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The impact of some commercial yeast strains on aroma compounds and sensorial analysis on two white wine varieties made in PGI Dealurile Olteniei, Romania

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Abstract. Eight wines of Pinot gris and five wines of Sauvignon blanc obtained by fermenting grape juices from PGI Dealurile Olteniei with different commercial selected yeast strains and with indigenous microbiota were compared in terms of sensorial characteristics and their composition in minor volatile aroma compounds. An easy handle methodology with dynamic head-space trap, Gas Chromatography-Mass Spectrometry based, (HS-trap-GC-MS) permits the identification of 49 aroma compounds. The aim of the work was to link these aroma compounds, arranged in different chemical families, with the sensorial analysis and to establish the characteristics of each biotechnology used in the trials so we can find solutions to improve the quality of white wines made in hot climate zone that in time was a traditional area of red wines.

1. Introduction

Ever since oldest times the hill areas of PGI Dealurile Olteniei have proven excellent conditions for winegrowing and especially for the red wine producing grapes varietis as the great savant Ion Ionescu de la Brad mentioned in 1868 in "Agricultura Română din judeţul Mehedinţi": "... the greatest benefits from the vineyards come from Blahniţa and Câmpul areas where the famous vineyards of Oreviţa, Rogova, Drância, Oprişorul are located". In this context it is well known the potential of Golul Drâncei-Mehedinţi for red wine and also for some white wine according to the official task book of the PGI Dealurile Olteniei (2011). The customer preferences for much more fruity-floral style of white wines requires in the last decades improvements in winemaking technology and new approaches in using biotechnologies in winemaking [6, 19].

It is well known that the wine aroma can be classified according it origin into three groups: primary (varietal and pre-fermentative included), secondary (fermentative) and tertiary aroma (wine ageing). As the primary aromas cannot be developed into a very worm climate and the tertiary aroma is not so welcomed for fresh & fruity style white wines the winemakers in the area need to play different strategies in order to achieve as much as possible new and stronger aromas in the wines.

The description of wine aroma is not a simple task for researchers because more than 800 volatile compounds have been identified at a wide range of chemical families and concentration levels [5, 12–14]. The combination of varietal and fermentative aromas are the first quality factor for the differentiation of the white wines obtained from a certain variety and in a certain terroir. In the context of a competitive global market some few international grape varieties in some traditional production areas have been intensely studied [1, 2]; nevertheless the characteristics of different indigenous varieties or the potential of international varieties in different East-European areas remain still unknown at the present day.

The differences among wines produced from the same grape variety, same PGI, from the same vintage, at the same ripening period and subjected to the same pre-fermentative treatments, but whose fermentations are carried out with different selected yeasts or with indigenous yeasts should be caused to the effect of inoculated yeast that offers undeniable advantages regard to the control and homogeneity of the fermentations [14, 15]. Despite these assertions, some researchers have not found appreciable differences between fermentations carried out with selected yeasts and those performed with indigenous yeasts. In the opinion of some authors it is advisable to use selected yeasts in new wine-growing areas, from early stages of fermentation, while indigenous yeasts are preferable in well-established areas [4, 8, 11, 16].

In recent years, hyphenated techniques have received ever-increasing attention as the principal means to solve complex analytical problems. This way, the use of Gas Chromatography (GC), coupled to Mass Spectroscopy (MS), in combination with dynamic head-space trap (HS-trap) showed a powerful integrated platform for the analysis of the volatile compounds present in grape, juice or wine samples [2, 3, 18].

This work is focused to the application of modern analytical techniques (HS-GC-MS) and sensorial analysis for the differentiation of wines obtained from the same musts (8 wines of Pinot Gris and 5 wines of Sauvignon blanc) using different starter cultures. The aim is to evaluate the influence of the yeasts on the organoleptic character in order to find the biotechnological solution that can achieve the proper solution for the commercial approach of the wine style.

2. Material and methods

2.1. Experimental wines production

In order to conduct this study, grapes of Pinot gris and Sauvignon blanc variety, healthy, at the technological maturity, manually harvested from Oprişor - Golul Drâncei vineyard - PGI Dealurile Olteniei area, were used. The experiment was conducted three vintages: 2013, 2014 and 2015. The grapes were destemmed and crushed. In the case of Sauvignon Blanc the mash was kept for a 6 hours maceration at 10 °C. The obtained must was homogenized and transferred to 5000 litres stainless steel tanks - 8 tanks (in the case of Pinot Gris) and 5 tanks (in the case of sauvignon Blanc) in equal quantities, for batch fermentation. For each year the same enzymatic products for clarification and selected yeasts for controlled fermentation were used. The difference between the variants consisted in the way the clarification was made (gravitational or enzyme-gravitational) and the use or not of various selected yeast strains for the alcoholic fermentation.

For Pinot gris the experimental variants were the following:

PG0 - control, gravitational clarification of the juice, no enzyme treatment, fermentation 18-20 °C, spontaneous fermentation

PG1 - gravitational clarification of the juice, no enzyme treatment, fermentation 16–18 °C, selected yeast Y1

PG2 - gravitational clarification of the juice, enzyme treatment E1 2 g/hL, fermentation 16–18 °C, selected yeast Y1

PG3 - gravitational clarification of the juice, enzyme treatment E2 1 g/hL, fermentation 16–18 °C, selected yeast Y1

PG4 - gravitational clarification of the juice, enzyme treatment E3 1 g/hL, fermentation 1618 °C, selected yeast Y1

PG5 - gravitational clarification of the juice, enzyme treatment E3 1 g/hL, fermentation 16–18 °C, selected yeast Y2

PG6 - gravitational clarification of the juice, enzyme treatment E3 1 g/hL, fermentation 16–18 °C, selected yeast Y3

PG7 - gravitational clarification of the juice, enzyme treatment E3 1 g/hL, fermentation 16–18 °C, selected yeast Y4

For Sauvignon blanc the experimental variants were the following:

SB0 - control, prefermentative cold maceration at 10 °C, 6 hours, gravitational clarification of the juice, no enzyme treatment, fermentation 18–20 °C, spontaneous fermentation.

SB1 - prefermentative cold maceration at 10 °C, 6 hours, gravitational clarification of the juice, enzyme treatment E1 2 g/hL, fermentation 14–16 °C, selected yeast Y2

SB2 - prefermentative cold maceration at 10 °C, 6 hours, gravitational clarification of the juice, enzyme treatment E1 2 g/hL, fermentation 14–16 °C, selected yeast Y3

SB3 - prefermentative cold maceration at 10 °C, 6 hours, gravitational clarification of the juice, enzyme treatment E1 2 g/hL, fermentation 12–14 °C, selected yeast Y

SB4 - prefermentative cold maceration at 10 °C, 6 hours, gravitational clarification of the juice, enzyme treatment E1 2 g/hL, fermentation 12–14 °C, selected yeast Y6.

All fermentation were made at controlled temperature (12–18 °C) in Oprisor wine cellar of Carl Reh Winery. The commercial yeast strains were encoded from Y1 to Y6. After the end of alcoholic fermentation (when ethanol content remained constant), a sample of 10 L (glass container) was filtered using BVT-20 filter sheets (Omniafiltri, Italy) and stored in cellar conditions (5–10 °C). All wines were analysed two months after filtration.

2.2. Gas-chromatographic analysis of volatile compounds

In order to conduct the determination of the volatiles compounds, all samples were analysed using head space technique with enrichment on a trap material connected to a gas chromatograph with a mass spectrometer detector (Shimadzu HS 20 trap-GC2010plus-MS8040TQ). The system uses helium as carrier gas and the adsorption material in trap as stationary phase is a resin of 2,6-diphenylene oxide (TENAX). At 6 mL of wine were added a mixture of 0.8 g from the following salts NaCl, Na_2SO_4 and KH_2PO_4 in a vial for analysis of vapours (headspace fraction) by the method of salting out. All samples were heated to 70 ºC and shacked at 25 rpm for 5 minutes and then the vials were pressurised to 60 KPa with helium to remove condense. The volatile fraction is transferred in to a Tenax trap at -10 °C by a transfer line at 150 °C. Before injection for half a minute the trap is dry purged and then the volatiles are transferred at 280 °C with a split of 1/50 in to the analytic column. The separation column used is a Phenomenex® ZB WAXplus 60 m × 0.25 mm ID ×0.15 μm which is contained in a temperature - controlled oven. Temperature program for separation begins: constant for 3 minute (the total injection time 2 minute) at 82 °C raped with 3 °C/min. to 135 °C, maintained for 1 minute, then 7.5 °C/min. up to 160 °C, maintained for 1 minute and finally raped with 27 °C/min. to 240 °C constant for 8 minute (total temperature program 37 minutes). Separation is carried-out at a constant linear velocity of 35 cm/s (column flow 1.5 mL/min). The 8040 triple quadrupole is utilised in Q3 (third quadrupole) scan mode from 30–400 Da at 0.1 s event time (5000 scan/sec). The ion source interface is maintained at 230 °C and source at 200 °C. The results are processed qualitatively comparing them to different MS databases available: Nist14, Willey 10th, FFNSC and SZTERP. For the quantitative results, all samples are processed by internal standard method relative to 4-methyl-penta-2-ol.

2.3. Sensory evaluation

For each vintage a wine sensory evaluation were performed two months after bottling by an expert panel

Table 1. Analytical parameters of experimental variants, variety Pinot gris, vintages 2013–2015.

Experimental Variant and Vintage	Alcohol %v/v	Total Acidity g/L g/L tartaric ac tartaric ac	Reducing substances g/L	Volatile acidity g/L acetic ac acacid	SO_2 free mg/L	SO_2 total mg/L	pH
PG0–2013	13.3	5.8	7.2	0.48	25	110	3.42
PG0–2014	12.9	6.0	4.1	0.40	26	105	3.29
PG0–2015	13.5	6.2	7.4	0.73	28	118	3.48
PG1–2013	13.7	5.8	2.6	0.32	28	109	3.40
PG1–2014	13.1	6.1	3.7	0.40	26	107	3.33
PG1–2015	13.8	6.0	3.6	0.52	28	120	3.45
PG2–2013	13.6	5.9	2.9	0.28	34	109	3.42
PG2–2014	13.1	6.1	3.5	0.39	24	105	3.27
PG2–2015	13.8	6.2	3.7	0.49	34	120	3.43
PG3–2013	13.7	5.8	2.6	0.29	32	111	3.42
PG3–2014	13.0	6.0	3.4	0.39	27	105	3.31
PG3–2015	13.7	6.1	3.6	0.47	35	117	3.48
PG4–2013	13.7	5.8	2.7	0.26	34	109	3.44
PG4–2014	13.1	6.1	3.4	0.38	28	104	3.30
PG4–2015	13.8	5.9	3.3	0.48	33	122	3.47
PG5–2013	13.7	5.8	2.9	0.28	36	108	3.43
PG5–2014	13.2	6.1	3.1	0.36	32	108	3.32
PG5–2015	13.7	5.9	3.8	0.49	35	120	3.49
PG6–2013	13.6	5.9	3.1	0.26	34	109	3.42
PG6–2014	13.2	6.1	2.8	0.35	30	104	3.30
PG6–2015	13.8	6	3.6	0.50	36	119	3.47
PG7–2013	13.6	5.8	3.0	0.32	34	111	3.44
PG7–2014	13.1	6.1	3.2	0.36	28	106	3.31
PG7–2015	13.7	6.1	3.5	0.54	33	122	3.46

Table 2. Analytical parameters of experimental variants, variety Sauvignon blanc, vintages 2013–2015.

Experimental Variant and Vintage	Alcohol %v/v	Total acidity g/L tartaric ac tartaric ac	Reducing substances g/L	Volatile acidity g/L acetic ac aacid	SO_2 free mg/L	SO_2 total mg/L	pH
SB0 - 2013	12.8	5.9	5.3	0.38	28	111	3.34
SB0 - 2014	11.8	6.1	4.8	0.45	30	115	3.21
SB0 - 2015	13.4	6.6	3.9	0.79	32	125	3.15
SB1 - 2013	13.1	6.0	3.1	0.21	38	109	3.35
SB1 - 2014	12.0	6.1	3.3	0.34	39	113	3.23
SB1 - 2015	13.6	6.5	3.2	0.62	39	122	3.11
SB2 - 2013	13.1	5.9	2.9	0.19	37	108	3.32
SB2 - 2014	12.1	6.2	3.4	0.36	38	112	3.22
SB2 - 2015	13.6	6.7	3.1	0.73	38	124	3.17
SB3 - 2013	13.0	6.0	3.9	0.46	32	110	3.34
SB3 - 2014	11.9	6.0	3.7	0.52	32	115	3.21
SB3 - 2015	13.5	6.5	3.5	0.85	34	125	3.19
SB4 - 2013	13.0	6.0	3.4	0.36	34	109	3.33
SB4 - 2014	12.0	6.1	3.5	0.35	34	114	3.23
SB4 - 2015	13.5	6.5	3.4	0.73	36	123	3.20

of 5 members of Romanian Wine Tasters Association with experience as sensory judges (same members each year). Blind tests were carried out for each grape variety by comparing the control with the variants. Samples were served in ISO glasses and coded with random two digit numbers. Judges were asked to fill two different sheets: one with general attributes of the wines (smell, taste, overall harmony), one with sensory descriptors considered typical for each variety (Pinot Gris: aroma intensity, complexity, fruit aromas, flowers, vegetal, citrus, exotic, mineral; Sauvignon Blanc: aroma intensity and complexity, fruit aromas, flowers, vegetal, citrus, exotic, acacia, elder, green nuts) using marks from 1 to 9 for each sensory descriptor.

3. Results and discussion

3.1. Oenological characteristics

Tables 1 and 2 lists the values for the basic enological chemical analysis for the two varieties technological variants. Both controls (PG0 and SB0) regardless of vintage showed the lowest ethanol content and the highest values

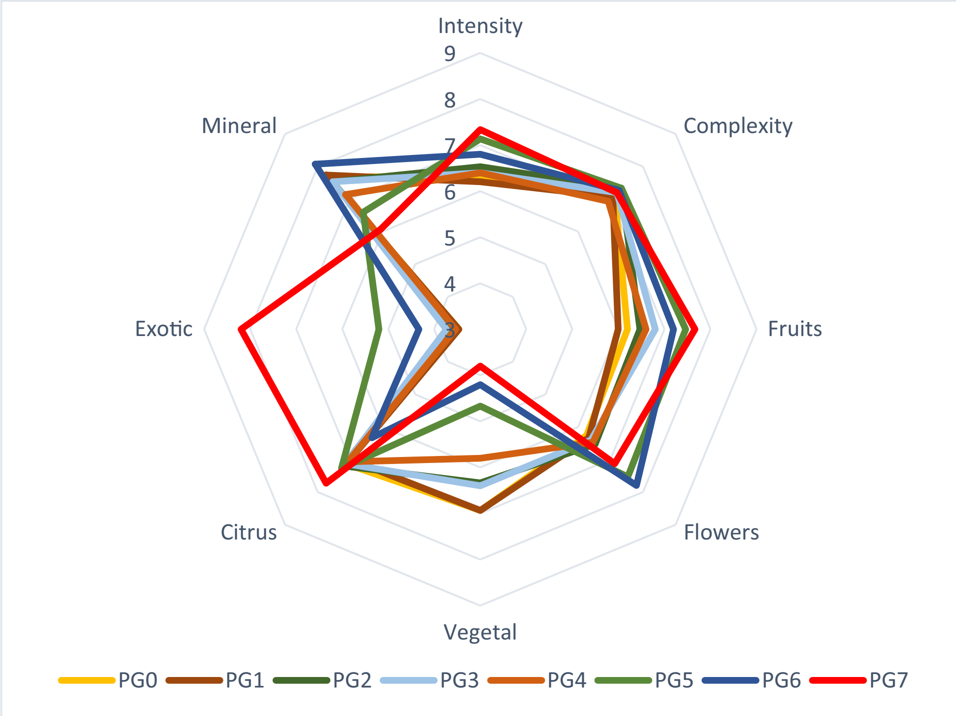

Figure 1. Sensory evaluation of Pinot gris wines fermented with different selected yeasts, PGI Dealurile Olteniei, averages 2013–2015.

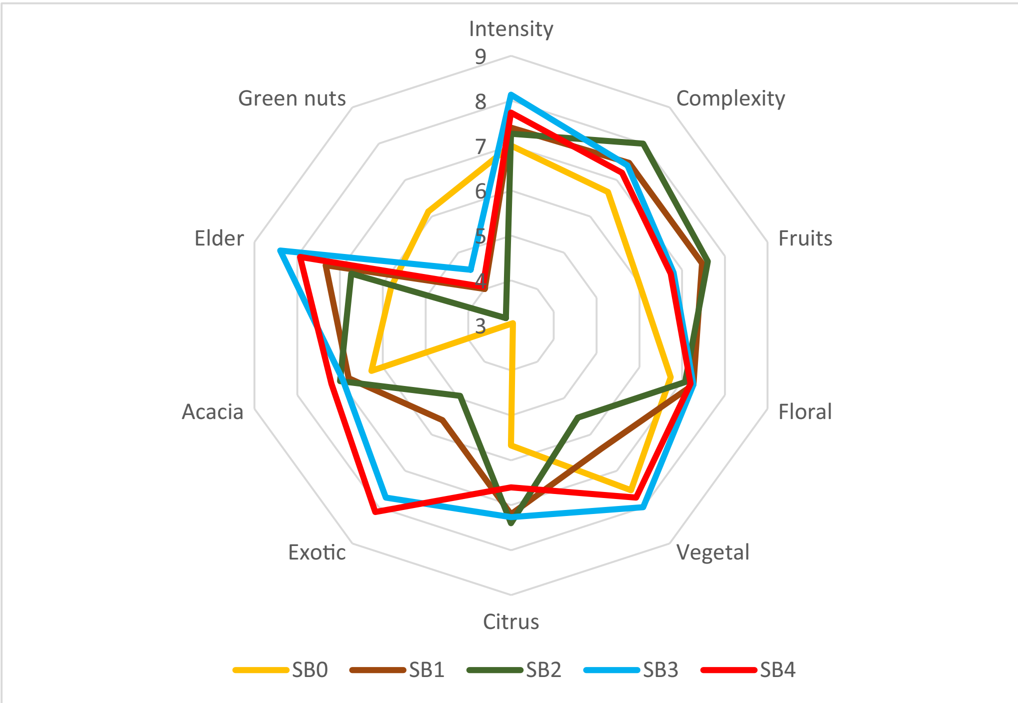

Figure 2. Sensory evaluation of Sauvignon blanc wines fermented with different selected yeasts, PGI Dealurile Olteniei, averages 2013–2015.

of the residual sugars, generally being not considered like dry wines (less than 4 g/L residual sugar). Some selected yeast, Y1 and Y2, were able to ferment every vintage untill less residual sugar. The fermentation carried out by selected yeasts showed slight differences among them with respect to all oenological variables quantified. The volatile acidities were systematically bigger in controls comparing with other variants, unconcerned the variety or vintage.

3.2. Sensory evaluation

The aim of this test was to evaluate if there were significant differences on the organoleptic characteristics among the young wines obtained using indigenous microbiota and different selected yeast with the goal to improve the overall quality of the white wines.

For Pinot gris as it is shown in Fig. 1 the enzyme used in clarification influences some organoleptic

Table 3. Sensory evaluation of Pinot gris wines fermented with different selected yeasts, PGI Dealurile Olteniei, results vintage 2015 compared with average 2013–2015.

Variant	Intensity	Complexity	Fruits	Floral	Vegetal	Citrus	Exotic	Mineral
PGO- 2015	6.20	7.40	6.40	6.60	6.60	7.20	3.80	7.60
AVPGO	6.33	7.13	6.20	6.27	6.93	7.13	3.47	7.67
PG1- 2015	6.20	7.60	6.20	6.80	6.80	6.80	3.20	7.40
AVPG1	6.20	7.07	6.00	6.33	6.93	7.00	3.47	7.73
PG2- 2015	6.40	8.20	6.60	7.00	6.40	7.20	3.60	7.20
AVPG2	6.53	7.33	6.47	6.53	6.33	7.20	3.67	7.53
PG3- 2015	6.20	8.00	6.80	6.80	6.20	7.60	4.20	7.00
AVPG3	6.40	7.20	6.80	6.40	6.40	7.13	3.73	7.53
PG4- 2015	6.20	7.40	6.60	6.20	5.60	7.20	3.60	6.60
AVPG4	6.40	6.93	6.60	6.47	5.80	7.07	3.53	7.13
PG5- 2015	7.20	7.80	7.40	7.60	4.20	7.60	6.20	5.80
AVPG5	7.13	7.33	7.47	7.53	4.67	7.27	5.20	6.60
PG6- 2015	6.60	7.20	7.20	8.00	4.40	6.40	4.80	8.00
AVPG6	6.80	7.27	7.20	7.80	4.20	6.33	4.33	8.07
PG7- 2015	7.20	7.40	8.20	7.20	3.40	7.80	8.60	5.40
AVPG7	7.33	7.20	7.67	7.13	3.80	7.73	8.20	6.07

Table 4. Sensory evaluation of Sauvignon blanc wines fermented with different selected yeasts, PGI Dealurile Olteniei, results vintage 2015 compared with average 2013–2015.

Variant	Intensity	Complexity	Fruits	Floral	Vegetal	Citrus	Exotic	Acacia	Elder	Green nuts
SB0 - 2015	7.00	6.60	6.40	7.00	7.60	5.20	2.60	6.00	5.40	6.20
AV SB0	7.00	6.67	6.00	6.73	7.53	5.67	2.93	6.27	5.80	6.13
SB1 - 2015	7.40	7.80	8.20	7.60	5.40	7.80	6.20	7.00	7.60	4.20
AV SB1	7.40	7.47	7.47	7.27	6.40	7.20	5.60	6.80	7.33	4.00
SB2 - 2015	7.60	8.20	8.60	7.20	4.20	7.00	6.20	6.40	7.20	3.60
AV SB2	7.27	8.00	7.60	7.07	5.53	7.40	4.93	7.00	6.73	3.20
SB3 - 2015	8.40	8.00	7.40	6.80	7.80	7.20	8.40	7.40	8.40	3.80
AV SB3	8.13	7.40	6.80	7.27	8.00	7.27	7.73	6.93	8.40	4.53
SB4 - 2015	7.80	7.40	7.80	7.60	8.20	6.80	8.20	7.80	8.20	4.20
AV SB4	7.73	7.20	6.73	7.20	7.73	6.60	8.13	7.20	7.93	4.07

characteristics (less vegetal, much more fruity/floral aromas) compared with control, but there are not significant differences between different types of enzymes. All controls showed sometimes more aromatic complexity but systematically were less intense compared with the variants fermented with selected yeasts. Among the selected yeasts Y2 and Y4 excels in accentuating some exotic, floral-fruity aromas.

For Sauvignon blanc as it is shown in Fig. 2 the controls are less intense in aromas unconcerned the vintage. Some selected yeasts, Y5 and Y6, showed systematically good marks for exotic aromas, elder and acacia flowers and Y2 were much more consistent in fruit and floral, exotic aromas.

3.3. Identification of free wine volatile compounds and correlation with wine sensory results

Identification of maximum 49 relevant volatile wine compounds was performed by using authentic standards NIST08 and Wiley7 mass spectral databases. We were more interested in esters because they are formed by yeasts during the alcoholic fermentation and they are responsible for the fruity aromas of fresh white wines [4]. The results of GC-MS analysis are in Table 5 for Pinot Gris and in Table 6 for Sauvignon Blanc. Table 5 Volatile aroma compounds identified in Pinot gris wines fermented with different selected yeasts, PGI Dealurile Olteniei, vintage 2015 Table 6 Volatile aroma compounds identified in Sauvignon blanc wines fermented with different selected yeasts, PGI Dealurile Olteniei, vintage 2015.

Regarding the correlations between chemical compounds and the results of sensory analysis we can comment the following: for Pinot gris the high mark of exotic notes for PG7 can be explained by higher concentration of ethyl propionate that is usually responsible for tropical aromas [9]; the higher concentration of methyl octanoate (grass aromas) and isoamyl hexanoate (tomato leaf notes) [17,19] explain the bigger marks of vegetal notes for the control PG0; from the other hand the higher concentration of butyl acetate (sensory attributes – citrus) or isobutyl acetate (passion fruit) [10] for variant PG7 have not any correspondence in the wine tasting marks.

For Sauvignon blanc the higher marks for elder and vegetal notes of SB3 and SB4 can be explained by higher concentration of isobutyl acetate and ethyl nonanoate (sensory attributes - cat urine) [7]; the increasing from SB0 to SB4 of the exotic marks can be explained by higher concentration of ethyl propionate. The vegetal notes in SB0 without exotic and elder high marks can be explained by the higher concentration in isoamyl hexanoate without the support of important concentration of isobutyl acetate or ethyl propionate.

Table 5. Volatile aroma compounds identified in Pinot gris wines fermented with different selected yeasts, PGI Dealurile Olteniei, vintage 2015.

Nr.	Chemical Compound	mvali eq SI							
		Pg0	Pg1	Pg2	Pg3	Pg4	Pg5	Pg6	Pg7
1	1-propanol	6.22	25.46	11.48	18.54	16.43	10.78	40.15	14.69
2	isoamylacetate	110.79	235.11	151.24	143.44	136.31	230.89	112.14	259.66
3	2,6-dimethyl-4-heptanone	19.61	19.16	18.54	22.29	85.77	20.78	32.86	43.89
4	ethyl palmitate	7.46	5.78	6.65	7.88	4.89	5.06	6.07	7.41
5	3-methyl-1-butanol	6043.50	6003.59	5728.61	5942.56	6130.44	5837.36	6121.26	6102.52
6	ethyl nicotinate	3.34	3.82	3.51	4.00	3.12	4.42	5.30	3.23
7	2,3,3 trimethyl 1,7-octadiene	59.83	57.17	64.73	80.94	42.26	45.81	24.51	70.97
8	3-hexen-1-ol, acetate	25.66	4.57	15.54	30.39	582.99	12.06	20.50	19.40
9	3 methyl 1-pentanol	591.68	576.07	564.65	569.52	1286.18	600.23	1028.71	542.58
10	octanoic acid, ethyl ester	0.98	2.62	3.22	2.87	2.98	8.17	2.86	1.42
11	isoamyl hexanoate	42.37	13.31	18.40	22.44	18.94	22.81	23.27	20.93
12	3-hexen-1-ol	2792.63	581.45	4051.92	1451.26	1876.14	2363.82	2536.75	2626.27
13	isobuthyl acetate	0.23	1.98	2.79	2.42	3.48	3.59	1.24	4.98
14	2-propanone, 1-hydroxy-	4.79	12.95	9.65	10.05	8.76	10.24	6.89	2.88
15	3-pentanol	106.51	262.13	133.40	192.55	20.67	81.83	48.91	281.39
16	1-propanol, 3-ethoxy-	2.46	2.45	2.98	1.74	3.25	2.37	1.82	0.98
17	ethyl pelargonate	0.98	3.68	2.76	3.04	2.42	2.98	3.26	3.17
18	1-methoxy-3-2-hydroxyethyl nonane	10.30	7.22	5.37	8.03	6.48	11.10	19.53	5.83
19	1-methoxy-3-hydroxymethylheptane	2.70	1.98	3.29	5.89	7.55	2.57	3.76	2.78
20	2,5-dimethyl-1-hepten-4-ol	7.51	12.43	15.96	14.84	15.47	12.89	13.67	10.45
21	ammonium oxalate	17.99	15.06	18.74	8.05	3.12	11.52	12.54	23.40
22	benzaldehyde	7.45	14.71	17.31	15.70	16.48	12.91	15.72	12.93
23	ammonium acetate	2796.81	2481.46	3679.23	2595.40	810.15	3847.11	3270.45	2463.41
24	ethyl nonanoate	3.47	10.76	12.89	18.21	16.62	12.78	14.90	14.37
25	propanoic acid	45.52	2.97	3.04	27.48	43.02	59.44	50.96	68.28
26	3-methylbutyl ester	1981.13	3176.19	3176.02	2465.39	4348.94	2639.88	2718.06	3175.19
27	n-Butyric acid	23.51	24.80	21.60	22.42	26.68	44.92	55.26	21.89
28	diethyl ester	5.64	9.55	5.78	10.85	26.35	7.90	13.97	28.36
29	isovaleric acid	126.93	78.74	124.85	103.08	66.62	93.97	144.05	112.58
30	hexanoic acid	16.30	7.66	15.32	7.35	2.05	28.24	27.27	8.37
31	hexanal	23.29	20.24	21.16	14.66	18.76	21.42	31.71	21.72
32	2-phenylethyl ester	9.34	3.29	7.55	5.65	2.32	4.56	5.78	5.32
33	ethyl laurate	2.76	5.62	4.60	5.76	4.24	5.20	3.14	2.78
34	pentadecanoic acid 3-methylbutyl ester	90.90	91.29	58.06	94.72	66.43	46.95	74.52	89.45
35	hexanoic acid	269.11	430.30	349.87	316.75	583.85	304.70	312.08	388.74
36	methyl 3-nonenoate	14.79	12.89	16.21	12.65	24.09	16.26	19.04	15.76
37	phenylethyl alcohol	579.40	510.72	520.54	445.13	505.82	659.49	730.59	512.99
38	Ethyl trans-2-hexenoate	3.45	1.45	1.29	2.99	2.64	2.45	1.98	3.25
39	1-dodecanol	369.06	391.57	369.28	312.81	842.49	395.23	407.71	361.96
40	tetradecanoic acid ethyl ester	3.31	4.30	1.98	2.70	3.96	2.76	2.45	2.41
41	ethyl palmitate	1.12	4.49	3.52	2.61	4.12	3.98	4.23	1.34
42	octanoic Acid	4.80	14.92	12.67	13.63	14.88	18.64	12.89	15.98
43	buthyl acetate	5.86	6.90	8.32	9.15	8.17	9.76	6.20	19.92
44	ethyl heptanoate	558.15	250.34	322.62	355.00	495.30	735.49	879.99	441.44
45	ethyl propionate	0.64	4.54	2.84	3.92	2.72	11.58	7.03	14.50
46	hexadecanoic acid, ethyl ester	1.20	0.98	1.22	1.48	3.37	15.18	27.62	13.31
47	n-decanoic acid	3.40	2.25	1.83	2.43	1,12	2.62	35.82	3.56
48	methyl octanoate	33.23	6.35	16.39	21.89	21.43	15.91	16.74	8.77
49	lauric acid	619.54	798.09	489.55	550.84	558.04	579.43	645.93	467.40

4. Conclusions

The HS-GC-MS hyphenated techniques applied to the analysis of wine volatile compounds permits the differentiation of wines obtained from the same must fermented with different selected (commercial) yeasts.

The study showed that it is possible to correlate these results with sensorial analysis marks for both varieties used in this experiment. Not least, during the three vintages study, some selected yeast showed important characteristics from an organoleptic point of view. Y2 and Y4 for Pinot gris and Y2, Y5 or Y6 for Sauvignon blanc can be appropriate solutions for fresh/fruity style wine wines with increased aromas.

The study confirmed that, even in areas with hot climate and not very suitable for good quality white wines,

Table 6. Volatile aroma compounds identified in Sauvignon blanc wines fermented with different selected yeasts, PGI Dealurile Olteniei, vintage 2015.

Nr.	Chemical compound	mvali eq SI				
		SB0	SB1	SB2	SB3	SB4
1	1-propanol	12.34	13.56	12.89	23.56	33.59
2	isoamylacetate	108.86	135.28	144.75	123.50	81.96
3	1-propanol	22.14	14.33	27.18	15.04	31.75
4	2,6-dimethyl-4-heptanone	37.19	16.24	52.54	6.59	44.40
5	1-butanol, 3-methyl-	1422.81	1359.25	1220.57	1167.35	703.37
6	3-hexen-1-ol	11.11	37.65	31.06	4.52	14.49
7	4-methyl-2-hexanol	7.36	7.63	6.20	6.48	7.97
8	1-pentanol, 3-methyl-	6.85	12.09	8.62	6.83	31.63
9	octanoic acid	2372.05	2773.52	5300.48	2493.99	15.74
10	1-hexanol	11.05	25.70	14.66	8.98	40.92
11	isoamyl hexanoate	40.35	17.11	16.38	21.22	15.12
12	propanoic acid, 2-hydroxy-	226.16	515.32	458.92	337.82	496.13
13	isobuthyl acetate	24.33	35.70	28.24	55.66	40.32
14	2-propanone, 1-hydroxy-	10.36	3.37	2.24	2.74	1.42
15	ethyl pelargonate	7.68	5.50	9.01	4.44	2.34
16	2,5-dimethyl-1-hepten-4-ol	11.06	9.49	8.97	8.42	12.28
17	tridecane, 2-methyl-	4.38	8.11	3.78	4.86	6.87
18	4-heptanol, 2-methyl-	3.45	10.29	12.87	12.27	15.59
19	ammonium oxalate	17.35	9.87	4.37	16.25	6.80
20	1-octanol	5.86	7.96	12.93	5.26	8.47
21	ethyl decanoate	2276.79	2591.14	2943.08	1358.20	2399.89
22	propanoic acid, 2-methyl-	21.45	94.98	32.89	35.37	26.57
23	octanoic acid, 3-methylbutyl ester	4.19	5.48	4.95	5.88	6.16
24	ethyl nonanoate	25.88	20.46	24.28	34.88	29.73
25	n-butyric acid	76.54	152.39	112.64	49.02	30.47
26	butanedioic acid, diethyl ester	42.85	80.34	30.95	37.75	18.12
27	isovaleric acid	4.67	47.39	18.56	2.79	12.12
28	acetic acid	89.97	98.62	106.43	47.22	121.02
29	ethyl laurate	93.28	132.86	148.75	68.27	212.93
30	pentadecanoic acid, 3-methylbutyl ester	13.71	11.32	6.04	4.64	3.68
31	hexanoic acid	490.79	849.21	516.30	398.80	396.54
32	benzenemethanol	3.11	10.68	3.71	2.67	4.24
33	phenylethyl alcohol	363.95	608.57	431.66	342.90	476.11
34	methyl octanoate	8.85	6.00	3.93	3.45	3.64
35	ethyl palmitate	6.86	5.99	2.77	1.12	0.96
36	ethyl miristate	2.12	5.04	21.67	31.48	28.41
37	octanoic Acid	1352.91	2435.94	1350.39	1214.42	1033.28
38	hexadecanoic acid, ethyl ester	13.67	41.15	28.05	87.98	75.69
39	ethyl heptanoate	766.85	900.33	357.31	361.38	286.84
40	ethyl 9-hexadecanoate	10.71	16.59	13.88	16.10	62.50
41	1-hexadecanol	5.89	12.77	11.23	14.72	13.42
42	benzoic acid	9.03	0.94	1.91	2.17	0.36
43	buthyl acetate	4.54	9.99	15.57	16.30	14.01
44	lauric acid	24.63	48.14	29.08	28.37	9.82
45	ethyl propionate	8.34	15.41	15.83	18.30	15.98

we can produce good quality fresh/fruity style wines using the correct and adapted biotechnological solution in winemaking.

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