PRODUCTION OF NATURAL LOW ALCOHOL WHITE CHARDONNAY WINE BY USING IMMOBILIZED YEAST

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Summary: This article presents results about production of Chardonnay low alcohol wines using Pro Restart 43® - immobilized yeasts, wild yeasts and EZFERM 44 - active dry yeast at the combined alcoholic fermentation processes.

Key words: low alcohol wines, yeasts, fermentation, immobilized yeast.

Introduction

The days of alcohol-heavy wine might be numbered as new research and market demand point towards lighter wines. A new wine yeast can produce wines with lower alcohol levels, according to the research team that developed it [22].

The result of collaborative research by Lallemand Oenology and the French National Institute for Agricultural Research (INRA), in Montpellier, France, the new, non-GMO Saccharomyces cerevisiae yeast is capable of producing lower alcohol levels in wine and with no undesirable compounds [7].

This particular wine yeast is the first in the S. cerevisiae species to be selected for its low rate of sugar to alcohol conversion. For example, in a wine with a potential alcohol level of 15.8 percent, the new wine yeast reduces the alcohol by 1.3 percentage points and compensates by producing more glycerol, which increases the perceived mouthfeel (or softness) of the wine 18, 19, 20, 21].

The yeast did not produce such compounds as acetoin that may give a wine bad aromas and the acetate level was particularly low during trials. Wine is seen as being out of step with market trends, as better vine selection and vineyard practices produce wines with increasingly high alcohol levels. However, consumers are pushing for healthier, less-alcoholic and lower carb wines [2].

Also, since wine is taxed by alcohol level in many countries, it makes economic sense for producers to reduce the strength. High levels of alcohol can also alter the sensory quality of wines by increasing the perception of hotness and by decreasing the perception of acidity and aroma [6].

Reducing the alcohol content of wine has been a major focus of winemaking research. One of the most attractive and least expensive options is to use yeasts that produce less alcohol from the same amount of sugar, such as this new wine yeast [4, 6, 11, 16].

Such is the demand for lower-alcohol wines that the New Zealand wine industry is embarking on a seven-year research campaign to get on board the bandwagon [3].

Almost $14 million is to be spend by the country's wine industry. New Zealand Winegrowers chief executive, Phillip Gregan said the Lifestyle Wines program would focus on market-led opportunities both in this country and overseas [5].

"What we are seeing around the world markets is consumers are interested in living healthier lifestyles and part of that is growing interest and concern about what they eat and drink. We are seeing an interest in lower alcohol and calorie wines and this is the genesis of this project." [12, 13, 14].

In wine production, yeasts are responsible for transforming the sugar present in the grape must into ethanol, carbon dioxide and hundreds of secondary products that collectively contribute to the qualities of the product [21].

Hence, these microorganisms may have a positive or negative influence in the sensory traits of the product. Although non-Saccharomyces yeasts were long consider harmful, evidence in recent years has shown that their use may give complex organoleptic characteristics to the wine, thus increasing its quality because they produce compounds such as glycerol, isoamilic alcohol, succinic acid, acetic acid and propanol that affect the sensory characteristics of the product [5, 6, 7].

Yeasts can be define as unicellular fungi, either ascomycetes or basidiomycetes, that have vegetative states which predominantly reproduce by budding or fission and which do not form their sexual states within or on a fruiting body [8, 9, 10].

In traditional winemaking, natural (spontaneous) fermentation of grape juice is carried out by a sequence of different yeast species. The early stages are dominated by the growth of non-Saccharomyces yeasts, characterized by a low fermentative power. In some cases, wine produced with pure yeast mono-cultures lack flavor complexity that may originate from good indigenous fermentations [15, 17, 18].

Products fermented simultaneously by yeasts and O. oeni showed the highest score for phenolic aroma and consequently the lowest global evaluation. Whereas wines that were sequentially inoculated with malolactic bacteria had the highest acceptance, with better fruity and floral aromas and high scores of global descriptor [11, 12, 16].

Materials and Methods

As research's objects were accepted Chardonnay musts, Pro Restart 43® - immobilized yeasts, wild yeasts and EZ FORM 44 - active dry yeast.

EZFERM 44 is a strain that is distinguish by its high alcohol tolerance and its particular ability to consume fructose. It is a strong fermenter, does not have high nitrogen or oxygen requirements and respects varietal character. It is recommend for correcting sluggish or stuck fermentations and for fermenting under difficult conditions.

ProRestart 43® is yeast cells are encapsulate within alginate (natural polysaccharide extracted from seaweed) and are acclimatize to alcohol or other harsh conditions. Restarting a stuck or sluggish fermentation with active dried yeast also requires preparing a more time-intensive starter culture before being introduce into a stuck or sluggish fermentation.

Alcoholic fermentation went with oxygen dosage. Dosed oxygen, which had a positive influence on biomass accumulation, and transforming sugars into dioxide of carbon and water. Fermentation was monitored daily, as determined by refract meter thus УРЛ-1 sugars remaining in the environment that were to be converted into alcohol. After, completion of alcoholic fermentation with yeast immobilized tubes were then dried and subjected to dialysis prompting and measuring, it was determinate exact t formed pure yeast biomass.

For determination of physical and chemical indexes of obtained wine were used analytical methods appropriate standard and recommended by the OIV.

Results

We can see, from the figure 1, that the alcoholic fermentation is in normal regime. It sees a slight decrease in sugar in the first 3 to 7 days, because occurs yeast multiplication. Starting with day 4-8, yeasts were most intense activity and transforms large quantities of sugars into alcohol and CO_2.

Towards, the end, because alcohol is formed in the environment, the power decreases gradually fermenting yeasts metabolize quantities increasingly smaller sugars. Yeasts are growing increasingly more difficult and some cells die.

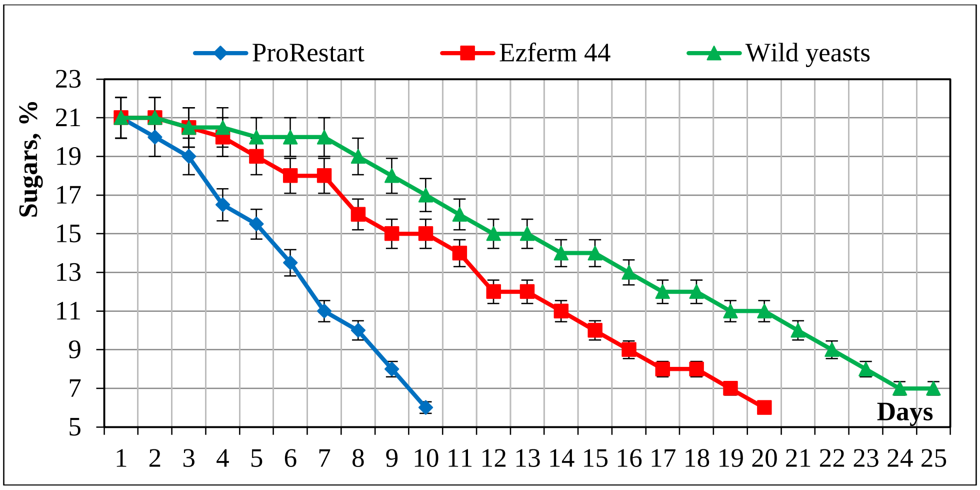

Fig. 1. Changes in the sugars content of Chardonnay's must, fermenting at 12°C

The shortest duration of fermentation was present in the sample with immobilized yeast. The process of fermentation took place about 10 days for sample with immobilized yeast and 20 – 25 days for samples with Ezferm 44 yeast and respectively wild yeast.

The dates obtained in figure 2 describe that fermentation at 16 ^{0}C is faster than 12°C, but it is the same duration for sample with immobilized yeast. Therefore, temperature do not influence activity of immobilized yeast in the fermentation processes.

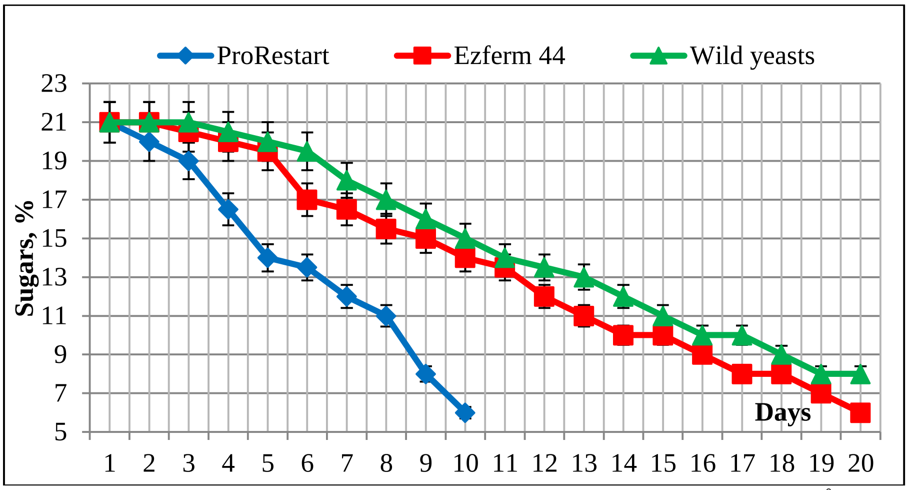

Fig. 2. Changes in the sugars content of Chardonnay's must, fermenting at 16°C

The evolution of alcoholic fermentation at 21°C is not so different than others. The sample with immobilized yeast had 7 days duration, but others samples in 17 – 19 days.

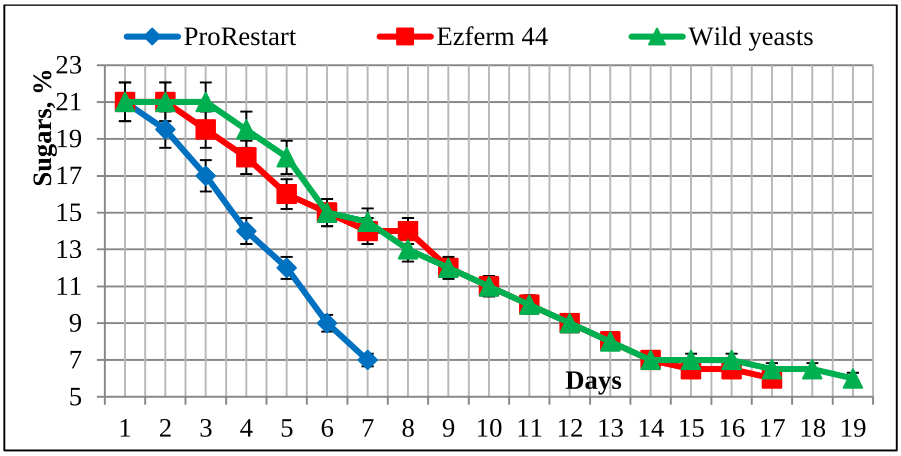

Fig. 3. Changes in the sugars content of Chardonnay's must, fermenting at 21°C

The physical-chemical indices that describe obtains wines are in table 1. The alcohol range is between 8,1 ÷ 8,5, but sugars content are 7,5 g/L for sample with immobilized yeast and 6,9 ÷ 7,0 for others samples.

VA and TA is in normal range. The component of total acidity is normal too. Tartaric acid are in range between 2,1 ÷ 2,8 g/L. Malic acid are in range between 1,3 ÷ 1,5 g/L. Lactic acid are in range between 2,1 ÷ 2,5 g/L. Citric acid are in range between 0,02 ÷ 0,04 g/L. Succinic acid are in range between 0,63 ÷ 0,74 g/L.

After taste, better test note has sample with immobilized yeasts because it had a good smell from white fruits and flowers, a stronger body that it is structured and complex.

Table 1. Physical-chemical indices of obtained Chardonnay wines

Physical-chemical indices	**ProRestart**	**Ezferm 44**	**Wild yeasts**
Alcohol, %	8,1 ± 0,5	8,3 ± 0,5	8,5 ± 0,5
Sugars, g/L	7,5 ± 0,5	7,0 ± 0,5	6,9 ± 0,5
TA, g/L	6,9 ± 0,1	6,8 ± 0,1	6,6 ± 0,1
VA, g/L	0,38 ± 0,01	0,37 ± 0,01	0,41 ± 0,01
Total SO_2, mg/L	127 ± 5	148 ± 5	166 ± 5
pH	3,01 ± 0,01	3,11 ± 0,01	3,60 ± 0,01
Tartaric acid, g/L	2,8 ± 0,1	2,4 ± 0,1	2,1 ± 0,1
Malic acid, g/L	1,5 ± 0,1	1,4 ± 0,1	1,3 ± 0,1
Lactic acid, g/L	2,5 ± 0,1	2,3 ± 0,1	2,1 ± 0,1
Citric acid, g/L	0,04 ± 0,01	0,03 ± 0,01	0,02 ± 0,01
Succinic acid, g/L	0,74 ± 0,01	0,68 ± 0,01	0,63 ± 0,01

Conclusions

Cell immobilization has become an important practice in biotechnology recent years leading to increased performance and economy fermentation processes.

Using fixed and fixed in wine microorganisms are highly appreciated worldwide and therefore to increase performance wine industry in Moldova have been researching for pure yeast biomass growth.

This study has allowed the development of a scheme for obtaining low alcohol wines by using immobilized yeast at alcoholic fermentation.

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