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Chemical composition, total phenolic content and colour of red wine obtained from grapes autochthonous to Romania

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Abstract

Fetească neagră is one of the oldest Romanian grape variety. Red wine technology is more complex than of the white wine mainly due to the phenolic's extraction in maceration and to the malolactic fermentation process. The most important characteristic of Feteasca Neagra red wine is its intense colour. The phenolic compounds extracted in the maceration process, have a decisive influence on the colour and wine stability.

Keywords: Feteasca Neagra, maceration, exogenous enzyme preparations, yeast starter culture.

1. Introduction

Red wines occupy a significant part in the worldwide production of wine. The main characteristics of red wines, which make them differ to white wines, are colour, taste and aroma, nutritional properties, and physiological action on the human body [1,2]. Quality of red wines is based on the chemical content, namely to the phenolics from the raw material. The autochthonous grape variety Feteasca Neagra is famous for their rich flavour profile that contributes in resulting superior quality red wines [3,4].

Feteasca Neagra is one of the oldest grapes varieties found nowadays in Romania. The aroma of this wine variety is pleasant and complex, associated to the aroma of black currants. The taste is generally balanced, consistent and vigorous. Acidity is an appropriate characteristic of the variety, leaving a pleasant and persistent flavour. The high alcoholic potential, dry extract, dyes, as well as acidity, are in perfect harmony, which gives the Feteasca Neagra red wine finesse and smoothness unique, standing out as a quality wine.

Essential stages in the winemaking process of red wine are the maceration, alcoholic fermentation, malolactic fermentation, as well as wine clarification [5,6,7,8]. During the maceration of wine, the formation of aroma compounds occurs together with the extraction of anthocyanins present in grapes peels, due to pectinase action [9,10,11]. Pectolytic enzymes, which are found naturally in grapes, have a limited role in the extraction of coloured and aroma compounds. Therefore, wine producers tend to increase the extraction yield of these compounds by addition of pectolytic enzymes.

Clarifying operation of the must and wine are mandatory to obtain a quality product. This process can be difficult and may take time due to particles that have different weights and sediment at the bottom of the tank.

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To speed clarifying, the usage exogenous enzyme preparations is mandatory. In the process of must clarifying, can be distinguished three phases: enzymatic phase, due to the degradation of pectins, there is a decrease of viscosity, flocculation phase, caused by disruption of the protective colloid of pectins, and sedimentation phase, when existing slurry particles are deposited by gravity.

The present study aimed the fermentation monitoring and the chemical composition assessment of red wine obtained from grapes autochthonous to Romania – Feteasca Neagra variety – in the presence of exogenous enzymes and by the addition of yeast starter culture.

2. Material and methods

Sampling. The biological material used in this research consisted on Feteasca Neagra red grapes autochthonous to Romania. Red wine was produced and analyzed during October 2014 and March 2015 in the Wine Pilot Station of the University of Agricultural Sciences and Veterinary Medicine of Cluj-Napoca, Romania.

Production of Feteasca Neagra red wine. Feteasca Neagra grapes varieties were evaluated qualitatively and quantitatively, and were introduced in production line of red winemaking. The grapes were declustered and crushed, then were transferred to maceration tank with the addition of pectolytic enzymes Essezym-Color (Essedielle, Italy), at a dose of 3 g/hL. Maceration was conducted over a period of 7 days at a temperature of 14-17^{o}C. At the end of this operation, pomace was subjected to pressing, and the must obtained was then transferred to the fermentation tank. Here was inoculated with *Saccharomyces cerevisiae* yeast starter cultures Prime 10 (Essedielle, Italy), at a dose of 20 g/hL. Alcoholic fermentation took place at temperatures of 14-17^{o}C. Wine was racked, then transferred to malolactic fermentation. The aim of this phase was to improve the flavour components and taste of red wine. Stabilization operations consisted of cold stabilization and two types of filtration - alluvial (using kieselguhr) and with the filter plates. After bottling, wine was stored at a temperature of 15 ^{o}C, in dark place.

Microbiological analysis. The yeast cell number was analyzed by using the Thoma camera. The yeast viability was assessed according to standardized method, using methylene blue solution.

Fermentation monitoring. The process of fermentation was assessed by the ethyl alcohol content, original proof extract, relative density and temperature [12,13,14].

*Evaluation of wine colour.*The analysis of wine colour compounds was performed according to, method A [15]. A spectrophotometer Shimadzu UV-1700 PharmaSpec UV-VIS was used and the measurements were registered to the wavelength of 625, 550, 495 and 445 nm. Using the chromaticity diagram, were calculated the chromaticity coordinates, relative luminance and dominant wavelength. Red wine Fetească Neagră obtained in the Pilot station was compared to a commercial blank sample.

Antioxidant activity and total phenolic content. Antioxidant activity was conducted according to [16]. The composition in phenolic compounds was evaluated according to the Folin-Ciocalteau method.

Analysis conducted on the final product. For the wine classification, two types of analysis were carried out: ethanol content – by using the ebuliometric method, and sugar content by Schoorl method [17]. All the analysis were performed in triplicate and the mean value of each was considered.

3. Results and Discussion

During the fermentation process were monitored the parameters represented in Table 1-2.

Until day 7, wine maceration and fermentation performed only with the indigenous yeast present in grapes (Table 2). The addition of yeast starter culture determined a significantly increase of the yeast cell number and alcohol content starting from day 8 of fermentation.

Table 1. Evaluation of total acidity and pH during the winemaking process of Feteasca Neagra red wine

Sampling day	Total acidity g/l H_2SO_4	pH	Sampling day	Total acidity g/l H_2SO_4	pH
0	3.43	3.60	15	3.52	3.85
1	3.57	3.73	16	3.47	3.84
2	3.67	3.74	17	3.43	3.83
3	3.67	3.84	18	3.43	3.82
4	3.70	3.84	19	3.43	3.82
5	3.72	3.85	20	3.52	3.65
6	3.43	3.79	21	3.52	3.86
7	3.38	3.76	22	3.57	3.82
8	3.28	3.83	23	3.62	3.84
9	3.38	3.74	24	3.57	3.83
10	3.43	3.73	25	3.52	3.81
11	3.47	3.75	26	3.62	3.85
12	3.52	3.79	27	3.62	3.84
13	3.62	3.78	28	3.67	3.85
14	3.52	3.84			

Table 2. Monitoring parameters – yeast cell number, alcohol content, total extract and fermentation grade – during fermentation of red wine Feteasca Neagra

Sampling day	Yeast cell number x 10^6	Alcohol content. % vol.	Total extract. %	Fermentation grade. %
0	2.50	4.27	7.80	52.00
1	2.50	4.28	7.81	52.01
2	3.00	4.62	8.35	52.45
3	3.40	4.63	8.22	52.89
4	4.00	4.65	9.00	50.00
5	5.50	4.67	9.36	49.86
6	9.80	4.63	10.73	46.24
7	9.90	5.54	10.67	52.51
8	12.00	7.97	8.45	70.73
9	20.00	8.57	8.23	74.09
10	90.00	11.75	5.47	89.70
11	100.00	11.78	4.00	90.00
12	110.00	12.40	3.49	96.19
13	92.00	12.60	3.14	96.95
14	26.00	13.40	2.95	97.32
15	24.00	13.50	2.89	97.43
16	21.00	13.50	2.85	97.52
17	18.00	13.50	2.78	97.54
18	16.50	13.60	2.80	97.52
19	14.70	13.70	2.85	97.53

20	13.20	13.70	2.84	97.53
21	12	13.7	2.86	97.55
22	11.4	13.7	2.87	97.56
23	10.8	13.7	2.88	97.57
24	8.1	13.8	2.85	97.57
25	7.3	13.9	2.84	97.58
26	5	13.9	2.86	97.58
27	3.7	13.9	2.88	97.57
28	3.5	13.9	2.86	97.56

Evaluation of chromatic characteristics showed that blank red wine sample (same variety, Feteasca Neagră) presented a lighter crimson colour (λ dominant 585-598 nm; 1090% brightness), comparing to the sample where added Essezym-Color product, which appeared with a net red hue (λ dominant 599-650; brightness: 800.3%).

Total phenolic content of red wine Feteasca Neagră was 1.09 mg galic acid/mL. Analysis conducted on the final product revealed the following values: total acidity 2.3 g/L H_2SO_4, pH 3,87, sugar content 27 g/L, alcohol content 13.9 % vol.

4. Conclusion

The usage of exogenous enzyme preparations – pectinases, and naturally existing enzymes in the grape, as well, help to obtain a wine with remarkable colour and gustatory finesse, intense olfactory and expressive character. Results showed that red wine Feteasca Neagra can be classified as a superior quality dry red wine, with improved chromatic characteristics.

Compliance with Ethics Requirements. Authors declare that they respect the journal's ethics requirements. Authors declare that they have no conflict of interest and all procedures involving human / or animal subjects (if exist) respect the specific regulation and standards.

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