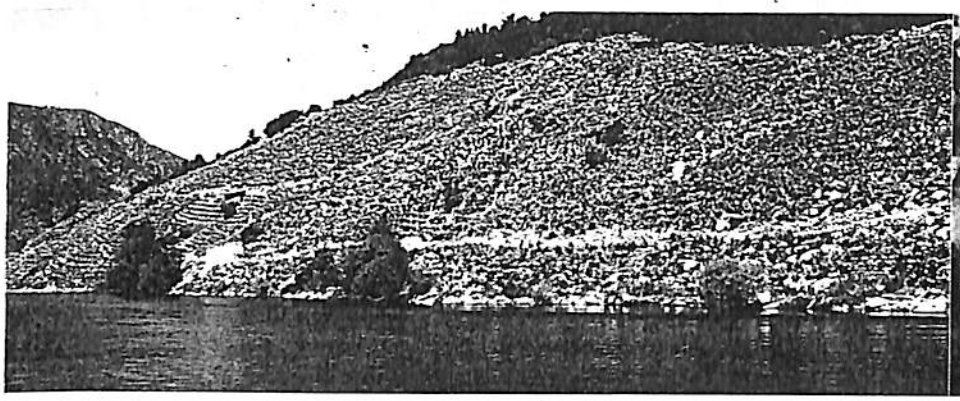

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DEUXIÈME CONGRÈS INTERNATIONAL
SUR LA VITICULTURE DE MONTAGNE ET EN FORTE PENTE

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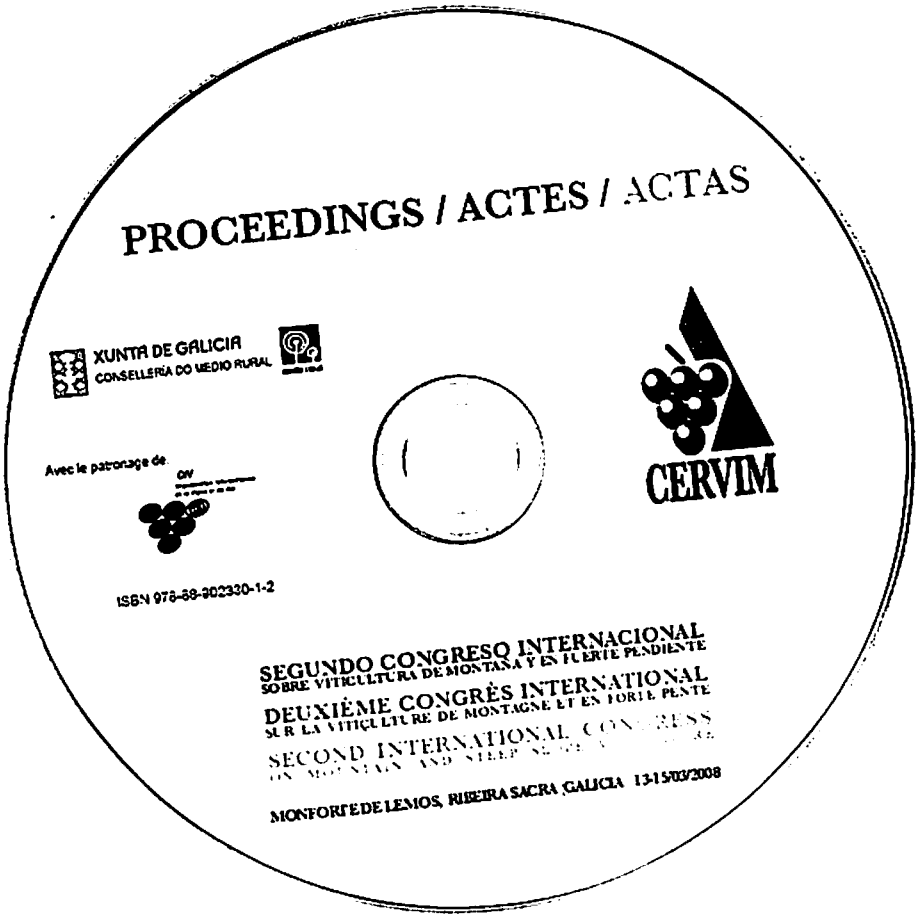
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Chemical and sensory characterisation of Nebbiolo VQPRD wines from North Piedmont

Caractérisation chimique et sensorielle des vins VQPRD obtenus du 'Nebbiolo' dans le Nord du Piémont

Características químicas y sensoriales de los vinos VQPRD obtenidos del "Nebbiolo" en el norte del Piamonte

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Abstract

Nebbiolo vine is largely growed in Piedmont and used for the production of an high number of typical Italian VQPRD wines as Barolo, Barbaresco, Carema and others. Due to its adaptability to different climatic conditions and soils Nebbiolo vineyards are present in all Piedmont area from the South in the Langhe hills to the North, near the Alps and the wines obtained are very different with chemical and sensory characteristics correlated to their production area. Unlike wines produced in the South of Piedmont (Barolo, Barbaresco, Nebbiolo) that were well characterised and studied the Nebbiolo VQPRD wines produced in the North of Piedmont (Carema, Sizzano, Lessona, Fara, Boca and Bramaterra) are not well known and characterised.

The aim of this work was then to define for the first time the chemical and sensory characteristics of these wines. The study was conducted for a large number of commercial samples of each wine, furnished directly by producers in 2004 and 2005 years and oenological parameters (ethanol, extract, acidity, ash), acids (tartaric, malic, lactic and citric), polyphenols and chromatic parameters were determined. A sensory Descriptive Analysis was also performed with the purpose to define for each wine its sensory parameters and a Quantitative Descriptive card that can be used for wine characterisation in new production rules.

Obtained results showed a large variability among these wines due to the different winemaking techniques used by producers but also a good discrimination among wines according to the differences in their production area.

Résumé

Le cépage 'Nebbiolo' est cultivé dans plusieurs vignobles du Piémont (nord –ouest d'Italie) et il est à la base de plusieurs vins italiens à appellation d'origine tels que Barolo, Barbaresco, Carema, etc.

À cause de sa capacité d'adaptation à des climats et des sols différents on le retrouve dans plusieurs milieux de toute la région depuis les coteaux méridionaux des Langhe jusqu'aux limites nord, au pieds des Alpes. Par conséquent on obtient des vins bien typés avec des caractéristiques très différentes au point de vue soit chimique, soit sensoriel, en relation avec le terroir. Au contraire de ses vins produits dans la partie sud du Piémont (Barolo, Barbaresco, Nebbiolo d'Alba, Roero) qui ont été étudiés depuis longtemps, la plupart de ceux de la partie nord (Carema, Lessona, Bramaterra, Gattinara, Fara, Boca, Sizzano, Ghemme) n'a pas encore été si bien analysée et caractérisée. Le but de cette recherche a été celui de définir les caractéristiques de ces vins VQPRD.

L'étude a pris en considération un grand nombre d'échantillons commerciaux prélevés directement chez les producteurs en 2004 et 2005. Les paramètres œnologiques considérés étaient: éthanol, extrait, cendres, acidité, teneur en acide tartrique, malique, lactique et citrique, polyphénols, ainsi que les paramètres chromatiques. Ensuite on a complété l'étude par une analyse descriptive du profil sensoriel pour définir les paramètres sensoriels de chaque vin et par une fiche descriptive quantitative destinée à être utilisée pour la caractérisation des vins au cours de la recherche de nouveaux modèles de production.

Les résultats obtenus à ce jour ont montré une grande variabilité parmi les vins examinés à cause des différentes techniques de vinification utilisées par les producteurs, mais aussi une bonne possibilité de discrimination entre les vins des différents milieux de culture.

Resumen

La variedad "Nebbiolo" se cultiva en varios viñedos del Piamonte (noroeste de Italia) y se utiliza para elaborar varios vinos italianos con denominación de origen tales como Barolo, Barbaresco, Carema, etc. Debido a su gran capacidad de adaptación a las condiciones climáticas y a diferentes suelos, la viña Nebbiolo está presente en distintas partes de la región, desde el sur, en las colinas de Langhe, hasta el norte, cerca de los Alpes. Por eso, sus vinos son muy diferentes y presentan unas características químicas y sensoriales relacionadas con su área de producción. A diferencia de los vinos producidos en el sur del Piamonte (Barolo, Barbaresco, Nebbiolo d'Alba, Roero), que han sido estudiados desde hace tiempo, la mayoría de los vinos elaborados en el norte (Carema, Lessona, Bramaterra, Gattinara, Fara, Boca, Sizzano, Ghemme), todavía no han sido analizados con detalle ni son tan conocidos.
Por eso, el objetivo de este estudio fue definir por primera vez las características de dichos vinos VQPRD. El estudio abarcó un amplio número de muestras comerciales facilitadas directamente por los productores en 2004 y 2005. Los parámetros enológicos que se tuvieron en cuenta fueron: etanol, extrato, acidez, ceniza, ácidos (tartárico, málico, láctico y cítrico),
polifenoles, así como los parámetros cromáticos. Después se ha completado el estudio con un análisis descriptivo del perfil sensorial a fin de definir los parámetros sensoriales de cada vino y se ha se ha elaborado una ficha descriptiva cuantitativa para la caracterización de los vinos durante la búsqueda de nuevos modelos de producción.
Los resultados obtenidos hasta el momento, no sólo han presentado una gran variedad entre los vinos estudiados debido a las distintas técnicas de vinificación utilizadas por los productores, sino que también han dejado al descubierto una buena posibilidad de discriminación entre los vinos provenientes de distintos zonas de cultivo.

Introduction

Nebbiolo is one of the most important vine of Italy and it is cultivated almost exclusively in the North-Western areas of the peninsula, most notably in Piedmont, where it thrives in a large number of VQPRD wines such as Barolo, Barbaresco, Carema and others. Nebbiolo ripens very late (usually mid October) and due to its adaptability to different climatic conditions and soils Nebbiolo vineyards are present in all Piedmont area from the South at the Langhe hills to the North, near the Alps. When it is fully ripe it is characterised by abundant amounts of flavour, aroma, acidity and tannins and the wines obtained are very different on chemical and sensory characteristics correlated to their production area. So young wines are usually full of fresh red fruits and violet aromas, whereas older products have notes ranging from black fruits to truffles to an ethereal rose quality that are hard to find in any other wine on earth.
Although wines produced in the South of Piedmont (Barolo DOCG, Barbaresco DOCG, Nebbiolo DOC) have been very well characterised and studied (Ubigli *et al.*, 1991; Cagnasso, 1996; Gerbi *et al.*, 2000; Gerbi *et al.*, 2002) there is a lack of knowledge on the Nebbiolo VQPRD wines produced in the North of Piedmont (Boca DOC, Bramaterra DOC, Carema DOC, Fara DOC, Gattinara DOCG, Ghemme DOCG, Lessona DOC and Sizzano DOC).
Therefore the aim of this work was to define, for the first time, the chemical and sensory characteristics of these wines. The study on oenological parameters (ethanol, extract, acidity, ashes), acids (tartaric, malic, lactic and citric), polyphenols and chromatic parameters was conducted on a large number of commercial samples of each wine, furnished directly by producers in 2004 and 2005. A sensory Descriptive Analysis was also performed with the purpose to define for each wine its sensory parameters and to create a Quantitative Descriptive card that could be used for wine characterisation in new production rules.

Materials and Methods

Samples

A total of 64 samples (4 Boca DOC; 2 Fara DOC; 9 Gattinara DOCG; 15 Ghemme DOCG; 4 Sizzano DOC; 9 Carema DOC; 5 Lessona DOC; 16 Bramaterra DOC) were examined. Wines were acquired directly from producers according to their aging rules.

Chemical analysis

The main analytical parameters (ethanol, total acidity, volatile acidity, fixed acidity, dry matter, ashes, ashes alkalinity, pH) were determined according to the European Official Methods (EEC, 1990). Tartaric, malic, lactic and citric acids and glycerol were determined by HPLC using an ion exchange column (Schneider *et al.*, 1987; Gerbi and Tortia, 1991). Total polyphenols were determined using the Folin-Ciocalteau reactive (Singleton and Rossi, 1965). Phenolic compound indexes were determined as described by Di Stefano *et al.* (1989): total flavonoids, non-anthocyanin flavonoids and flavanols reactive to vanillin all expressed as (+)-catechin (mg/L), proanthocyanidins expressed as cyanidin chloride (mg/L).

Chromatic properties as colour intensity as sum of absorbance at 420 nm and 520 nm and colour tone as ratio between absorbance at 420 nm and 520 nm were determined according to the method described by Glories (1984). Further, CIELAB index were determined with reference to illuminant C (Piracci, 1994): clarity (L*), red-green component (a*), yellow-blue component (b*), chroma (C*), hue (H*). All absorbance measurements were made using a UV-1601PC spectrophotometer (Shimazdu Scientific Instruments Inc., Columbia, MD, USA) and chromatic properties were carried out using a glass cuvette (2 mm optical path).

Sensory analysis

The panel was formed by ten tasters (8 males and 2 females with an age between 30 and 42 years) and panellists were recruited according to ISO (3972:1991; 5496:1992; 8586/1:1993 and 8586/2:1993).

The assessors developed the list of attributes during twelve sessions of analysis. The assessors agreed on a consensus list of attributes for profiling, on the definition of each attribute and also on reference standards for each descriptor. Analytical grade reagents were used as standards (Sigma-Aldrich Chemical, Milano, Italy).

Sensory analysis were carried out in the morning (11:00-13:00) with white light and samples were given in random order. Each sample was coded with a random three-digit number. The sensory laboratory was designed according to guidelines UNI-ISO 8589 (1990) with separate booths. Room temperature was 22±1 °C.

Results

Chemical results

The Boca DOC, the Fara DOC, the Ghemme DOCG and the Sizzano DOC are produced in the Novara Province using a mix of Nebbiolo and others local vines such as Vespolina or Bonarda. For Boca DOC wine Nebbiolo wild vine must be used in a percentage of 45-70%, for Fara DOC in a percentage of 30-50%, for Ghemme DOCG must be used in a percentage more than 75% and for Sizzano DOC in a percentage of 40-60%.

The Gattinara DOCG, the Lessona DOC and the Bramaterra DOC are produced in the Vercelli Province using a mix of Nebbiolo and local vine such as Vespolina and others. For Gattinara DOCG wine Nebbiolo vine must be used in a percentage of at least 90%, for Lessona DOC in a percentage of at least 75% and for Bramaterra DOC Nebbiolo must be used in a percentage of 50-70%. Finally the Carema DOC is produced in the Turin province using at least 85% of Nebbiolo vine.

Generally these wines are aged with a minimum of three years; only Lessona DOC and Bramaterra DOC are aged for at least two years.

Table 1 presents mean values and standard deviations of the physical-chemical parameters examined.

For oenological parameters as ethanol, extract, ashes acids or glycerol standard deviation is generally very low while for polyphenolic and colour compounds shows an high variability. This can be due to differences in aging time and percentage of Nebbiolo used for wine production.

Although wines are produced in mountain vineyard, extract, ashes and potassium are very high. Almost all products have finished the malo-lactic fermentation with production of very different quantities of lactic acid. Five of the examined wines presents a lactic acid concentration over 3,5 gL^{-1} while tartaric acid is lower than 2 gL^{-1}. This is a very evident demonstration of the insufficient maturation of grapes in vintages considered.

According to the Nebbiolo antocyaninins composition and the long aging time, polyhenol and above all flavanoids concentrations are very high while antocyanins are very scarce.

Obtained colours are then characterised by low values of colour intensity and high value of colour tone that determines a typical orange tone much appreciated by consumers.

Table 1 – Mean values (X) and standard deviations (SD) of analytical parameters of the examined wines (nd – not determined)

Table 1 – Moyenne (X) and deviation standard (SD) des parameters analytiques des vins analyseé (nd – non determiné)

	Boca DOC		Fara DOC		Gattinara DOCG	
	X	SD	X	SD	X	SD
Ethanol (mlL^{-1})	12.9	0.2	13.6	0.1	12.,6	0.3
Extract (gL^{-1})	28.38	0.59	29.50	1.56	30.08	1.49
Ashes (gL^{-1})	2.99	0.38	2.66	0.17	3.02	0.22
Ash alcalinità ($meqL^{-1}$)	24.8	2.8	23.0	1.4	22.3	1.4
Potassium (mgL^{-1})	1118	185	1080	106	1247	111
Total acidity ($gL^{-1}L$)	6.2	0.5	6.0	0.4	6.0	0.3
pH	3.53	0.11	3.54	0.03	3.56	0.06
Volatile acidità (gL^{-1})	0.7	0.1	0.7	0.1	0.6	0.1
Citric acid (gL^{-1})	0.18	0.08	nd	-	0.31	0.15
Tartaric acid (gL^{-1})	1.54	0.50	1.79	0.08	1.58	0.19
Malic acid (gL^{-1})	0.15	0.06	0.46	0.02	0.13	0.03
Lactic acid (gL^{-1})	4.09	0.62	2.22	0.11	4.52	0.31
Glycerol (gL^{-1})	9.08	0.29	11.65	2.62	9.21	0.81
Total polyphenols (mgL^{-1} as (+)-catechin)	2511	268	2596	30	2317	283
Total flavonoids (mgL^{-1} as (+)-catechin)	1833	272	3385	67	1777	173
Total anthocyanins (mgL^{-1} as malvidin-3-glucoside chloride)	80	20	184	28	107	21
Monomer anthocyanins (mgL^{-1} as malvidin-3-glucoside chloride)	13	1	18	1	10	2
Flavan reacting to vanillin (mgL^{-1} (+)-catechin)	1619	585	2607	140	1231	218
Proanthocyanidins (mgL^{-1} as cyanidin chloride)	2781	231	3121	255	3190	370
Color intensity (1mm)	0.537	0.060	0.590	0.200	0.564	0.096
Color tone	1.063	0.091	1.020	0.129	1.071	0.,060
P%	93.651	4.362	95.601	4.208	95.813	3.379
Y%	6.967	2.633	7.739	5.272	7.449	3.522
D (nm)	611	3	611	11	610	7
L*	31.102	6.379	32.032	11.773	34.500	5.410
a*	52.638	7.459	51.904	1.010	53.944	7.014
b*	50.650	11.234	54.596	4.147	58.409	6.798
h*	0.776	0.031	0.810	0.047	0.823	0.119
C*	78.815	2.086	75.332	2.367	80.015	2.117

	Gemme DOCG		Sizzano DOC		Carema DOC	
	X	SD	X	SD	X	SD
Ethanol (mlL^{-1})	12.7	0.4	12.5	0.4	12.8	0.6
Extract (gL^{-1})	28.04	2.08	28.28	2.60	27.81	1.67
Ashes (gL^{-1})	2.66	0.17	2.80	0.27	3.,07	0.28
Ash alcalinità ($meqL^{-1}$)	20.3	1.6	21.0	1.4	22.8	2.9
Potassium (mgL^{-1})	1075	87	1175	92	1242	103
Total acidity ($gL^{-1}L$)	6.0	0.3	5.7	0.2	6,3	0.2
pH	3.51	0.07	3.51	0.01	3.57	0.08
Volatile acidità (gL^{-1})	0.7	0.2	0.7	0.1	0.5	0.0
Citric acid (gL^{-1})	0.08	0.11	0.23	0.1	nd	-
Tartaric acid (gL^{-1})	1.70	0.19	1.90	0.16	1.64	0.20
Malic acid (gL^{-1})	0.20	0.18	0.42	0.15	0.21	0.24
Lactic acid (gL^{-1})	3.25	1.34	3.20	0.29	3.52	0.46
Glycerol (gL^{-1})	9.05	0.89	9.60	1.68	11.76	0.74
Total polyphenols (mgL^{-1} as (+)-catechin)	2691	318	2612	476	2305	262
Total flavonoids (mgL^{-1} as (+)-catechin)	1791	288	2099	236	2583	464
Total anthocyanins (mgL^{-1} as malvidin-3-	92	15	141	9	98	23

glucoside chloride)						
Monomer anthocyanins (mgL^{-1} as malvidin-3-glucoside chloride)	9	4	18	5	11	5
Flavan reacting to vanillin (mgL^{-1} (+)-catechin)	1198	330	1227	448	1123	225
Proanthocyanidins (mgL^{-1} as cyanidin chloride)	3387	475	2874	172	3057	694
Color intensity (1mm)	0.599	0.090	0.557	0.045	0.553	0.099
Color tone	1.017	0.067	1.001	0.050	1.156	0.119
P%	96.558	1.856	95.806	0.816	95.44	2.683
Y%	6.737	1.937	7.799	1.711	7.,918	3.292
D (nm)	613	4	612	4	608	6
L*	32.740	9.395	33.372	3.502	33.159	5.702
a*	54.593	3.068	56.923	1.160	51.250	2.649
b*	54.682	3.486	55.718	3.406	55.870	4.893
h*	0.789	0.019	0.774	0.033	0.823	0.055
C*	77.426	4.235	79.686	2.463	75.920	3.620

	Lessona DOC		Bramaterra DOC	
	X	SD	X	SD
Ethanol (mlL^{-1})	12.6	0.5	12.6	0.6
Extract (gL^{-1})	30.08	1.08	26.86	2.95
Ashes (gL^{-1})	3.28	0.38	2.46	0.52
Ash alcalinità ($meqL^{-1}$)	25.0	2,8	19.0	5.3
Potassium (mgL^{-1})	1377	135	1038	188
Total acidity ($gL^{-1}L$)	5.9	0.3	5.9	0.8
pH	3.58	0.06	3.40	0.16
Volatile acidità (gL^{-1})	0.6	0.1	0.6	0.1
Citric acid (gL^{-1})	nd	-	0.33	0.32
Tartaric acid (gL^{-1})	1.36	0.25	1.61	0.30
Malic acid (gL^{-1})	0.29	0.20	0.92	0.79
Lactic acid (gL^{-1})	2.78	0.23	1.96	0.72
Glycerol (gL^{-1})	9.90	1.54	8.30	0.48
Total polyphenols (mgL^{-1} as (+)-catechin)	2563	288	2418	399
Total flavonoids (mgL^{-1} as (+)-catechin)	3099	537	1707	363
Total anthocyanins (mgL^{-1} as malvidin-3-glucoside chloride)	103	15	87	41
Monomer anthocyanins (mgL^{-1} as malvidin-3-glucoside chloride)	9	6	16	15
Flavan reacting to vanillin (mgL^{-1} (+)-catechin)	1395	269	948	406
Proanthocyanidins (mgL^{-1} as cyanidin chloride)	2916	456	2982	672
Color intensity (1mm)	0,590	0,137	0,669	0,163
Color tone	1.117	0.115	0.939	0.157
P%	95.646	3.234	96.918	2.,929
Y%	7.506	3.784	6.071	2.947
D (nm)	611	6	617	8
L*	32.152	6.861	28.660	6.933
a*	53.712	1.984	55.186	3.069
b*	55.080	1.745	53.442	5.525
h*	0.798	0.029	0.775	0.044
C*	76.960	1.245	77.358	3.996

Sensory results

Descriptors furnished by panelists were extracted using sensory cards and analysed for their consistence with products. Then, after a specific training, panellists were used to assess wines using these descriptors to determine their efficacy (lack of confusion or redundancy). Descriptors with an unacceptable level of variation in term of usage were eliminated from the following test. At the end of this stage a Quantitative

Descriptive Card useful for these wines was defined (Fig. 1). No colour descriptors were defined and its analysis was performed only with a spectrophotometric approach.

Conclusions

Chemical and sensory analysis of Nebbiolo wines produced in North Piedmont showed that their composition is very similar with a higher effect of vines used above all for colour characteristics. Then reported values can be used by producers for a new definition of production rules. Nevertheless sensory analysis results can be used not only to define the sensory profile of each wine and its correspondence to production rules but also to define the effect of Nebbiolo vine used on characteristics of these wines.

References

Cagnasso E. (1996) - Estrazione di polifenoli dalle parti solide dell'uva Nebbiolo da Barolo con sistemi diversi di vinificazione. Tesi di Specializzazione. Università degli studi di Torino.

EEC (1990) - Commission Regulation N. 2676 of 17 September 1990 Determining Community methods for analysis of wines. OJ L272, 3.10.1990.

Di Stefano R., Cravero M.C. and Gentilini N. (1989) - Metodi per lo studio dei polifenoli dei vini. L'Enotecnico. 25: 83.

Gerbi V. and Tortia C. 1991. Monitoraggio di zuccheri, etanolo, glicerolo e acidi principali nel corso di fermentazioni alcoliche mediante HPLC. In: Colagrande O. (ed.), La tecnica HPLC come strumento di studio e di controllo di qualità in enologia. Piacenza, 1 Marzo 1991, 27-32, Biorad, Milano.

Gerbi V., Zeppa G. and Rolle L. (2002) - Evoluzione delle antocianine nel corso della vinificazione delle uve nebbiolo. In "Ricerche e innovazioni nell'Industria Alimentare", a cura di S. Porretta, Vol. V, p. 420. Chirotti (Ed.), Pinerolo, TO, I.

Gerbi V., Zeppa G., Rolle L., Ubigli M. and Alessandria F. (2000) - Caratterizzazione delle produzioni vitivinicole del Barolo, Aspetti enologici e sensoriali. Supplemento al n° 24 di Quaderni della regione Piemonte, Agricoltura.

Glories Y. (1984) - La couleur des vins rouges. 2me partie. Mesure, origine et interprétation. Conn. Vigne Vin. 18: 253.

ISO 3972 (1991) - Sensory analysis - Methodology - Method of investigating sensivity of taste. International Organisation for Standardisation, Geneva, Switzerland.

ISO 5496 (1992) - Sensory analysis - Methodology - Initiation and training of assessors in the detection and recognition of odours. International Organisation for Standardisation, Geneva, Switzerland.

ISO 8586-1 (1993) - Sensory analysis - General guidance for the selection, training and monitoring of assessors. Part 1 - Selected assessors. International Organisation for Standardisation, Geneva, Switzerland.

ISO 8586-2 (1994) - Sensory analysis - General guidance for the selection, training and monitoring of assessors. Part 2 - Expert. International Organisation for Standardisation, Geneva, Switzerland.

Piracci A. (1994) - Evaluation instrumentale de la couleur. J. Int. Sci. Vigne Vin. 28: 247.

Schneider A., Gerbi V. and Redoglia M. (1987) - A rapid HPLC method for separation and determination of major organic acids in grape musts and wines. Am. J. Enol. Vitic. 38 (2): 151-155.

Singleton V.L. and Rossi J.A. (1965) - Colorimetry of total phenolics with phosphomolybdic-phosphotungstic acid reagent. Am. J. Enol. Vitic., 16, 144-158.

Ubigli M., Rissone M., Gerbi V. and Anfosso P. (1991) - Analisi strumentale e sensoriale del Barbaresco a D.O.C.G. Rivista Vitic. Enol., 64 , n°2/91.

UNI-ISO 8589 (1990) - Analisi sensoriale - Criteri generali per la progettazione di locali destinati all'analisi sensoriale. Enta Nazionale di Unificazione, Milano, Italia.

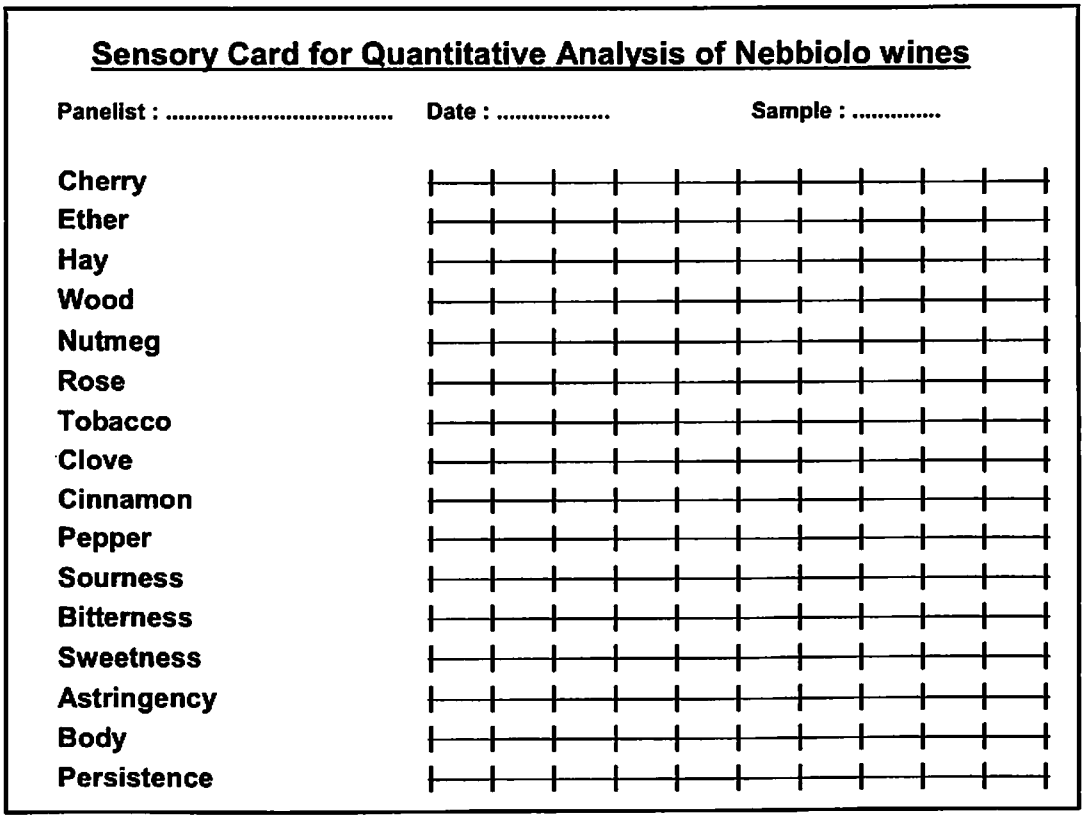

Fig. 1 – Sensory card defined for analysis of Nebbiolo wines
Fig. 1 – Fiche d'analyse sensorielle pour la caractérisation des vins Nebbiolo