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# New insights on the use of wine yeasts

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Yeast characteristics aimed to satisfy the new tendencies in wine sector will be explored. The use of indigenous starters, selected among yeast biota of specific environments, is proposed as a tool for production of premium quality wines possessing characteristics correlated to the specific production environment. Wine aromatic complexity can be improved also by the use of mixed starter cultures, composed by *Saccharomyces cerevisiae* and various non-*Saccharomyces* species, which can allow contemporary the control of undesirable microflora and/or reduction of ethanol content in wine. Moreover, the increasing request of organic wines determines changes in yeast microbiota and fermentation conditions, requiring starter strains with peculiar features, such as low production of H<sub>2</sub>S, SO<sub>2</sub>, acetaldehyde, and ability to reduce copper content in wine.

## Addresses

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## Introduction

The international competition within the wine market and consumer demands for innovative wines are providing new challenges in winemaking. A relevant trend in winemaking is to reduce the use of chemical compounds in both vineyard and winery. In the organic productions, the use of copper and sulphur-based molecules as alternative to chemical pesticides seems to affect the composition of grape microbiota; furthermore, high copper residues can be present in grape must and wine. Another problem of organic winemaking process is the higher risks of oxidation, microbial contamination and, on the other hand, of H<sub>2</sub>S production. At the same time, to enhance

the characterisation and typing of wines in relation to a given geographical area is positively perceived. In this regard, vineyard yeast biota can strongly contribute to the uniqueness of the wines derived from each specific area. The enhancement of the overall profile of the wine could be achieved by using selected culture of non-*Saccharomyces* (NS) yeasts coupled with *Saccharomyces cerevisiae* starter strain. Therefore, an innovative biotechnological approach to satisfy these new tendencies in winemaking is the use of new specific selected starter, able to reflect their specific footprint in the finished wine.

## Yeast signature on wine *terroir*

According to OIV (International Organisation of Vine and Wine), 'terroir' refers to 'an area' 'microbial *terroir*', that is the microbiome contribute to the identity of wine, is a process that starts in the vineyards and then evolves along the different stages of fermentation [1,2].

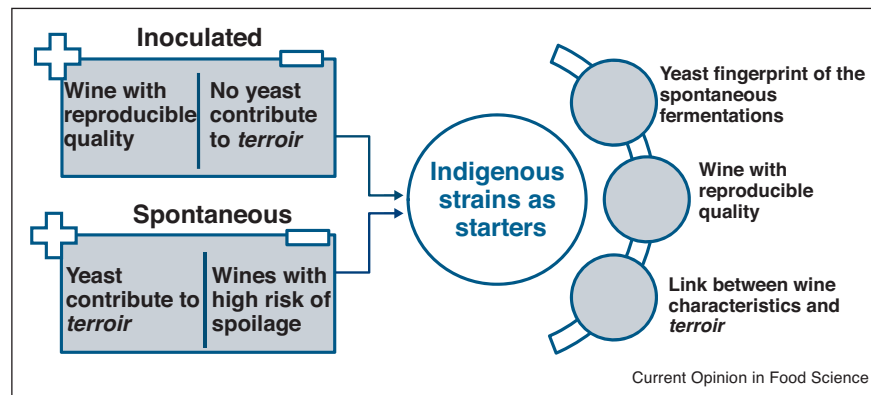
## Spontaneous and inoculated fermentation

Grape fermentation can be performed by deliberate inoculation of yeast starter or allowing the microbes naturally associated with grapes to conduct the fermentation. The inoculated option reduces the potential for these microbes to contribute to *terroir* as consequence of the use of commercial starter strains, whereas the metabolic interactions developing in spontaneous fermentation could be the key to the microbial contribute to *terroir*. However, due to the complex and often-unpredictable nature of microbial interactions, this practice can lead to wines at higher risk of spoilage. As a consequence, worldwide uses commercial starters of *S. cerevisiae* to ensure a predictable and reproducible process. The side-effect of this practice, as a consequence of the availability of a limited number of commercial starters, is the reduction of native microbiota effect and the production of wines with similar analytical and sensory properties, reducing the correlation between wine characteristics and their territory.

## Yeast community of a *terroir*

To obtain wines that reflect a certain *terroir*, it is essential to reproduce industrially the microbial fingerprint of the spontaneous fermentations, avoiding the risks associated with uncontrolled fermentations. In this context, many research groups have proposed the use of indigenous strains, isolated from specific environments and selected on the basis of technological properties and quality traits, as a strategic tool for wine-makers interested to unequivocally link a wine with its environment of

Figure 1



Contribution of indigenous strains to wine *terroir*.

production [3–6] (Figure 1). In fact, it has been widely shown that microbial diversity is characteristic of a given area [7,8] and this microbial population affects the wine character with different compounds as result of microbial metabolism [9\*\*]. For this reason, ecological studies of indigenous yeasts from different vineyards [10] and microbial analyses of spontaneous alcoholic fermentations in different winemaking regions [11] are of interest to better manage the winemaking process and to determine the source of microorganisms that produce a particular ‘microbial footprint’ [12].

#### Influence of yeast origin on wine characteristics

Recent evidences indicated that genetically distinct regional populations of *S. cerevisiae* affect wine phenotype in terms of volatile composition. Knight *et al.* [13\*] demonstrated the correlation between yeast genotype origin and quality parameters of experimental wines obtained by inoculating the selected strains coming from the different wine regions. By analyzing 63 *S. cerevisiae* isolates from two different grape varieties, Capece *et al.* [14\*] found that both genetic and phenotypic diversities of the strains were correlated to geographical origin of the strains. Results of the evaluation of primary and secondary aroma of Gewürztraminer wines, inoculated with three selected autochthonous and one commercial *S. cerevisiae* strains, demonstrated that the aroma profile of wine obtained by the indigenous strains resulted the most complex and more typical [15].

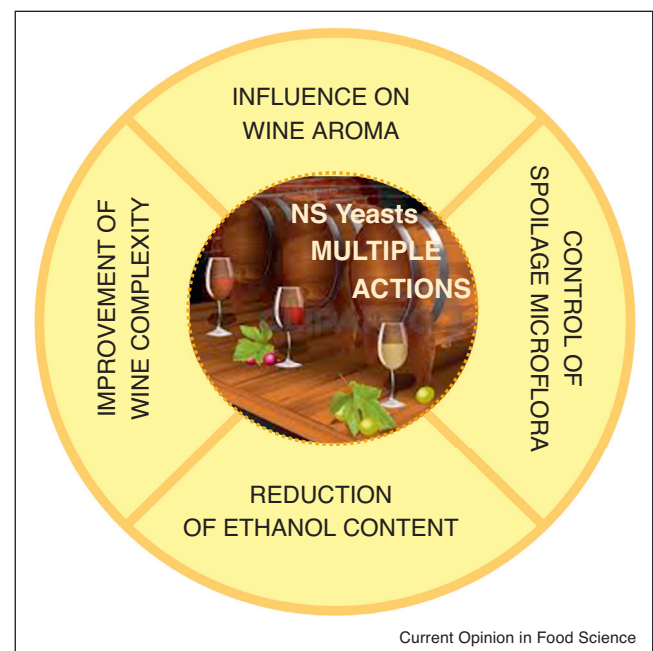
#### Multiple beneficial actions on the use of NS in winemaking

After the reevaluation of the role of NS in winemaking, during the last recent years, several studies have focused the attention on multiple modalities and fields of application (Figure 2). Since these yeasts are in general unable to complete alcoholic fermentation, their use in co- or sequential inoculation with *S. cerevisiae* is the most common application [16,17].

#### Influence of NS yeast on wine composition and aroma profile

A plethora of studies highlighted the important role of NS to improve wine complexity and specificity through the enhancement of primary and/or secondary aroma compounds [18,19]. More recent studies indicated that *Hanseniaspora vineae* enhanced benzenoid compounds and phenyl ethyl acetate [20,21], while *Torulasporea delbrueckii* enhanced 3-Sulfanylhexasan-1-ol in mixed fermentation with *S. cerevisiae* commercial strain [22]. In other mixed fermentations with *Starmerella bacillaris*, *Zygorotulaspora florentina* and *Hanseniaspora uvarum* a positive influence

Figure 2



Modalities and fields of application of non-Saccharomyces (NS) in winemaking.

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