

Origins of selected natural wine yeasts

*Wine yeasts are found everywhere in various environments and have been domesticated progressively over time. These microorganisms play an essential role in wine.
No yeast, no wine.*

ORIGIN OF YEASTS

A few facts

- Yeasts are **unicellular fungi**
- Yeasts are **natural living microorganisms** globally omnipresent in the environment
- **Pasteur** linked yeasts to fermentation in 1860
- Yeasts are used in **bread, wine, beer, spirits** production and many other **fermented food** and drinks, dating back to the Pharaohs
- The biodiversity of yeast includes thousands of strains
- Around **300 selected natural wine yeasts** are used today by winemakers
- Each one of them has their **own unique properties** and has an impact on wine quality in different ways

GOING FURTHER

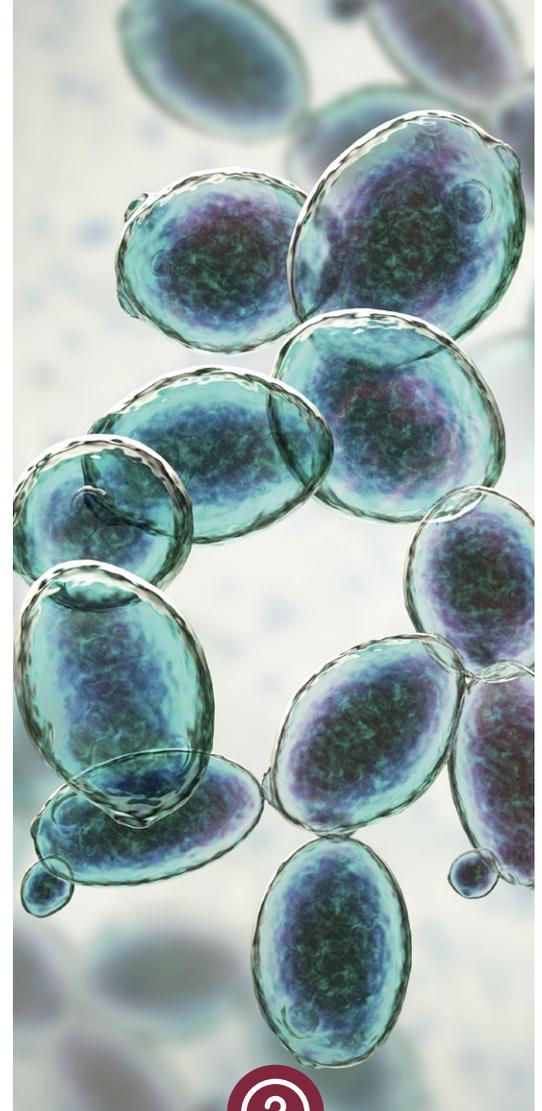
Yeasts have been used for **centuries** by man in the fermentation process involved in **winemaking, breadmaking** and **brewing**. Pasteur linked yeasts to fermentation in 1860. Scientific progress during the 20th century, led to further identification and characterization. More than 3000 species have been studied so far!

Yeasts are **ubiquitous** in nature. Similarly, as with all beings, there is a large diversity of yeast "strains". Each strain is adapted to different conditions. Specific species and strains are well adapted to a wine environment are called **wine yeasts**.

Wine yeasts **feed on sugars** to reproduce themselves, but under certain conditions, they switch **to fermentation and then convert sugar into alcohol and develop flavor compounds**. A naturally occurring phenomenon that helped produce wine across the ages.

A BIT OF YEASTORY

- **5400 BC:** Large scale-wine production in the northern Zagros Mountains
 - **3140 BC:** Wine yeast residues found in wine jars in Ancient Egypt
 - **1680:** Antoni Van Leeuwenhoek observes yeast cells with a primitive microscope
 - **1860:** Louis Pasteur links microscopic yeast cells to the process of fermentation
 - **1888:** Emil Hansen perfects Pasteur's method for the isolation of pure yeast cultures
 - **1890:** Hermann Müller-Thurgau creates the concept of inoculating must with selected yeast cultures
 - **1965:** First active dried yeast produced commercially in California
- ↓ *Wine yeast is an essential partner in winemaking !*



DID YOU KNOW?

Any yeast strain is classified by genus, specie, and strain.

Most wine yeast strains are of the genus *Saccharomyces* and specie *cerevisiae*.

saccharo = sugar
myces = fungi
cerevisiae = beer

MORE ABOUT ORIGINS AND USES OF SELECTED NATURAL WINE YEASTS

A few facts

- Selected natural wine yeasts **are cultivated yeasts for winemaking**
- Typically for wine, yeast is found in the **grape must** and in the **winery environment**
- Now, winemakers have the possibility to **choose selected natural wine yeasts with specific characteristics, for the style of wine while respecting their terroir.**

GOING FURTHER

We can find a whole **ecosystem** living on grapes: yeasts, but also bacteria, molds, and other microorganisms. There is a diversity of microorganisms present in a random way which varies every year depending on the climate, the viticulture practices and human intervention.

Natural selected wine yeasts are simply **the best of the indigenous yeasts**. They are **collected in nature** directly from active must fermentation, isolated, studied and selected. Then they are grown to be used in wineries after rigorous **quality controls**. Each strain is distinct and has **specific characteristics**. Some are stronger fermenters and better at extracting specific grape aromas than others, some have real oenological advantages (see role and advantages of selected natural wine yeast).

Saccharomyces cerevisiae is the most commonly used wine yeast. Indeed, this specie is well **adapted** to the wine environment. It is found associated with grape must, cellars and other ecological niches. Nowadays, winemakers are starting to also use **newly found and studied genus and species carefully selected** for their beneficial contribution to wine process.

Winemakers can then choose the **selected wine yeast, most adapted** to their wine conditions, the wine style and their terroir.

EXPERT INSIGHTS

“*The use of selected yeasts, which are exactly the same genetically as they were when they were isolated from nature, is no more ‘unnatural’ than using vine cuttings from a nursery to establish a vineyard.*”

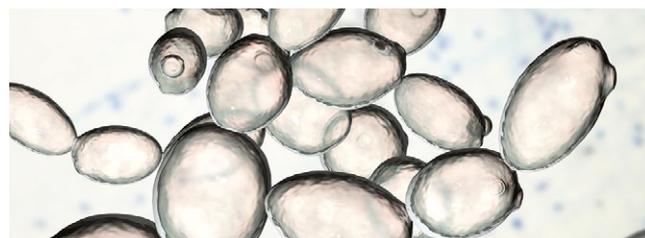
Dr Jamie GOODE - PhD in plant biology and author of Wine Science



DID YOU KNOW?

We can find wine yeast associated with some insects (bees, wasp, fruit flies, ...)

That fact explains why the same strain can be found in multiple places.



Roles and advantages of wine yeast

The wine yeast *Saccharomyces cerevisiae* is an essential element to secure alcoholic fermentations.

Today, wine producers understand that yeast is also an ally to bring out the full potential of their wines. It can help reveal complex aromas, stabilize wine color, enhance roundness, modulate the intensity of flavors and bring forward the wine's distinct personality.

WHY IS THIS MICROORGANISM SO UNIQUE?

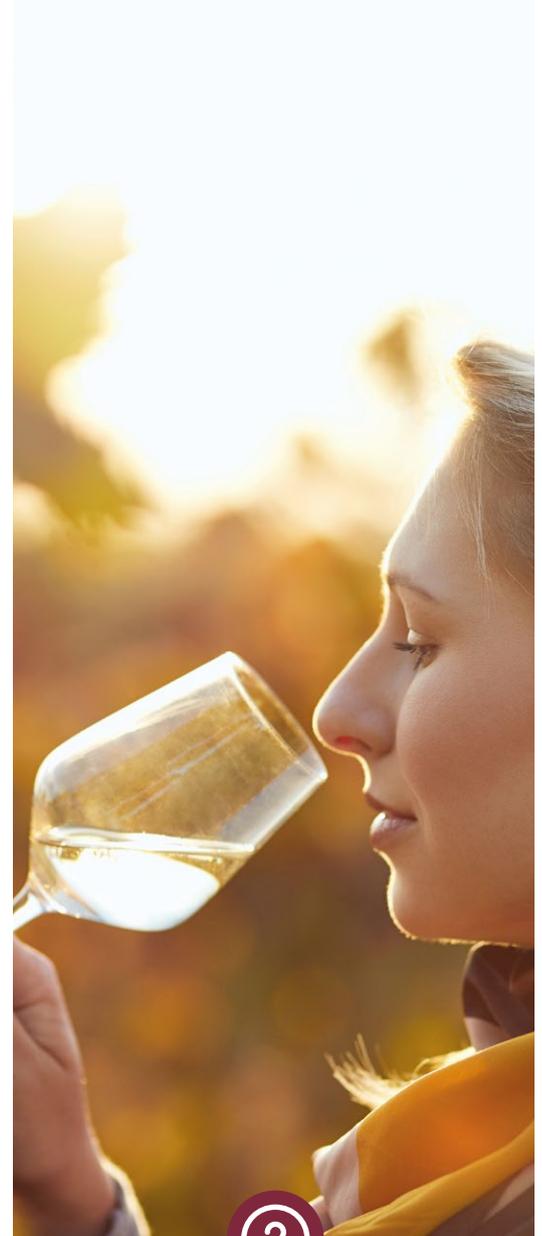
A few facts

- Yeast is a living cellular factory
- Selected wine yeasts transform sugar into alcohol during fermentation
- Selected wine yeasts naturally bring out different aroma compounds to wine

GOING FURTHER

Yeasts, such as *Saccharomyces cerevisiae*, are naturally capable of transforming and combining all elements needed for their own **growth**. They are able to use two different mechanisms

1. In the presence of air and sugars, yeasts breathe and multiply abundantly, without forming alcohol. The sugar they feed on is transformed into carbon dioxide and water. Yeast producers use this metabolic process called respiration to multiply selected wine yeasts.
2. During the winemaking process, the sugar concentration is very high and there is little oxygen, the yeast then switches to the fermentative metabolism. This leads to the transformation of sugars into alcohol and carbon dioxide. This metabolic process is called fermentation.



DID YOU KNOW?

80% of all aroma-active compounds in wine come from yeasts.

(Source: Ribereau Gayon 2006)



YEAST IN WINEMAKING: USES AND IMPACT ON THE WINE PROFILE

A few facts

- Selected natural wine yeasts lead to successful fermentations
- Yeast can reveal varietal and fermentation aromas
- Yeast management is essential to optimize the fermentation process and obtain the best aromatic and sensory profile

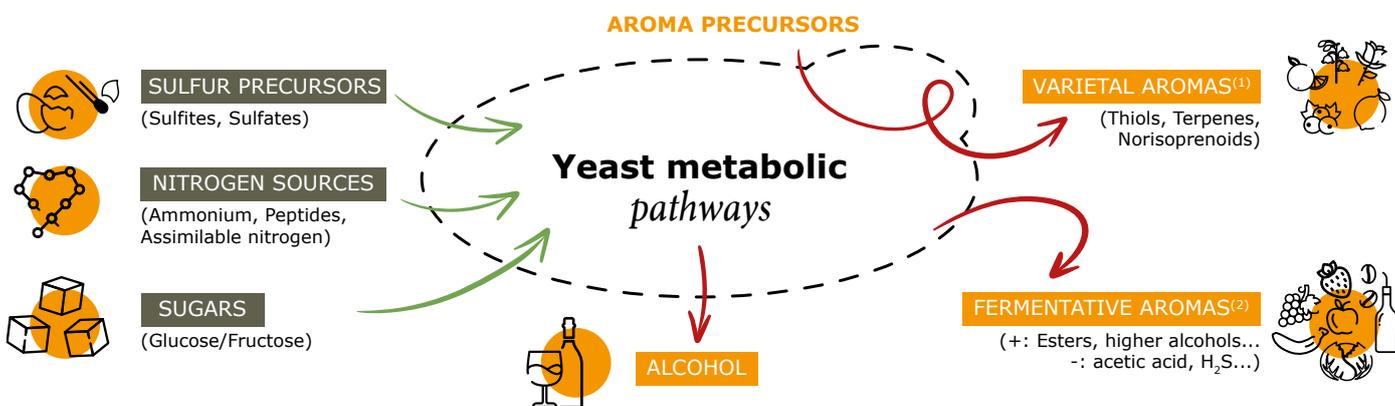
GOING FURTHER

Winemakers rely on either indigenous or selected natural yeasts to carry out their fermentations. Spontaneous fermentation and the lack of control over the process often lead to fermentation problems and faulty wines (volatile acidity, volatile phenols, sulfur off-flavors, etc).

WHY INOCULATE WITH SELECTED NATURAL WINE YEASTS¹?

- To minimize the contribution of undesirable yeasts and bacteria and maximize the chance of **a successful fermentation and a quality wine**
- To control the production of sulphur dioxide (SO₂) and hydrogen sulfide (H₂S) and other faults which can lead to undesirable aromas
- To reveal the aroma and flavor potential of the wine through the specific positive metabolism of each yeast strain

WINE YEASTS CAN INFLUENCE TWO TYPES OF WINE AROMAS:



1. The grapes' derived or **"varietal"** aromas, such as certain floral and citrus notes. These compounds are naturally present as «aromatic precursors» but odorless before being revealed by the action of wine yeast.
2. Fermentation's derived or **"fermentative"** aromas, such as certain fruity aromas resulting from the yeast metabolism.

The aromatic profile of the wine is a combination of these aromas, interacting with each other, with the alcohol and also with other compounds. Thus, creating a **complex and fascinating wine style**.

EXPERT INSIGHTS

“The quality of an alcoholic fermentation thus lies in its ability to respect and reveal the grape's potential.”

Matthieu Dubernet, Consulting Oenologist – CEO, Dubernet Laboratories

¹ König H. et al. 2017



Biodiversity and selection of selected wine yeasts

The microflora of grapes and musts forms a complex biological system where a great variety of bacteria and yeasts interact in multiple ways. Harnessing that biodiversity gives winemakers many options to produce high quality wine respecting their terroir. Having the appropriate yeasts to complete fermentation and produce quality wine should not be a 'stroke of luck'.

BIODIVERSITY: AN INFINITE RESOURCE FOR SELECTION

A few facts

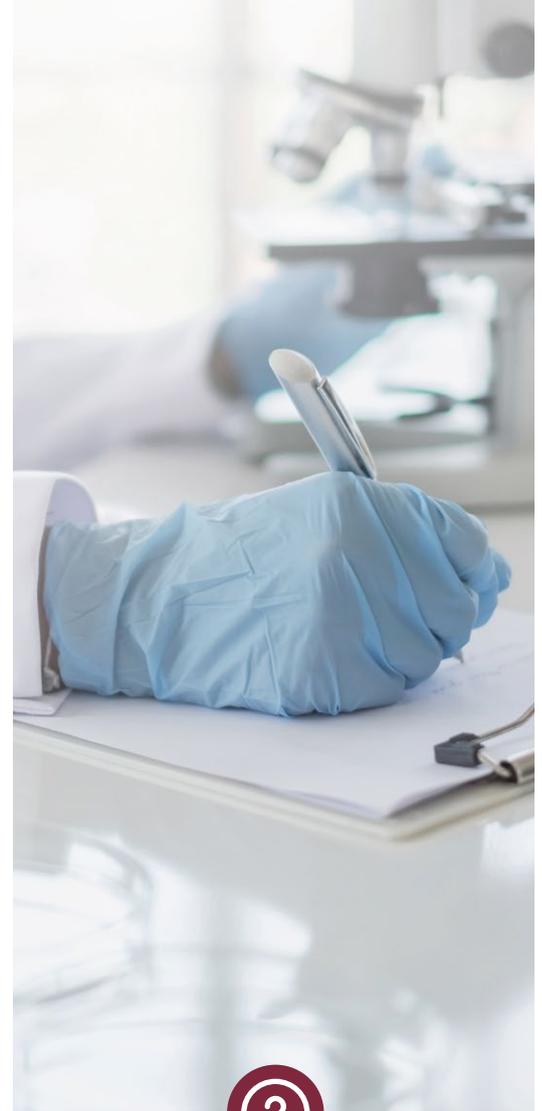
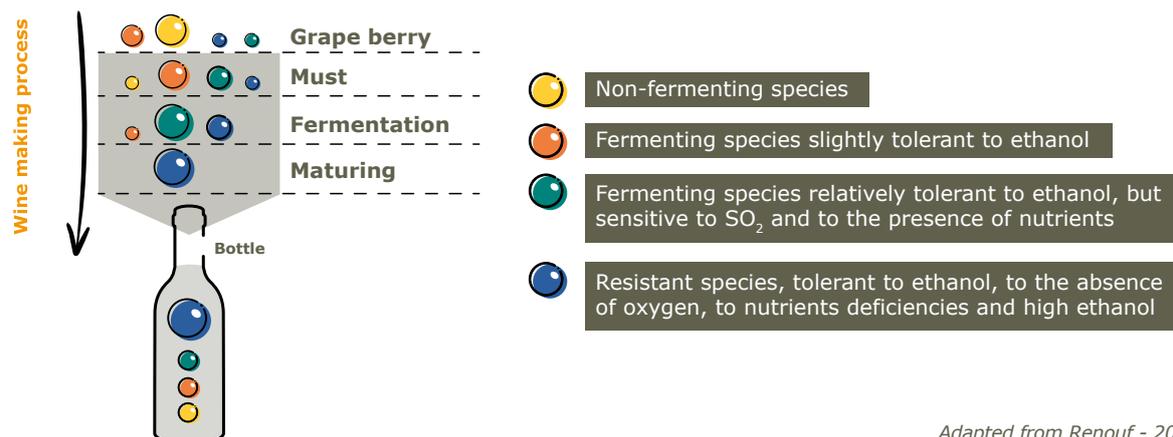
- The ecological diversity of the grape and the must is not reserved only for beneficial microorganisms
- Many other species besides *S. cerevisiae* are present in the early steps of fermentation many are rogue microbes
- Yeast selection aims to isolate the ones beneficial to wine quality, the majority are *Saccharomyces* and nowadays, non-*Saccharomyces* are also selected
- Selected wine yeast species will all contribute differently to wine (such as sensory impact, reduction in the use of SO₂, acidity management - see dedicated technical sheet: "Roles and Advantages")
- Selected natural wine yeasts inoculation aims at populating musts with beneficial microorganisms

GOING FURTHER

Wine yeast strains are found around the world, and their geographical expansion is directly linked to **the expansion of wine production**.

At the beginning of wine fermentation, *Saccharomyces cerevisiae* does not represent the dominant species. Other species are present, and not all of them are good for the wine as many can lead to faulty wines. However, some other non-*Saccharomyces* yeasts can be beneficial to wine quality. It is the selection and characterization of all those beneficial microorganisms within this biodiversity which allows to make quality wine.

Microbial Diversity



DID YOU KNOW?

Wine yeast strains have a unique historical origin in Mesopotamia.

HOW ARE WINE YEASTS ISOLATED AND SELECTED?

A few facts

- The process from the beginning of the research to the selection of the final yeast can take from 3 to 5 years
- Winemakers can choose the selected natural wine yeasts that will best meet their expectations, represent their wines style, and respect their terroir
- The selection of yeast allows winemakers to gain time, avoid sensory faults and successfully control and achieve consistency reflecting their wine identity
- Similarly to what is being done with grapevine selections, new selection tools are developed for wine yeast to deliver very specific contributions (such as lower SO₂ production or lower alcohol production). As with the grapevine selection process, the techniques used are not involving GMOs and are simply an accelerated process of what can happen spontaneously.



GOING FURTHER

Rigorous selection work is necessary to obtain the best indigenous yeast present in a must.

FIRST SELECTION PHASE

It consists of taking **must samples** from recognized terroirs. These musts are taken to a specialized laboratory or wine institute where they are left to ferment **spontaneously**. Many of the spontaneous fermentations are not of quality (stuck fermentation, faults etc) so the focus is on the microorganisms leading to a successful fermentation. At various steps of the alcoholic fermentation, **yeasts are isolated** from each sample, identified and a collection of yeasts is created. It can range from several hundred strains to a few thousands. This collection can be built over several vintages.

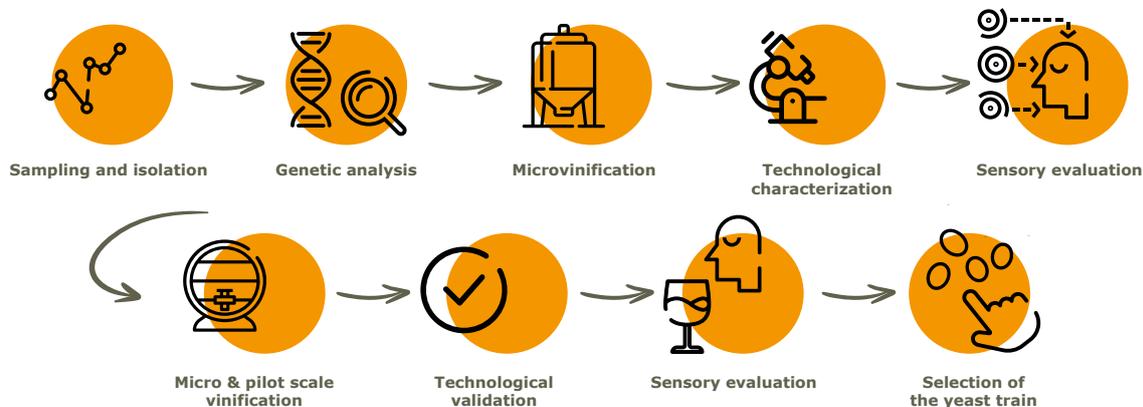
SECOND SELECTION PHASE

It consists in testing and screening the **performance** of these yeasts. Trials are carried out first at laboratory scale and then at winery scale. Meanwhile the yeasts are also tested for their abilities to be grown and dried in large quantities. The selected yeasts respect the specific grape varieties of the vineyard not distorting their intrinsic qualities and ideally **better revealing** them. This avoids the hazards of unpredictability with **spontaneous fermentations** and the possible spoilage that may result.



DID YOU KNOW?

Yeast selection and production have been one of the most important innovations in winemaking.



Wine yeast growth and production

Nowadays, the demand for quality wine yeast is growing. For this reason, it is now produced in specialized yeast growing facilities. The work of yeast specialists consists of selecting the best yeast cells and growing them in large quantities that can then be preserved and packaged so that they are available for winemakers. Yeast can come in various forms: liquid, compressed, frozen, dry and encapsulated. Wine yeast is predominantly available in dry format.

THE YEAST PRODUCTION PROCESS

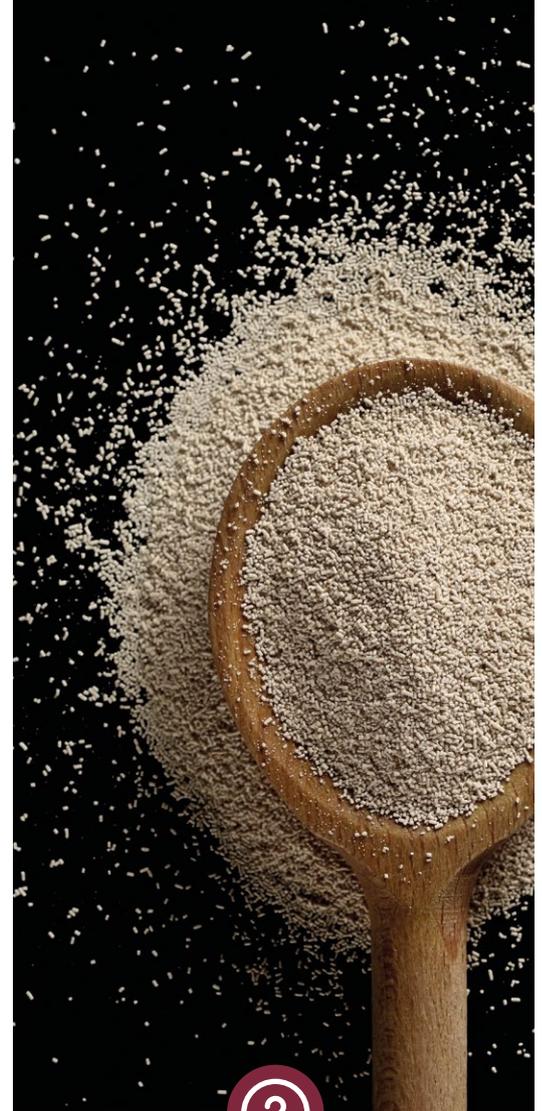
A few facts

- Production means that yeast cells are put in the right conditions to grow and multiply
- Yeast cells are grown successively in multiplication tanks (from small flasks to big tanks) containing a specific culture medium
- Dry yeast is obtained after removing most of the water from the "yeast cream"

GOING FURTHER

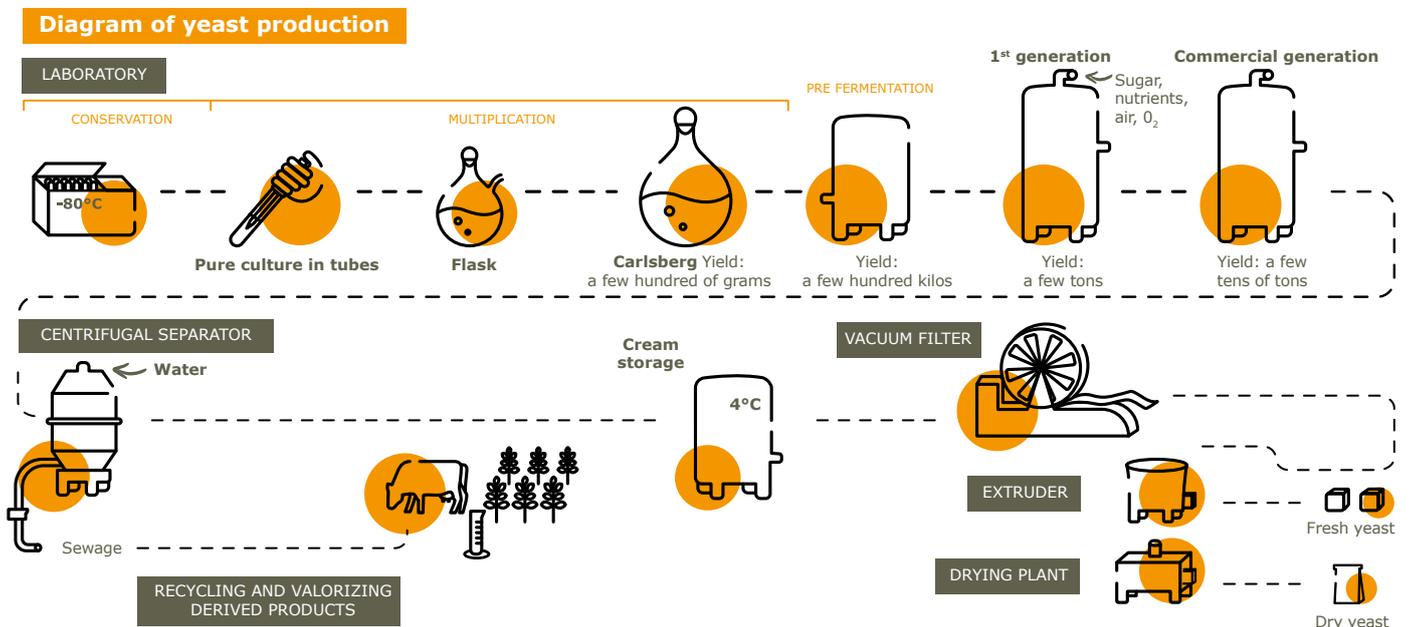
Yeast production consists of putting a limited number of yeast cells in **all the right conditions** which enable the yeast cells to **multiply**. It all begins in what we call a « **yeast collection** » where the different strains of yeast are stored at -80°C . A few colonies of yeast are **transferred to a culture medium** and this is placed in an incubator at a favorable temperature. The multiplication process begins and requires patience, expertise and care!

Next, the yeast cells are transferred to a larger environment (multiplication tanks). The purpose of these different stages is to successively **increase the biomass**, namely the quantity of cells produced, to reach enough yeast, while maintaining the best physiological state possible. To obtain dry yeast, the yeast cream is washed filtered, and dried, making it possible to remove almost all water from the yeast while maintaining it alive and retaining its intrinsic qualities.



DID YOU KNOW?

The number of yeast cells can be multiplied by more than 1000 in just one day.



THE BENEFIT OF ACTIVE DRY YEAST

A few facts

- Active dry yeasts are able to ferment sugars efficiently, either after rehydration or pitched directly into the must for some yeast strains
- Dry yeast offers better stability and longer shelf life
- Dry yeast allows wine makers **more flexibility** and **consistency** in the fermentation process
- Selected wine yeast must respect OIV specifications and additional internal controls.

GOING FURTHER

Active Dry Yeast (ADY), as the name states, is dry yeast which, **once rehydrated, will be reactivated** and able to **ferment the sugars** that are in the must as well as to contribute to the development of **flavors and aromas**.

The use of active dry yeast has been widely accepted in the wine industry as both **quality** and **diversity have been improved** considerably in the last decades. It has been a revolutionary advancement for the wine industry. The production of active dry yeast is above all, growing a living microorganism. Therefore, it starts from a vial with **pure and stable culture** followed by a series of **multiplication steps** in vessels of increasing volume. In the final production tank, the yeast is grown fully **aerobically**. The final powder (see figure 1) has a minimum dry matter of 92% and is vacuum-packed to be **protected against oxidation** and **moisture** and to allow its preservation for **up to 4 years** depending on the yeast producers.

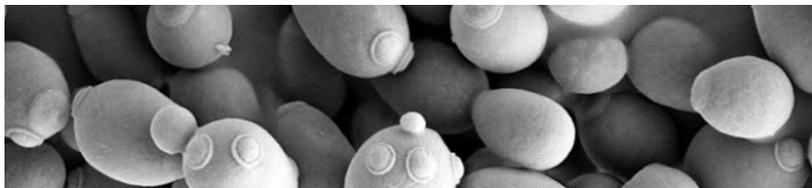


Figure 1: Optical microscopy image of active dry yeast powder granules prior to packaging

To prepare active dry yeast for fermentation, it needs to be rehydrated, either prior to pitching the yeast in must, or directly in grape must for some dry yeasts strains. Then the yeast preparation is added to the **wine tank**. As soon as the yeast is in contact with must, it is ready to ferment! This is definitively a natural, **reliable and secure way to achieve consistent fermentations** from batch to batch and meet winemakers' needs while respecting the wine potential.

5 BENEFITS OF ACTIVE DRY YEASTS (ADY) FOR WINEMAKERS:

- **Long shelf life** (preservation of yeast): one of the major advantages
- More **economical**
- **No need** for **propagation** or starter preparation
- **No need** for quality management **equipment**
- **Reliable** and **consistent quality**

EXPERT INSIGHTS

“Grapes lead to must. Only yeast converts it into wine.”

Prof. Dr. Monika Christmann



DID YOU KNOW?

Without *Saccharomyces cerevisiae*, there would be no alcoholic drinks, no bread and no fermented foods.



About selected natural wine yeast

1. ARE WINE YEASTS NATURAL?

All yeast strains and species used in the winemaking process are natural. Whatever their origin, they are all coming from nature as they typically have first been found on grapes, in musts or in the wine cellars.

2. WHAT ARE INDIGENOUS/WILD WINE YEASTS?

Grapes brought in from harvest, as well as the environment of the wine cellar, already host a variety of microorganisms called «wild yeasts» such as *Kloeckera*, *Pichia*, *Metschnikowia*, *Saccharomyces* and *Candida* genera. Some of these yeasts can contribute positively to the winemaking process but most die out as the activity of stronger fermentative yeasts, such as the *Saccharomyces* genus, increases, populating the must and producing alcohol. For the winemaker, the negative yeasts can cause problems such as off-aromas (ie faulty wines) and stuck fermentations. The winemaker therefore has to control the fermentation environment.

3. WHAT ARE 'SELECTED NATURAL WINE YEASTS'?

Over the centuries, winemakers have realised that uncontrolled fermentations led by unknown wild yeasts have limitations on their ability to produce good quality wine consistently. This led to selection programs as winemakers were learning more about yeasts. The most common yeast species associated with winemaking is *Saccharomyces cerevisiae* (a yeast variety historically used in food and beverages). Winemakers found that this yeast has predictable fermentation capabilities and other attributes beneficial to wine quality. Winemakers and yeast specialists thus continue to select from the biodiversity of other species which can offer additional benefits for wine producers.

4. ARE SELECTED NATURAL WINE YEASTS NON-GMO?

As their name indicates, Selected Natural Wine Yeasts have been selected from nature and not engineered. Selected Natural Wine Yeasts are yeasts that have been selected among wild yeasts and/or through microbiological techniques. So they are not GMO*.

*: According to regulation (EC) No. 1829/2003 of the European Parliament and of the Council on Genetically Modified Food and Feed.



5. CAN WE USE SELECTED NATURAL WINE YEASTS IN ORGANIC WINE MAKING?

Yes. To make organic wine a winemaker is obliged to follow EU regulation No 203/2012 (and its amendments) which provides that wine yeast can be used in organic wines whether the yeast is produced under organic principles or non-organic principles. However, if the organic selected wine yeast is available to the winemaker for its particular purpose, it shall be used for organic winemaking.

6. ARE SELECTED NATURAL WINE YEASTS VEGAN FRIENDLY?

Yes, yeasts used in the winemaking process are vegan friendly.

7. CAN WINE YEASTS CAUSE ALLERGIES?

Although the residual presence of wine yeast in the final wine is very small, any individual who has a medically identified sensitivity to yeast should avoid all yeast containing products.

8. ARE WINE YEASTS PROPERTIES MAINTAINED WHEN DRIED?

Wine yeasts retain their initial properties whether they are in cream, dry form or freshly sampled from a fermenting must. The selection, biomass production and drying processes are designed to keep their original properties.

9. CAN SELECTED WINE YEASTS MAKE WINES REPRESENTATIVE OF THEIR TERROIR?

Yes. The use of selected natural wine yeast supports the production of wine that respects the terroir. The use of selected wine yeast allows for the optimal expression of the grape variety and reduce the risk of aromatic deviation, while respecting the sense of place and the efforts to produce quality grapes for quality wine.

