,19
LSD 1% = 5,89

Answer (1996): All the judges chose the wine after bottling.

Table 4. Results of sensory evaluation in 1997
Tablica 4. Rezultati degustacije vina 1997. g.

Number of judges	Harvest year 95	Harvest year 94	Harvest year 95	Harvest year 93	Harvest year 94	Harvest year 93
1	+	-	+	-	-	-
2	+	-	+	-	-	-
3	+	-	+	-	-	-
4	+	-	+	-	-	-
5	+	-	+	-	-	-
Total	5	0	5	0	0	0

LSD 5% = 5,19
LSD 1% = 5,89

Answer (1997): All the judges chose the wine 12 months after bottling.

The sessions were held two times. The significance of the answers in all sessions was on the level of 1%.

b) Rank total test (line up from 1st to 3rd place)

Question: Line up the presented wine from 1st (the best) to 3rd place.

Table 5. Results of sensory evaluation in 1996
Tablica 5. Rezultati degustacije vina 1996. g.

Line	Vintage of wines	Sum
1.	Normal harvest 95	5**
2.	Normal harvest 94	12
3.	Normal harvest 93	13

LSD 5% = 6 - 14
LSD 1% = 6 - 19

Answer (1996): All the judges lined up the wine in this order:
1st = the wine after bottling
2nd = the wine after 12 months of bottle aging
3rd = the wine after 36 months of bottle aging

Table 6. Results of sensory evaluation in 1997
Tablica 6. Rezultati degustacije vina 1997. g.

Line	Vintage of wines	Sum
1.	Normal harvest 95	5**
2.	Normal harvest 94	12
3.	Normal harvest 93	13

LSD 5% = 6 - 14
LSD 1% = 6 - 19

Answer (1997): All the judges lined up the wine in this order:
1st = the wine after 12 months of bottle aging
2nd = the wine after 24 months of bottle aging
3rd = the wine after 36 months of bottle aging

According to KRAMERA citation by AMERINE et al. (1976) the values in the interval from 6 to 14 are not significant at the level of 5%. The values in the interval from 6 to 19 are not significant at the level of 1%. All the results between these values are significant.

Putting the points in "normal scores" the results are as shown below:

Normal vintage 95	Normal vintage 94	Normal vintage 93
0.864	0.346	- 0.518

LSD 5% = 0,54 LSD 1% = 0,76

The underlined values are not significant.

The session was held two times. The significance of the answers in all sessions was at the level of 1%.

c) Buxbaum method

Question: Give the following scores for each item: color 0 - 2; appearance 0 - 2; odor 0 - 4; taste 0 - 12; The best wine gets up to 20 scores.

Table 7. Results of sensory evaluation in 1996
Tablica 7. Rezultati degustacije vina održane 1996. g.

Sample no.	Harvest year	Score
1	1995	18.5***
2	1994	17.6
3	1993	16.2

Significant
5%* 1%** 0.1%***
0.46 0.64 0.88

Answer (1996): All judges agreed that the best wine was after bottling harvested in the year 1995.

Table 8. Results of sensory evaluation in 1997
Tablica 8. Rezultati degustacije vina održane 1997. g.

Sample no.	Harvest year	Score
1	1995	18.2***
2	1994	17.4
3	1993	15.2

Significant
5%* 1%** 0,1%***
0,46 0,64 0,88

Answer (1997): All judges agreed that the best wine was after 12 months of bottle aging = harvest year 1995.

The session was held two times. The significance of the answers in all sessions was at the level of 0,1%.

The results of sensory evaluation of **late harvest** Chardonnay wines by means of:

a) Paired sample test

Question: Which of the two presented wines is better evaluated?

Table 9. Results of sensory evaluation in 1996
Tablica 9. Rezultati degustacije vina 1996. g.

Number of judgge	Harvest year 93	Harvest year 94	Harvest year 93	Harvest year 95	Harvest year 94	Harvest year 95
1	+	-	+	-	-	-
2	+	-	+	-	-	-
3	+	-	+	-	-	-
4	+	-	+	-	-	-
5	+	-	+	-	-	-
Total	5	0	5	0	0	0

LSD 5%= 5,19
LSD 1%= 5,89

Answer (1996): All the judges chose the wine 24 months after bottle aging.

Table 10. Results of sensory evaluation in 1997
Tablica 10. Rezultati degustacije vina 1997. g.

Number of judgge	Harvest year 93	Harvest year 94	Harvest year 93	Harvest year 95	Harvest year 94	Harvest year 95
1	+	-	+	-	-	-
2	+	-	+	-	-	-
3	+	-	+	-	-	-
4	+	-	+	-	-	-
5	+	-	+	-	-	-
Total	5	0	5	0	0	0

LSD 5%= 5,19
LSD 1%= 5,89

Answer (1997): All the judges chose the wine 36 months after bottle aging.

The session was held two times. The significance of the answers in all sessions was at the level of 1%.

b) Rank total test (line up from 1st to 3rd place)

Question: Line up the presented wines from 1st (the best) to 3rd place.

Table 11. Results of sensory evaluation in 1996
Tablica 11. Rezultati degustacije vina 1996. g.

Line	Vintage of wines	Sum
1.	Late harvest 93	5**
2.	Late harvest 94	11
3.	Late harvest 95	14

LSD 5% = 6 - 14
LSD 1% = 6 - 19

Answer (1996): All judges lined up the wine in this order:
1st = the wine after 24 months of bottle aging
2nd = the wine after 36 months of bottle aging
3rd = the wine after bottling.

Table 12. Results of sensory evaluation in 1997
Tablica 12. Rezultati degustacije vina 1997. g.

Line	Vintage of wines	Sum
1.	Late harvest 93	5**
2.	Late harvest 94	11
3.	Late harvest 95	14

LSD 5% = 6 - 14
LSD 1% = 6 – 19

Answer (1997): All judges lined up the wine in this order:
1st = the wine after 36 months of bottle aging
2nd = the wine after 24 months of bottle aging
3rd = the wine after 12 months of bottle aging

According to KRAMERA citation by AMERINE et al. (1976) the values in the interval from 6 to 14 are not significant at the level of 5%. The values in the interval from 6 to 19 are not significant at the level of 1%. All the results between these values are significant.

Putting the points in "normal scores" the results are as shown below:

Normal vintage 95	Normal vintage 94	Normal vintage 93
0.864	0.346	- 0.518

LSD 5% =0.54 LSD 1% = 0.76

The underlined values are not significant.

The session was held two times. The significance of the answers in all sessions was at the level of 1%.

c) Buxbaum method

Question: Give the following scores for each item: color 0 - 2; appearance 0 - 2; odor 0 - 4; taste 0 - 12; The best wine gets up to 20 scores.

Table 13. Results of sensory evaluation in 1996

Tablica 13. Rezultati degustacije vina održane 1996. g.

Sample no.	Harvest year	Score
1	1993	19.8***
2	1994	18.7**
3	1995	17.9

Significant

5%*	1%**	0.1%***
0.46	0.64	0.88

Answer (1996): All judges agreed that the best wine was after 24 months of bottle aging.

Table 14. Results of sensory evaluation in 1997
Tablica 14. Rezultati degustacije vina održane 1997. g.

Sample no.	Harvest year	Score
1	1995	19.9***
2	1994	19.4
3	1993	18.7

Significant

5%*	1%**	0.1%***
0.46	0.64	0.88

Answer (1997): All judges agreed that the best wine was after 36 months of bottle aging.

The session was held two times. The significance of the answers in all sessions was at the level of 0,1%.

CONCLUSION

Chardonnay grapes were harvested in 1993, 1994 and 1995 on a normal harvest date and as late harvest. The obtained wine was bottled and stored in cellar at 12 °C and 75% of humidity. After bottling, after 12, 24 and 36 months, using different methods, wines were sensory evaluated. The obtained results allow us to conclude:

1. Wines from normal harvest obtained best quality immediately after bottling and 12 months later. The wines from normal harvest that aged a longer period (24 and 36 months) under reductive conditions in the bottle, lost in quality.
2. Wines from late harvest obtained best quality after 24 and 36 months of bottle aging. All other wines (immediately after bottling and 12 months later) did not get the full harmony and quality of late harvest that is required for those wines. Those wines were too new.
3. Justifiability of the results obtained are at 1% and 0.1%, according to Amerine et al (1976).
4. The obtained results imply that bottle aging of wine must be controlled with great care to obtain great white wines.

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