

Effect of yeast strain and lees contact on Chenin blanc wine quality

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This study forms part of a more general investigation into Chenin blanc. Aspects such as berry size and ageing potential of Chenin blanc wine are discussed in other articles.

Introduction

Chenin blanc plantings and tonnage pressed amount to approximately 18% of the total wine grapes in South Africa. In view of this prominent role played by Chenin blanc in the South African wine industry and as a result of competition with other white cultivars and other wine producing countries in overseas markets, there has been renewed interest in Chenin blanc as a white wine cultivar. Recent local and overseas competitions have shown that this cultivar, when cultivated and treated correctly, is able to produce high quality wines. Because cultivars of a neutral type, such as Chenin blanc, are mainly dependent on the presence of fermentation flavourants, viticultural and oenological factors that promote the development of positive fermentation components play an important role. In this study the effects of yeast strain and lees contact on Chenin blanc wine quality were investigated. Lees contact may be beneficial to certain styles of wine to impart more complexity and body (Zoecklein et al., 1997; Fornairon-Bonnefond et al., 2002).

Material and Methods

The investigation was conducted over four seasons (2001 – 2004). During the 2001 season pilot trials were conducted on Nietvoorbij grapes, which included yeast strains NT 45, NT 116, NT 7, VIN 13, VIN 7 and N 96 (from Anchor Bio-Technologies), RV 1, D 47, Lalvin QA 23 and Lalvin GRE (from Lallemand South Africa). These yeast strains were selected as a result of recommendations by winemakers and yeast manufacturers. Based on the results obtained, the remainder of the investigations concentrated on four yeast strains, namely VIN 13, N 96, QA 23 and NT 116. This selection was based on the successful completion of fermentation, ester production, the formation of lees character and overall wine quality. During the 2002 to 2004 seasons grapes from the Villiera estate were used. The lees concentration with and without the addition of enzymes also varied during the investigation.

During the final season (2004) three treatments, in combination with yeast strains VIN 13,

TABLE 1. The effect of yeast strains on Chenin blanc wine composition and wine quality directly after fermentation (2004 season)*

Gisras	Totale asetaat-esters (mg/l)	Totale etiel-esters (mg/l)	Totale hoër alkohole (mg/l)	Vrugtigheid/gistingsboeket (%)	Algehele wynkwaliteit (%)
VIN 13 (K)	12.042	4.728	155.118	54.9	52.6
N 96 (K)	10.813	5.443	174.815	50.0	48.4
QA 23 (K)	9.386	4.668	184.746	49.2	48.9
NT 116 (K)	15.258	4.024	165.147	56.7	50.9

* Controls

Total acetate esters = Sum of isobutyl acetates, isoamyl acetates and hexyl acetates

Total ethyl esters = Sum of ethyl butyrate, ethyl hexanoate and ethyl octanoate and ethyl decanoate

Total high alcohols = Sum of isobutanol, isoamyl alcohol and hexanol and 2-phenanol

All values are the average from three repetitions and the tasting data of six judges

TABLE 2. The effect of yeast strain and lees contact (five months) on Chenin blanc wine quality (2004 season).

Gisras en behandeling	Vrugtigheid/gistingsboeket (%)	Gismoer-karakter (%)	Swawel-agtig (%)	Volheid (%)	Algehele wynkwaliteit (%)
VIN 13 (K)	52.3a	7.1b	0.9b	43.3b	48.7a
VIN 13 (S)	51.3a	22.7a	3.0a	47.0b	49.9a
VIN 13 (E)	50.4a	31.0a	2.4ab	54.2a	53.1a
N 96 (K)	53.7a	4.1b	1.5a	46.9a	50.8a
N 96 (S)	51.3a	30.6a	1.3a	55.7a	53.8a
N 96 (E)	51.4a	33.6a	2.0a	51.4a	55.9a
QA 23 (K)	54.4a	6.7b	1.1a	45.6b	50.4b
QA 23 (S)	50.5a	33.4a	1.5a	48.6ab	53.2ab
QA 23 (E)	53.2a	32.1a	2.8a	55.1a	59.1a
NT 116 (K)	59.3a	6.5b	1.4a	50.6a	55.7a
NT 116 (S)	47.3a	29.1a	2.5a	50.7a	48.1a
NT 116 (E)	52.6a	33.0a	2.7a	50.6a	52.6a

* C = Control, S = Standard fermentation treatment, E = enzyme treatment

All values are the averages of three repetitions and the tasting data of six judges

Values with the same initials do not differ significantly ($p \leq 0.05$) (Each yeast strain and quality characteristic considered separately)

N 96, QA 23 and NT 116, were conducted as follows. Immediately after fermentation the control wines of each yeast strain were racked, stabilised and bottled according to standard Nietvoorbij small scale white wine vinification techniques. The second group of wines (standard lees treatment) were left on the full lees component in 20 litre stainless steel containers. The third group of wines (enzyme treatment) were also left on the full lees component in 20 litre stainless steel containers. To these wines were added 10 g/hl of a commercial enzyme ("Rapidas Filtration", DSM, France) in order to accelerate yeast cell autolysis.

In the last two instances the full lees component was removed after fermentation and aerated at 15°C for 48 hours by means of a shaking machine to prevent the formation of undesirable sulphur-type flavours (Lavigne-Cruège & Dubour-

dieu, 2001). After re-addition the containers of these two treatments were rolled weekly to achieve the blending of wine and lees. The wines were regularly monitored sensorially for the formation of lees character up to the time of bottling.

The following analyses were done during lees contact, i.e. total extract and total nitrogen (FAN). After five months on the lees the wines were cold stabilised, filtered, bottled and stored at 15°C.

The wines were analysed gas chromatographically 11 months after harvesting and sensorially evaluated by a panel of six experienced judges. The entire procedure was conducted in triplicate.

Results and Discussion

During the pilot trials in the 2001 season, it was

established that yeast strains RV 1 and D 47 were definitely conducive to the formation of sulphur, and these yeast strains could therefore be eliminated without further ado. It was further established that the formation of undesirable sulphur-type compounds could generally be prevented by aerating the lees directly after fermentation. With regard to body, yeast strain GRE fared exceptionally well, but could not be used because the wines did not ferment entirely dry. Yeast strains QA 23, N 96, VIN 13 and NT 116 produced the highest levels of acetate esters and corresponding fruitiness and were therefore automatic choices.

The pilot trials during the 2001 season and the trails during the two subsequent seasons formed the basis for the successful completion of the investigation during the 2004 season. The majority of the results from the previous seasons were confirmed by the latter investigation. For the purpose of this article, only the final results of the 2004 season will therefore be presented.

Directly after fermentation yeast strains VIN 13 and NT 116 showed the most fruitiness and highest overall wine quality, which corresponded with the highest acetate ester and lowest higher alcohol levels (Table 1). The trends of the sensorial data for individual yeast strains and lees treatments after lees contact (Table 2) differ slightly with

TABLE 3. The effect of yeast strain on Chenin blanc wine quality (2004 season)*

Gisras	Vrugtigheid/gistings-boeket (%)	Gismoer-karakter (%)	Swawel-agtig (%)	Volheid (%)	Algehele wykwaliteit (%)
VIN 13	51.3a	20.9a	2.2a	48.4a	50.7a
N 96	52.1a	23.7a	1.6a	51.6a	53.6a
QA 23	52.6a	24.9a	1.8a	50.0a	54.4a
NT 116	52.5a	23.7a	2.2a	50.6a	51.9a

* All values are the averages of three repetitions and the tasting data of six judges. Values are the averages of three treatments, namely the control, the standard fermentation treatment and the enzyme treatment. Values with the same initials do not differ significantly ($p \leq 0.05$) (Each yeast strain and quality characteristic considered separately).

TABLE 4. The effect of lees contact (five months) on Chenin blanc wine quality (2004 season)*.

Gismoer-behandeling	Vrugtigheid/gistings-boeket (%)	Gismoer-karakter (%)	Swawel-agtig (%)	Volheid (%)	Algehele wykwaliteit (%)
Kontrole	54.9a	6.1b	1.2b	46.6b	51.4b
Standaard gismoer-behandeling	50.1b	28.9a	2.1ab	50.5a	51.2b
Ensiem-behandeling	51.9ab	32.4a	2.5a	52.8a	55.2a

* All values are the averages of three repetitions and the tasting data of six judges. Values are the averages of the data of four yeast strains, namely VIN 13, N96, QA 23 and NT116. Values with the same initials do not differ significantly ($p \leq 0.05$) (Each yeast strain and quality characteristic considered separately).

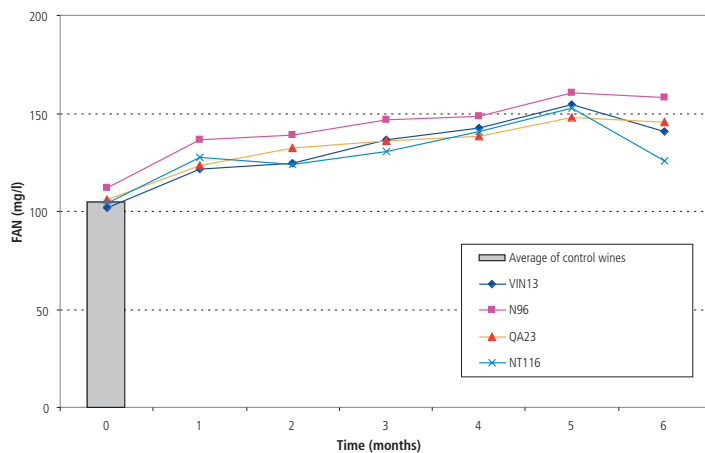


FIG. 1. The total nitrogen (FAN) concentration of Chenin blanc wine during lees contact and enzyme treatment (2004 season) (the analysis at month 6 was after cold stabilisation, filtration and bottling).

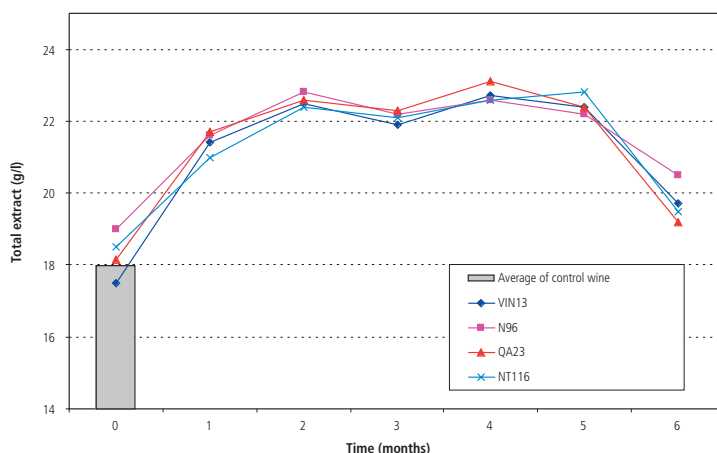


FIG. 2. The total concentration of extract of Chenin blanc wine during lees contact and enzyme treatment (2004 season) (the analysis at month 6 was after cold stabilisation, filtration and bottling)

regard to fruitiness and overall wine quality from the data directly after fermentation (Table 1), but correspond with those of the combined data (Tables 3 and 4). Although no statistical differences between yeast strains could be observed after five months' lees contact, the trends clearly indicated that yeast strain QA 23 produced the most fruitiness, lees character and highest overall wine quality (Table 3). It seems that yeast strain N 96 produced wines with slightly more body than the other yeast strains. With regard to the comparison between the control and the two lees treatments, the enzyme treatment produced the most lees character, the most body and statistically the highest overall wine quality (Table 4). As could be expected the control wines showed the most fruitiness, seeing that no lees character was involved that could possibly have masked it. This may be further ascribed to the fact that the control wines were left at 0°C for the most part of the lees contact period, while the lees treatments were kept at 15°C throughout. The above trends were also reflected in the individual results (Table 2).

In all instances the levels of sulphur-type flavours were insignificantly low, indicating that the aeration of the lees directly after fermentation was successful (Tables 2, 3 and 4).

With regard to the total extract and total nitrogen (FAN) levels that were monitored on an ongoing basis during lees contact, it is obvious that there were only minor differences between yeast strains (Figures 1 and 2). The trends of the total extract and FAN levels of the two lees treatments corresponded, therefore only the combined lees/enzyme treatment is shown. The FAN levels

increased gradually throughout, indicating that a certain amount of yeast cell autolysis did take place. The total extract reached a plateau after two months, but decreased with cold stabilisation, filtration and bottling at five months. This indicates that certain components, deriving from the lees, may be lost which will then go hand in hand with a decrease in mouth-feel or complexity. Despite this occurrence the treated wines still showed higher total extract levels than the control wines at the end of the trial period. This confirms the sensorial observation of more body and lees character in the treated wines (Table 4).

Conclusions and Recommendations

In general the observations over the entire period of investigation may be summarised as follows: The development of sufficient lees character was a problem throughout. This may be ascribed to the fact that the lees contact took place in steel containers (instead of wooden barrels where subtle taking up of oxygen takes place), or that Chenin blanc (perhaps only in this investigation) simply does not have the ability to form sufficient lees character, or a combination of the two aspects. Nuances of bread, sparkling wine, citrus and buttery flavours were nevertheless observed. The wines of the two lees treatments were consistently more full-bodied than the control treatments. It seems as though lees character may be lost to a

certain extent during fining, filtration and/or bottling. The wines also appear to show fairly little ageing character after 11 months, which might possibly signify that such wines could have a longer shelf life.

According to the results obtained under the conditions of this investigation, yeast strain QA 23 with enzyme treatment during lees contact appeared to offer the best parameters for the preparation of Chenin blanc wines where lees character and more body are required. It is very important to aerate the lees directly after fermentation to prevent the formation of undesirable sulphur-type compounds. Further good results will probably be obtained if lees contact takes place in wooden barrels. Ongoing investigations into this matter are recommended.

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Summary

EFFECT OF YEAST STRAIN AND LEES CONTACT ON CHENIN BLANC WINE QUALITY

The effect of yeast strain and lees contact on Chenin blanc wine quality was investigated over four seasons (2001 – 2004). Subsequent to a pilot study, four yeast strains, i.e. VIN 13, N 96, NT 116 and QA 23 were selected and used together with three treatments, i.e. control (no lees contact), standard lees contact and lees contact combined with enzyme treatment (Rapidase Filtration). Total extract and total nitrogen (FAN) were monitored during the process of lees contact. The wines were sensorially evaluated for fruitiness, lees character, sulphur-type aromas, body and overall wine quality. Results, obtained under the conditions of this investigation, suggest that yeast strain QA 23 together with enzyme treatment during lees contact, were the best parameters for the production of Chenin blanc wines where lees character and more body are required.

