

CULTURAL AND ENOLOGICAL PERFORMANCE OF MINORITY VARIETIES (*VITIS VINIFERA L.*) OF THE VINHOS VERDES DOC REGION

CHARACTERISTIQUES CULTURALES ET ENOLOGIQUES DE VARIÉTÉS MINORITAIRES (*VITIS VINIFERA L.*) DE LA RÉGION DOC VINHOS VERDES

Teresa MOTA^{1*}, João GARRIDO¹, António CERDEIRA², Deolinda FERNANDES³, Isabel ANDRADE³,
Élia FRANCISCO⁴, Raúl RODRIGUES^{4,5}, André MOTA⁶, José M. OLIVEIRA⁶, Isaura CASTRO⁷

¹Estação Vitivinícola 'Amândio Galhano', Quinta Campos de Lima, 4970-249 Paçô,
Arcos de Valdevez, Portugal

²Comissão de Viticultura da Região dos Vinhos Verdes, Rua da Restauração, 318, 4050-050 Porto
³Escola Superior Agrária de Coimbra, 3040-316 Bencanta, Portugal

⁴Escola Superior Agrária de Ponte do Lima, Instituto Politécnico de Viana do Castelo (ESAPL/IPVC), 4990-706 Refóios, Portugal.

⁵Centro de Investigação de Montanha (CIMO). Escola Superior Agrária (ESAPL/IPVC)

⁶IBB- Institute for Biotechnology and Bioengineering, Centre of Biological Engineering, Campus Gualtar, 4710-057 Braga, Portugal.
⁷Instituto de Biotecnologia e Bioengenharia, Centro de Genómica e Biotecnologia, Universidade de Trás-os-Montes e Alto Douro
(IBB/CGB-UTAD), 5001-80 Vila Real, Portugal.

*Corresponding author: Mota, Telephone: +351258480200, Fax: +351258453930, Email: tmota@vinhooverde.pt

SUMMARY

The *Vinhos Verdes* DOC Region is one of the largest Portuguese wine regions. In spite of several rivers crossing this region towards the Atlantic ocean conceiving important valleys more or less open, this region retains a considerable biodiversity in grapevines varieties, responsible by an equal diversity of typical wines from each one of the nine sub-regions: Amarante, Ave, Baião, Basto, Cávado, Lima, Monção / Melgaço, Paiva and Sousa (Order in Council 28/2008 and Ministerial Order 291/2009). Unfortunately, the legal rules are also responsible by the genetic erosion of such biodiversity (Mota, 2012) and the regional grapevine patrimony is in danger of disappearing. In reality, after a serious prospection of autochthonous varieties in the 80s, at this moment we know that the existence of some of them is confined to the collection fields.

Another preoccupation concerns the scarce information about these minority varieties. Thus, we carried out this study (during the years 2011 and 2012), concerning the cultural and oenological characteristics, in seven white varieties (Cainho, Cascal, Esganinho, Esganoso, Lameiro, Pintosa and S. Mamede) and eight red varieties (Doçal, Doce, Espadeiro Mole, Labrusco, Melhorio, Mourisco, Sezão and Verdelho). These varieties are installed in a ampelographic collection of the viticulture center, "Estação Vitivinícola Amândio Galhano" (EVAG) located in Arcos de Valdevez. Each grapevine variety was followed in 5 vines that are grafted in 196-17 Cl, planted 2.75m × 2.5m and trained in a VSP (Vertical Shoot Position) system.

Rendering parallel with the characterization and identification of these genotypes by microsatellite markers amplification, we report now their main cultural characteristics and corresponding oenological parameters. From this study resulted a group of varieties with different times of vegetative development (phenological states), different fertility and production of grapes, different sugar contents and chemical proprieties, and so, revealing a high interest to be included in the sub-regional vinification, avoiding the standardization of *Vinhos Verdes* wines.

Key Words: autochthon grapevines, Vinho Verde, phenological states, production, wine quality

RÉSUMÉ

La région DOC *Vinhos Verdes* est l'une des plus importantes régions viticoles portugaises. À cause de plusieurs cours d'eau qui traversent cette région vers l'océan Atlantique en concevaient d'importantes vallées plus ou moins ouvertes, cette région conserve une biodiversité considérable dans des variétés de vigne, chargées par une diversité égale de vins typiques de chacun des neuf sous-régions : Amarante, Ave, Baião, Basto, Cávado, Lima, Monção / Melgaço, Paiva et Sousa (décret 28/2008 et l'arrêté ministériel 291/2009). Malheureusement, les règles juridiques sont également responsables de l'érosion génétique de cette biodiversité (Mota, 2012) et le patrimoine régional vigne est en danger de disparition. En réalité, après une prospection sérieuse des variétés autochtones dans les années 80, en ce moment, nous savons que l'existence de certains d'entre eux se limite aux champs de collection.

Une autre préoccupation concerne les rares informations sur ces variétés minoritaires. Ainsi, nous avons effectué cette étude (pendant les années 2011 et 2012), concernant les caractéristiques culturelles et oenologiques, dans sept cépages blancs (Cainho, Cascal, Esganinho, Esganoso, Lameiro, Pintosa et S. Mamede) et huit cépages rouges (Doçal, Doce, Espadeiro Mole, Labrusco, Melhorio, Mourisco, Sezão et Verdelho). Ces variétés sont installées dans une collection ampélographique du centre de la viticulture, "Estação Vitivinícola Amândio Galhano" (EVAG) situé à Arcos de Valdevez. Chaque variété de vigne a été suivie en 5 souches qui sont greffés en 196-17 Cl, planté de 2,75 m x 2,5 m et formés dans un système Espalier-cordon (plan relevé).

Rendu parallèle à la caractérisation et l'identification de ces génotypes par amplification de marqueurs microsatellites, nous rapportons maintenant leurs principales caractéristiques culturelles et paramètres œnologiques correspondants. Cette étude a donné lieu à un groupe de variétés avec différentes périodes de développement végétatif (états phénologiques), fertilité et production de raisins différente, sucres aussi et des propriétés chimiques, et donc, révélant un grand intérêt à inclure dans la vinification sous-régionale, en évitant la standardisation des vins *Vinhos Verdes*.

Mots clés: variétés autochtones, Vinho Verde, états phénologiques, rendement, qualité

INTRODUCTION

Portugal is the European country with the highest density of indigenous grape varieties (Martins, 2009), and the *Vinhos Verdes* region contributes greatly to this reality.

In the years 80, during a process of restructuring and conversion of the Portuguese viticulture, only good quality varieties were considered. This made the adjacent legislation deprecate gradually varieties grown on a small scale, and besides they were included in official lists they were considered as secondary. Today, little or nothing is known about the oenological and cultural characteristics of this genetic heritage, and some varieties are almost exclusively in the collection fields. After nearly 10 years, comes a Portuguese project ‘Recognition and conservation of genetic resources of *Vitis* in Portugal’ (Carneiro, 1991) responsible for a variety inventory and assigned names throughout the country. All the varieties studied in this work are included in that inventory, although in some situations the official name of the variety has been abandoned and elected its synonymous to the official lists (Mota, 2012). Thus, at this moment it’s important to know ‘the history of the varieties into a list’ and not to confuse names and varieties. Today, for the correct names to the cultivars, we have the contribution of the characterization and identification of genotypes by microsatellite markers amplification (Veloso *et al.*, 2010; Castro *et al.*, 2012).

The abandonment of these varieties – the most of them natives of Lima Valley (Fernandes, 2012) – contributed unfortunately to the exclusion of them into the local and typical wines, embraced in the class ‘sub regional’.

MATERIAL AND METHODS

The grape varieties are installed in a ampelographic collection of the viticulture center, “Estação Vitivinícola Amândio Galhano” (EVAG) located in Arcos de Valdevez (41°48'N; 8°25'W). We studied a group of seven white varieties – Cainho, Cascal, Esganinho, Esganoso, Lameiro, Pintosa and S. Mamede - and a group of eight red varieties – Doçal, Doce, Espadeiro Mole, Labrusco, Melhorio, Mourisco, Sezão and Verdelho. Each grapevine variety was followed in five vines that are grafted in 196-17 Cl, planted 2.75 m × 2.5 m and trained in a VSP (Vertical Shoot Position) system.

In relation to the names of grape varieties, we decide in some cases by the latest official designation (Ordinance No. 380/2012) including Melhorio instead of Verdeal and Sezão instead of Sousão.

We followed the vegetative cycles during the years 2011 and 2012, since the bud burst to the harvest with the aim to know the fertility, the vigour, the production and the quality of the musts and wines. The fertility was assessed at flowering and the bunch and berry characterization after complete maturation, using OIV codes: bunch size (OIV 202), berry size (OIV 220) and juice yield (OIV 233). The musts were evaluated during three years (2010-2012) and the average of the juice parameters (sugars, titratable acidity and organic acids) analyzed, using International Organization of Vine and Wine methods followed by the CVRVV Laboratory. The physical and chemical parameters of the wines are reported to the vintage of 2011, and were obtained by high performance liquid chromatography (HPLC); by HPLC were determined the concentrations of residual sugars (glucose, fructose), glycerol, ethanol and organic acids (tartaric, malic, succinic and lactic). The determinations were performed in a Jasco chromatograph (Jasco, Essex, UK) equipped with a refractive index detector (Jasco 830-RI, Essex, UK), an ultraviolet detector ($\lambda = 210$ nm) and a Varian Metacarb 67H column (300 mm × 6.5 mm, Agilent Technologies, Santa Clara, CA, USA) operated at 80 °C. A 5 mmol/L H₂SO₄ solution was used as eluent at a constant flow rate of 0.3 mL/min. These analyses were made in triplicate.

RESULTS AND DISCUSSION

Phenological behaviour. Due to the climatic conditions, the vine behaved so differently in the two years of observation. Therefore, the year 2011th was marked by a precocity in relation to the average of the last 4 years, since bud burst (- 4 days) up to flowering (- 16 days) and up to veraison (- 20 days), and leads to a faster stages of flowering and veraison. In 2012th the irregularity of the thermal regime caused delays and irregularities in the bud burst and growth; in flowering occurred flowers abortion and incomplete fruit set, and also during the maturation occurred a water stress period. The cultivar that suffered more with this water stress was cv. Espadeiro Mole, and so, the results of this red grape variety are considered underrate in view of good conditions.

In the Figure 1 and Figure 2 we can see the phenological behaviour of the white and red cultivars, respectively, compared with cv. Loureiro and cv. Vinhão, the more important varieties of this region. Normally, at bud burst cv. Loureiro is precocious and cv. Vinhão is belated, but in maturity they revealed similarly precocity (Mota *et al.*, 2007) considered both as ‘mid-season’ varieties by Lopes *et al.* (2008).

In 2011th the dates of bud burst, flowering and veraison was respectively 25th of Mars, 15th of May and 25th of July for cv. Loureiro and 2nd of April, 18th of May and 24th of July for cv. Vinhão. In 2012th they were 31st of Mars, 8th of June and 22nd of August for cv. Loureiro and 6th of April, 10th of June and 25th of August for cv. Vinhão. Save cv. Pintosa (Figure 1) all the white varieties studied are later than cv. Loureiro particularly at veraison; the variety with the largest duration of the cycle is cv. Esganoso.

The red grape varieties behaviour is more homogeneous (Figure 2) except cv. Melhorio, extraordinary late at veraison and ripeness; only one variety has more precocity than cv. Vinhão at maturity: cv. Mourisco, a variety with a large berry size and firm fresh, characteristics own of a table variety (Bravo and Oliveira, 1916).

Vegetative and productive potential. Among the white cultivars (Table I), cv. Cainho revealed the highest response to the bud crop and the highest fertility, with significant differences to the others in particular against cv. Cascal and cv. Pintosa, due to their low bud burst index and less inflorescences per vine. After cv. Cainho, appear cv. S. Mamede, cv. Esganinho and cv. Lameiro also fertiles. In comparison with other important varieties, cv. Cainho is less fertile than cv. Alvarinho (2.060) and near cv. Trajadura (1.703) as reported by Mota *et al.* (2007); according with the same authors, also cv. S. Mamede is near cv. Loureiro (1.431), cv. Esganoso near cv. Arinto (1.005) and cv. Cascal near cv. Batoca (0.964).

In the red cultivars, the bud crop differences more accentuated are due to their particular vegetative performance (ex. internodes size); the bud burst index is particularly low in cv. Doce being cv. Doçal the least fertile by the significantly low number of inflorescences per vine. Generally, the fertility is higher in the red varieties and cv. Sezão, among them, is the most fertile, similar with cv. Vinhão (1.836) as referred by Mota *et al.* (2007).

In the Table II, we can appreciate the bunch and berry size by representative samples (Francisco, 2013) and the yield potential in the field. The bunch size is proportional to the respective bunch weight, significantly heavier in the white cultivars Pintosa, Lameiro and Cascal and in the red cultivar Verdelho. Probably, the higher berry size of cv. Pintosa and cv. Cascal contribute for their heavier bunch, while in the red cultivars not, because cv. Mourisco has a high berry weight but few berries per bunch and cv. Verdelho has a large number of small berries (number of berries per bunch not evaluated here). The must juice take by 100 g of berries, revealed by the other side, the degree of firmness of flesh, those is known as very firm, and so few juicy, in the cultivars Pintosa and Mourisco (Mota and Silva, 1986). The average of the two seasons considered, 2011 and 2012, reveals as the most productives, cv. Lameiro (W) and cv. Verdelho (R), respectively between the white and red varieties, exceeding widely the legal limit of the region (11 t/ha, tolerance until 13 t/ha). Likewise, cv. Pintosa, cv. Cascal and cv. S. Mamede are also productive between the white varieties, and cv. Cainho, besides its fertility is the least productive. Into the red varieties, the yields are more moderate and cv. Doçal is the least productive and the least fertile too; the cv. Espadeiro Mole suffered with the water stress in 2012, and so, the results of this red grape variety are considered underrate in view of good conditions.

The yield performance between the varieties is similar when express in kilograms per vine (Table III) in the 2011 vintage. In this year, pruning weight (kg per vine) and the weight cane on average (grams) are assessed to estimate the vigour, significantly difference between the white varieties; so, cv. Esganinho was the least vigorous and cv. Pintosa and cv. Esganoso the most vigorous, besides cv. Cascal record the highest weight cane (117.3 g). Into the red varieties cv. Sezão and cv. Verdelho revealed tendency for the most vigorous and cv. Labrusco the least, with canes very thin (26.1 g). The Ravaz index, ratio between de production (grapes) and the vigour (wood), shows an unbalanced in cv. Lameiro and cv. Esganinho (white varieties) and in cv. Labrusco (red variety) – excessive grapes for the vegetative potential – and quite the reverse, in cv. Esganoso and cv. Doçal.

Quality potential: musts and wines. The varieties, either white or red, revealed grate differences between themselves, as we can see in the Figure 3 (must results) and in the Table IV (wine results). Generally, the sugar content is good, excepting the values of the white cv. Esganinho (140.0 g/L) and the red cv. Melhorio (154.5 g/L). Afterwards, two red cultivars, cv. Sezão (175.8 g/L) and cv. Verdelho (181.6 g/L), are located under the line of 200 g/L for sugar content, but yet enough for the typical *Vinhos Verdes*, corresponding to 10.3 % vol. and 10.6 % vol., respectively (Figure 3). Concerning the acidic compounds, four varieties are clearly acid, cv. Cainho (W), cv. S. Mamede (W), cv. Melhorio (R) and cv. Espadeiro Mole (R); for this acidity, the tartaric fraction is the most responsible, and the malic one for cv. S.Mamede (W) and cv. Melhorio (R). The richest varieties in acid malic are cv. Cascal (W) and cv. Mourisco (R); by the other hand, cv. Doçar and cv. Doce, known by low values of tartaric and special low values of malic acid (Laranjo, 1991) as these results prove, are not rich in sugar as their names ‘sweet’ suggest.

In the wines (Table IV), the oenological performance between the varieties is similar to that revealed by the must values. The ethanol values differentiate some white varieties like cv. Lameiro, cv. Esganoso, cv. Pintosa and cv. Cascal, in harmony with the soluble solids (“Brix) of the corresponding musts; exception with the cv. Cainho, which perhaps didn’t transform all the sugar (1,6 g glucose/L). Between the red varieties, we distinguish cv. Labrusco, cv. Doce, cv. Espadeiro Mole and cv. Mourisco, also in harmony with the soluble solids.

Concerning the acids into the wine, the cv. S. Mamede keeps the higher value of tartaric in the berry (Figure 3), and the cv. Cascal, besides a low value of tartaric maintains the same values (1.7 g/L) of the two main organic acids: tartaric and malic revealed in the berry (Figure 3). The low value of acid lactic of the cv. Esganoso, suggest the occurrence of the malolactic fermentation, process not controlled in these wines. Between the red wines, the malolactic fermentation occurs in all the wines excepting in cv. Sezão.

CONCLUSIONS

The results obtained until this moment are very important in the defence of the minority varieties of *Vitis vinifera L.*, also autochthonous of the *Vinhos Verdes* DOC region. In this study, we found varieties with good yield potential, somewhat excessive (cv. Lameiro and cv. Verdelho); with low acidity (cv. Cascal, cv. Doçal, cv. Doce and cv. Mourisco) and with high sugar content (cv. Cascal, cv. Cainho, cv. Labrusco, cv. Doce and cv. Mourisco). One white variety, cv. Pintosa, earlier than cv. Loureiro (mid-season) and the majority with a ripening date not later than 10 days in 2012th and two or three red varieties earlier than cv. Vinhão (mid-season) and also, the majority with a ripening date not later than 10 days in both years.

Besides the genetic interest in the preservation of these varieties, they also could be recuperated to equilibrate the vinic masses, actuality much homogenous with the restrictive number of cultivars in culture.

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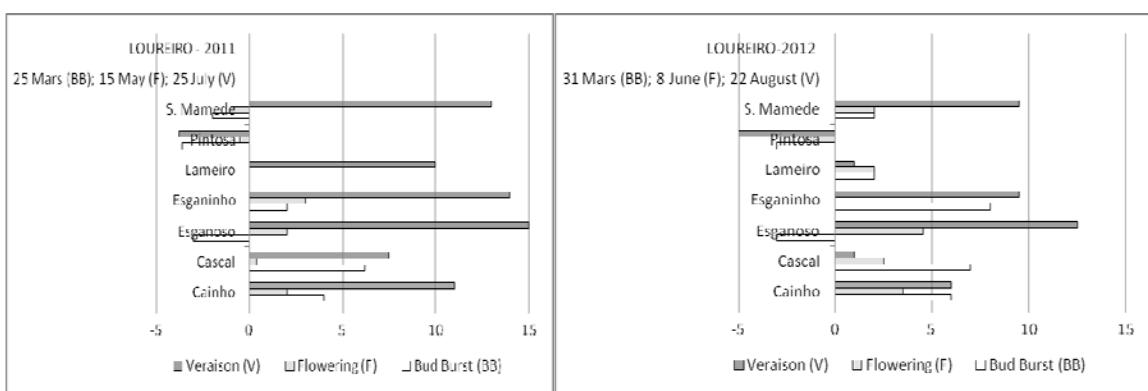


Figure 1. Phenological behaviour of the seven white grapevine varieties, comparing with cv. Loureiro. Two seasons (2011 and 2012) are shown.

Figure 1. Comportement phénologique des sept variétés blanches, en comparaison avec cv. Loureiro. Deux années (2011 et 2012) observés.

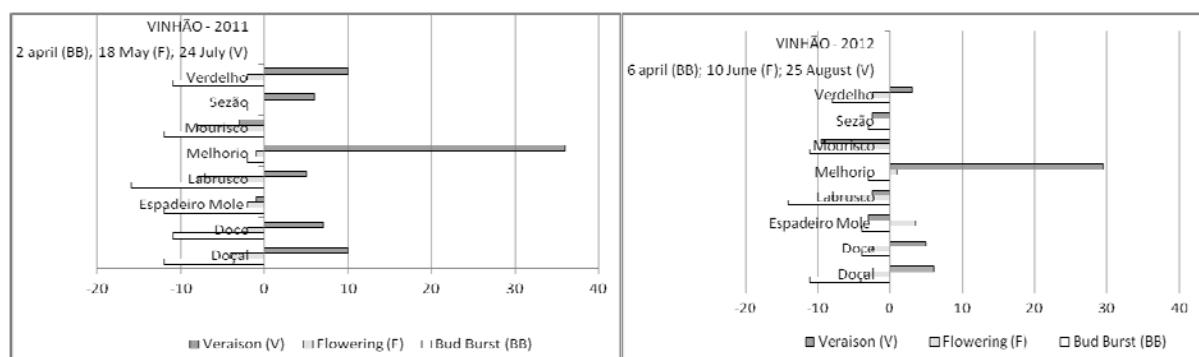


Figure 2. Phenological behaviour of the eight red grapevine varieties, comparing with cv. Vinhão. Two seasons (2011 and 2012) are shown.

Figure 2. Comportement phénologique des huit variétés rouges, en comparaison avec cv. Vinhão. Deux années (2011 et 2012) observés.

Table I. Vegetative and productive potential of the cultivars at flowering. Average of two seasons (2011 and 2012) are shown.

Tableau I. Potentiel productif et végétatif des variétés à la floraison. Moyenne de deux années (2011 et 2012) en évidence.

VARIETY TYPE	Bud crop (n° vine ⁻¹)	Bud burst index	Inflorescences number (n° vine ⁻¹)	Fertility (n° inflorescences/shoot)
White Grape Variety	Cainho	35.1 a	1.329 a	76.3 a
	Cascal	33.8 a	0.831 d	27.4 c
	Esganinho	26.4 b	0.930 cd	32.7 c
	Esganoso	31.0 ab	1.019 bcd	34.1 c
	Lameiro	34.5 a	1.205 ab	52.1 b
	Pintosa	33.9 a	0.894 d	31.0 c
	S.Mamede	27.6 b	1.159 abc	46.5 b
	Sig.	***	***	***
Red Grape Variety	Doçar	29.6 de	0.976 ab	20.4 d
	Doce	32.1 cde	0.765 b	32.8 cd
	Espadeiro Mole	33.0 cd	0.996 ab	48.1 bc
	Labrusco	41.2 a	1.051 a	68.6 a
	Melhorio	27.9 e	1.016 a	34.6 cd
	Mourisco	38.0 ab	0.968 ab	65.3 a
	Sezão	34.3 bcd	0.929 ab	58.4 ab
	Verdelho	35.1 bc	0.856 ab	48.4 bc
	Sig.	***	***	***

Means within columns designated by different letters are significantly different by Tukey HSD test ($p=0.05$).

*** indicate significance at $p<0.001$.

Table II. Bunch and berry characterization and yield potential (average of two seasons: 2011 and 2012). Bunch size (OIV 202); berry size (OIV 220) and juice yield (OIV 233)

Tableau II. Caractérisation des grappes et des baies et potentiel de production (moyenne de deux années: 2011 et 2012). Dimension de la grappe (OIV 202); dimension de la baie (OIV 220) et rendement en jus (OIV 233)

VARIETY TYPE	Bunch Size Length (cm) × Width (cm)	Bunch Weight (g)	Yield (kg/m ²)	Berry Size Length (mm) × Width (mm)	Berry Weight (g)	Must yield (ml juice / 100 g berries)
White Grape Variety	Cainho	7.7 × 6.4	51 d	0.629 e	10.8 × 11.2	1.14 c
	Cascal	13.2 × 9.2	332 b	1.518 bc	14.1 × 13.8	2.24 a
	Esganinho	11.6 × 7.6	176 c	0.871 de	13.7 × 13.8	1.54 b
	Esganoso	9.8 × 7.8	213 c	1.121 cde	14.6 × 13.4	1.84 b
	Lameiro	15.2 × 10.0	359 ab	2.639 a	13.2 × 12.8	1.53 b
	Pintosa	16.8 × 12.4	391 a	1.822 b	14.5 × 15.6	2.26 a
	S.Mamede	14.5 × 8.6	178 c	1.329 bcd	14.3 × 14.1	1.53 b
	Sig.	-	***	***	-	***
Red Grape Variety	Doçar	12.2 × 7.4	123 c	0.353 c	13.5 × 14.2	1.86 abc
	Doce	16.4 × 12.0	252 b	1.258 b	13.1 × 12.5	2.08 abc
	Espadeiro Mole	9.4 × 6.6	97 c	0.682 bc	13.6 × 13.3	1.69 bc
	Labrusco	10.6 × 6.6	110 c	1.109 b	12.7 × 11.2	1.07 d
	Melhorio	12.4 × 7.6	138 c	0.763 bc	14.1 × 15.4	2.15 ab
	Mourisco	11.8 × 8.6	123 c	1.189 b	14.3 × 14.2	2.22 a
	Sezão	10.7 × 6.5	129 c	1.185 b	14.1 × 13.9	1.85 abc
	Verdelho	15.6 × 11.4	386 a	2.535 a	13.6 × 13.3	1.60 c
	Sig.	-	***	***	-	***

Means within columns designated by different letters are significantly different by Tukey HSD test ($p=0.05$).

*** indicate significance at $p<0.001$.

Table III. Vegetative growth and vine balance. Values of one season (2011)**Tableau III.** Croissance végétative et équilibre. Valeurs d'un cycle végétatif (2011)

VARIETY TYPE	Yield (kg vine ⁻¹)	Pruning weight (kg vine ⁻¹)	Cane weight (g)	Ravaz Index
White Grape Variety	Cainho	4.4 c	1.4 bc	34.4 c
	Cascal	13.1 ab	2.3 ab	117.3 a
	Esganinho	5.7 c	0.7 c	42.1 bc
	Esganoso	7.7 bc	3.1 a	108.3 a
	Lameiro	18.6 a	2.2 ab	66.4 abc
	Pintosa	13.5 ab	2.8 a	106.1 ab
	S. Mamede	9.9 bc	1.8 abc	96.3 abc
	Sig.	***	***	***
Red Grape Variety	Doçar	2.2 c	1.3 a	42.3 bc
	Doce	10.1 b	1.9 a	71.3 abc
	Espadeiro Mole	6.7 bc	2.0 a	64.7 abc
	Labrusco	8.0 bc	1.0 a	26.1 c
	Melhorio	6.6 bc	1.1 a	43.5 bc
	Mourisco	9.6 b	1.6 a	56.7 abc
	Sezão	9.7 b	2.6 a	94.3 a
	Verdelho	21.4 a	2.3 a	79.9 ab
	Sig.	***	ns	***

Means within columns designated by different letters are significantly different by Tukey HSD test ($p=0.05$).

*** and ns indicate significance at $p<0.001$, and not significant, respectively.

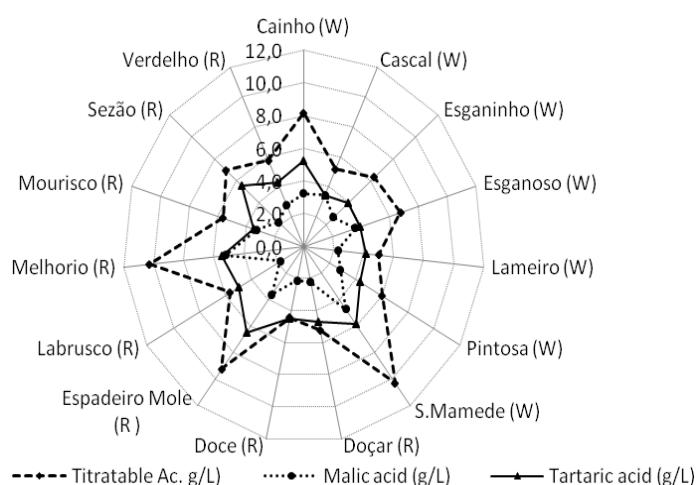
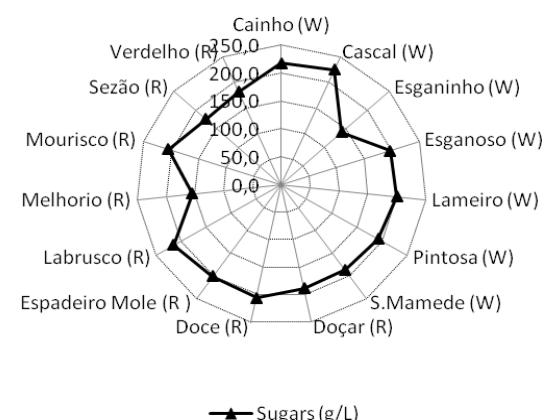


Figure 3. Results of the musts from the berries samples at ripening. Average of three years (2010-2012). W = white variety; R = red variety.

Figure 3. Résultats des moûts issus des échantillonnages des baies à la maturation. Moyenne de trois années (2010-2012). W = variété blanche; R = variété rouge.

Table IV. Physical-chemical parameters of the wines obtained by microvinification (vintage 2011). Means \pm Standard Deviation. GLU= Glucose; FRU= Fructose; GLY= Glycerol; ETH= Ethanol; TART= Tartaric acid; MAL= Malic acid; SUC= Succinic acid; LACT= Lactic acid.

Tableau IV. Paramètres physique et chimique des vins obtenus par micro vinification (vintage 2011). Moyennes \pm Standard Déviation. GLU= Glucose; FRU= Fructose; GLY= Glycérol; ETH= Éthanol; TART= Tartrique acide; MAL= Malique acide; SUC= Succinique acide; LACT= Lactique acide.

VARIETY TYPE	Must	Wine									
		Soluble solids (°Brix)	GLU (g/L)	FRU (g/L)	GLY (g/L)	ETH (g/L)	TART (g/L)	MAL (g/L)	SUC (g/L)	LACT (g/L)	
White Grape Variety	Cainho	23.2	1.6 \pm 0.56	0.4 \pm 0.01	3.4 \pm 0.14	54. 5 \pm 1.40	3.3 \pm 0.24	2.0 \pm 0.51	0.9 \pm 0.15	1.0 \pm 0.13	
	Cascal	23.2	0.4 \pm 0.03	2.7 \pm 0.25	5.5 \pm 0.26	77.4 \pm 1.34	1.7 \pm 0.03	1.7 \pm 0.51	1.6 \pm 0.19	0.5 \pm 0.04	
	Esganinho	15.4	Sample error								
	Esganoso	20.6	0.1 \pm 0.02	0.3 \pm 0.06	5.1 \pm 0.24	72.5 \pm 0.31	1.6 \pm 0.02	0.4 \pm 0.13	1.3 \pm 0.12	3.3 \pm 0.10	
	Lameiro	19.6	0.7 \pm 0.11	1.1 \pm 0.08	5.6 \pm 0.36	82.4 \pm 2.83	4.5 \pm 0.43	0. 9 \pm 0.17	1.2 \pm 0.01	1.0 \pm 0.16	
	Pintosa	20.6	0.4 \pm 0.11	0.4 \pm 0.04	5.3 \pm 0.15	72.5 \pm 2.16	3.3 \pm 0.05	1.6 \pm 0.04	1.1 \pm 0.18	0.7 \pm 0.02	
	S. Mamede	18.2	1.5 \pm 0.44	-	4.6 \pm 0.01	64.2 \pm 1.85	6.0 \pm 0.27	2.0 \pm 0.02	2.5 \pm 0.14	1.8 \pm 0.16	
Red Grape Variety	Doçar	19.2	0.4 \pm 0.02	0.2 \pm 0.03	5.3 \pm 0.33	49.7 \pm 4.26	1.4 \pm 0.20	0.3 \pm 0.02	5.9 \pm 0.37	2.4 \pm 0.68	
	Doce	21.2	0.5 \pm 0.03	0.3 \pm 0.05	7.0 \pm 0.32	78.4 \pm 2.58	2.0 \pm 0.34	0.2 \pm 0.01	3.2 \pm 0.12	2.5 \pm 0.04	
	Esp. Mole	19.8	0.8 \pm 0.06	0.3 \pm 0.04	7.2 \pm 0.46	74.4 \pm 6.24	3.6 \pm 0.32	0.0 \pm 0.00	6.7 \pm 0.42	3.6 \pm 0.26	
	Labrusco	21.6	0.5 \pm 0.05	0.2 \pm 0.04	6.9 \pm 0.85	82.4 \pm 7.11	2.7 \pm 0.51	0.0 \pm 0.00	2.3 \pm 0.61	2.2 \pm 0.31	
	Melhorio	16.8	0.4 \pm 0.03	0.2 \pm 0.07	4.2 \pm 0.41	46.6 \pm 0.86	2.4 \pm 0.11	0.0 \pm 0.00	3.2 \pm 0.15	2.3 \pm 0.20	
	Mourisco	20.8	0.4 \pm 0.03	0.2 \pm 0.02	6.4 \pm 0.41	68.0 \pm 3.29	1.7 \pm 0.05	0.2 \pm 0.12	2.4 \pm 0.26	2.2 \pm 0.40	
	Sezão	18.4	0.4 \pm 0.01	0.2 \pm 0.02	5.7 \pm 0.30	61.3 \pm 3.23	3.3 \pm 0.22	1.4 \pm 0.15	2.1 \pm 0.51	1.7 \pm 0.07	
	Verdelho	16.0	0.4 \pm 0.01	0.1 \pm 0.04	5.2 \pm 0.53	55.2 \pm 3.58	4.3 \pm 0.20	2.2 \pm 0.36	3.7 \pm 1.15	3.1 \pm 0.54	