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Comparing the ancestral and traditional methods of sparkling wine production

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Ancestral sparkling wine production has seen an increase in recent years. Under the label "ancestral method" consumers can find a wide variety of products, as each producer follows their own interpretation of the process without standardised guidelines. This study aims to identify the critical aspects of the ancestral procedure and to compare it to the traditional method.

INTRODUCTION

Most of the Premium sparkling wines in the world, like Champagne, Cava or Franciacorta, are produced following the traditional method, which involves a second fermentation of a base wine in a crown sealed bottle[1 2]. By contrast, the ancestral method is a single-fermentation method that had been historically abandoned due to the technical challenges that it presented[3].

In recent years, there has been a growing interest in ancestral-method sparkling wines, such as pétillant naturels or Pét-Nats, which are currently a huge commercial success in France[4]. The ancestral method offers two key advantages: it enables production of low-SO_2 wine, since there is no need for it once the fermentation has started, and it allows later harvests to be carried out, since no additional sugar is required for a second fermentation[5 6].

The recent commercial success of ancestral sparkling wines has brought to light the lack of scientific literature on the topic. The aim of this work was therefore to evaluate the impact of the ancestral method by producing sparkling wines using both the traditional and ancestral methods from the same grapes.

MATERIALS AND METHODS

Macabeo grapes were harvested when maturity parameters were at 18.6 ºBrix, 3.32 pH and a titratable acidity of 5.2 g tartaric acid/L. The obtained must was cold settled (8 ºC for 24 h + 20 mg/L pectolytic enzymes) and then inoculated with commercial *Saccharomyces cerevisiae* (Lalvin EC1118™, Lallemand, Inc., Montreal, Canada) following the manufacturer instructions. The must density was controlled periodically until 1005 kg/m^3 was reached (around 18.0 g/L of residual fermentable sugars). Two thirds of the fermenting grape juice were racked, cooled to 5 ºC and filtered using a 310 mm diameter plate filter (Cristalinox 310 mm, In Via, Sant Sadurní d'Anoia, Barcelona, Spain) and paper filter sheets (FIBRAFIX® AF 70, Filtrox, Santa Perpètua de Mogoda, Barcelona, Spain) to reduce the yeast population to 6.0 × 10^6 cell/mL (low population experimental condition). This filtered fermenting must was divided into two batches, one without any supplementation and the other supplemented with non-filtered fermenting must until a 12.0 × 10^6 cell/mL yeast population was achieved. During bottling, 20 mg/L of adjuvant 92 (Station Oenotechnique de Champagne, Epernay, France) were added in order to facilitate the riddling process. The remaining fermenting must was kept in the tank until the alcoholic fermentation had finished and was then racked, sulphited (40 mg/L of $K_2S_2O_5$), and stabilised at 4 ºC for a month. The obtained base wine was supplemented with 22 g/L of sucrose and a preadapted population of 2.0 × 10^6 cell/mL of the same commercial strain of *S.cerevisiae* used for the first fermentation to develop the second fermentation required in the traditional method[7]. In addition, 20 mg/L of adjuvant 92 (Station Oenotechnique de Champagne, Epernay, France) was added to facilitate the riddling process.

Six and twelve months later, the bottles were disgorged, and their contents used for analysis. The general oenological parameters were analysed following OIV recommendations[8]. Foam properties were studied using the MOSALUX device[9], which injects a controlled flow of carbon dioxide into a previously decarbonized wine sample, under standardized conditions. The gas injection induces foam formation of the sample allowing two key parameters to be measured: HM-maximum foam capacity (the wine's ability to generate foam when it is served) and HS-stable foam height (natural foam formation after pouring). Sensorial assessment was performed by a panel of 15 trained wine tasters using ISO official glasses (ISO 3591: 1997)[10].

RESULTS AND DISCUSSION

Table 1 shows the general oenological parameters for all the three wines after twelve months of ageing. Carbon dioxide pressure and ethanol content were higher in traditional sparkling wines, a phenomenon explained by the sugar supplementation of the base wine in the traditional method. The difference of 4 g/L of sugar at the bottling phase explains the additional bar in the traditional sparkling wines, while the addition of 22 g/L of table sugar at the tirage corresponds to the increase infinal ethanol content.

The total sulphur dioxide levels were low in all cases. However,they were higher in the traditional sparkling wine than in the ancestral sparkling wine due to the fact that, in the former, the base wine is protected from oxidation during the stabilization period, while in the latter, during bottling it is protected by carbon dioxide from the first fermentation and no stabilisation period is required.

The differences in titratable acidity, although statistically significant, can be explained by the higher consumption of citric acid in ancestral sparkling wine by yeasts. Citric acid comprises three acidic groups, which implies that its consumption may decrease acidity; meanwhile, the differences in L-lactic acid and fumaric acid may not be high enough to contribute to the differences in total titratable acidity[11]. The acetic acid composition for ancestral and traditional sparkling wines was the same, which may contribute to eliminate the misconception that the ancestral method can increase acetic acid concentration.

Figure 1 shows the foamability parameters of the wines. Results show that the method did not affect either of the studied foaming parameters. It is worth noting that the maximum foam height at 12 months was in the case of Ancestral-High population. Since a higher yeast population was introduced during bottling, bottle fermentation progressed more rapidly, potentially leading to an earlier release of macromolecules from dead yeast cells that act as positive foam agents[1]. Moreover, a trend of decreasing foaming parameters for the traditional Sparkling wines can be observed, which is probably for the higher ethanol levels.

Finally, Figure 2 shows the results of the sensorial assessment, with only

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TABLE 1. General parameters.

Parameter	Traditional				Ancestral							
					High population				Low population			
CO_2 pressure (bars)	5,86	±	0,15	B	4,8	±	0,17	A	4,84	±	0,14	A
Ethanol (%v/v)	12,2	±	0,2	B	10,7	±	0,1	A	10,7	±	0,1	A
Glycerol (g/L)	7,68	±	0,15	A	6,9	±	0,65	A	7,01	±	0,4	A
Residual sugars (g/L)	0,35	±	0,02	B	0,25	±	0,01	A	0,24	±	0,04	A
Total SO_2 (mg/L)	39	±	1	B	28	±	1	A	27	±	1	A
Titratable acidity (g of tartaric acid/L)	6,15	±	0,01	C	5,93	±	0,04	A	6,05	±	0,02	B
pH	2,99	±	0,02	A	2,95	±	0,02	A	2,98	±	0,02	A
L-(+)-Tartaric acid (g/L)	4,64	±	0,11	A	4,79	±	0,05	A	4,71	±	0,02	A
L-Malic acid (g/L)	0,5	±	0,11	A	0,33	±	0,09	A	0,43	±	0,1	A
L-Lactic acid (g/L)	0,04	±	0,01	A	0,2	±	0,02	B	0,22	±	0,02	B
Citric acid (g/L)	0,19	±	0,02	B	0,08	±	0,01	A	0,1	±	0,02	A
Acetic acid (g/L)	0,37	±	0,01	A	0,39	±	0,02	A	0,39	±	0,01	A
Fumaric acid (g/L)	0,08	±	0,04	B	0,01	±	0,01	A	0,02	±	0,01	A

Results are expressed as mean ± standard deviation of three replicates. Different letters in a row indicate the existence of statistical difference ($p < 0.05$).

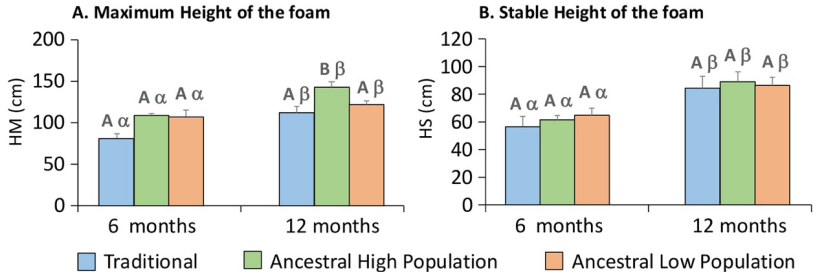


FIGURE 1. Foam properties.

Results are expressed as mean ± SD of three replicates. HM: maximum height; HS: stable height. Different letters indicate the existence of a statistical difference ($p < 0.05$). First row (capital letters) indicates the influence the elaboration method. Second row (Greek letters) indicates the influence of ageing time.

significant differences between the products in terms of three studied features. Carbon dioxide aggressivity and bubble size were found to be higher in traditional sparkling wine than in ancestral wine. These findings are consistent with other literature findings that have correlated lower CO_2 pressure inside the bottle with smaller bubble size, and therefore the results for these parameters may not be directly related to the method[12]. The ageing impact (i.e., on lees-derived aromas) was found to be higher for the ancestral sparkling wines.

Although the overall score differences are not significant, most judges awarded higher overall scores to the ancestral sparkling wine with a low yeast population. By contrast, several judges attributed the lower scores of the ancestral sparkling wine with a high yeast population to the presence of excessive yeast and autolysis-derived aromas.

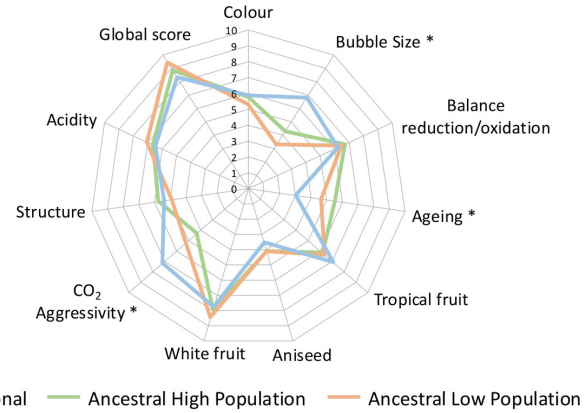


FIGURE 2. Sensory analysis of sparkling wines at 12 months of ageing.

Results are expressed as mean of 15 tasters. Different letters indicate the existence of a statistical difference ($p < 0.05$) between Traditional method sparkling wines and Ancestral Sparkling wines.

CONCLUSIONS

From these results it can be concluded that the ancestral method for producing sparkling wines is a suitable and interesting alternative to producing quality sparkling wines. It can also be concluded that, in the case of the ancestral method, lower yeast populations in the bottling process might be helpful for controlling the quality of the final product. However, it it is important to note that applying good oenological practices and to work carefuly during the production of ancestral sparkling wines is necessary to avoid producing faulty products. ■

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