INTRODUCTION

The definition of ‘basic’ (noun):
the essential facts or principles of a subject or skill
synonyms: fundamentals, essentials, rudiments, principles, first principles, foundations, preliminaries, groundwork, practicalities, realities, ABC

THE ANCHOR FERMENTATION GUIDE

This year we are going back to basics. The basics of winemaking, the science of winemaking, wine microbiology and the products and the principles that support the process with which we create wine. This book aims to serve as a practical guide and reference when discussing these various components of the winemaking process.

In 2018, Anchor Yeast will turn 95 years old. As a supporter of Anchor and our products, this means you have been with us on a journey where together we have achieved many important milestones:

• The first company in the Southern Hemisphere to produce yeast.
• 43 YEARS since you, the SA wine industry, used the first commercially produced Anchor wine yeast.
• VIN 13, the first hybrid wine yeast turns 27 YEARS old this year.
• The first ever interspecies hybrid, Exotics SPH, celebrates 8 YEARS of iconic wine production.
• The first company in the world to introduce blends of both yeast and bacteria.
• As Anchor Yeast celebrates its 95th birthday, our products are available on 8 different continents and in 37 different countries.

South Africa will always be the home of Anchor Yeast, with yeast manufactured in state of the art facilities and products created to cater to the South African wine conditions. In the latter years, we have also branched out and incorporated more than just yeast into our portfolio. This means that we can now offer you solutions and tools to create quality wine, that not only focus on fermentation. The rest of the production chain can also now benefit from the quality products manufactured and distributed by Anchor Yeast. We are able to broaden our product scope by forging partnerships with leaders in industries other than yeast.

ANCHOR SUPPORTING YOU FROM GRAPE TO GLASS

It is for this reason that this first edition for 2018, going back to basics, will focus not only on yeast, but also other product categories including yeast nutrition, bacteria, as well as enzymes for quality and process enhancing applications - everything you need for a successful fermentation. Our second edition, to be released after harvest, will focus on tannins and mannoproteins as tools to enhance the final wine quality before bottling. This way we can add value to you the winemaker and act as a partner throughout the production process: LITERALLY FROM GRAPE TO GLASS.

ANCHOR OENOLOGY

As a result, we are proud to bring you the brand-new Anchor Oenology division, no longer just Anchor Wine Yeast. We have been partnering with the South African wine industry for 43 years and our aim is to further enrich that relationship by delivering innovative, wine-quality enhancing products from the grape to the glass. Trust us as your partner in wine... providing the products you need, when you need them!

Our tagline says it best...
SUPPORTING YOU FROM GRAPE TO GLASS.

So cheers, gesondheid, na zdravi, santé, prost, salute, salud to the next 43 years!
GETTING TO KNOW THE ANCHOR TEAM

With the 2018 edition of the Harvest Book, we would like to introduce some new faces, as well as some familiar faces...

Director of Anchor Oenology: Danie Malherbe
Joined: August 2017
dmalherbe@anchor.co.za / 060 660 6360

As one of the newest members of our team, but a familiar face in the industry, Danie requires very little introduction. His favourite food is anything from the braai, you can catch him on top of a motorcycle or behind a rifle scope hunting for supper.

International Product Manager: Elda Lerm
Joined: October 2012
elerm@anchor.co.za / 082 903 0694

In her new role, Elda is usually on a plane somewhere, otherwise busy reading multiple books at the same time. She prefers winter over summer, white over red and brutal honesty above everything else. Kickboxing and action netball make her smile.

Technical Sales Manager: Mmule Masalesa
Joined: August 2007
mmasalesa@anchor.co.za / 082 882 3539

Mmule’s laugh is contagious and she loves beer, running and golf (in that order). Her favourite superhero is Superman and she has a mini Doberman Pincher called Spiky. When she is not popping into your cellar for a visit, she is off travelling the world.

Technical Sales Manager: Praisy Dlamini
Joined: April 2017
pdlamini@anchor.co.za / 082 907 0171

Praisy is crazy about nature and loves laughing, as well as plum-coloured lipstick and cats. Her favourite colour is baby blue and she suffers from alaktrophobia (a fear of chickens). She loves to have people over for dinner, where she uses the good wine for both drinking and cooking.

Technical Sales Manager: Lauren Behrens
Joined: September 2017
lbehrens@anchor.co.za / 082 426 1369

Lauren, also known as Lolly or Lola, enjoys “kuiertjies” on the kitchen floor with her hubby and friends. She has a variety of perfumes for each occasion and loves wildlife, camping and travelling. She hates escalators, being late and sharing her chocolate.

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Exports and Administration: Kathy Kedzior
Joined: August 1998
kkedzior@anchor.co.za / 021 534 1351

You get between Kathy and a piece of cake (preferably chocolate) at your own risk, same for her two kids. She has the world’s dirtiest sense of humour and loves to travel (despite the fact that she gets airsick). Can be bribed, all you need to do is add to her collection of keychains from around the world.

Product Planning and Quality Assurance Manager: Farieda Safudien
Joined: July 1985
fsafudien@anchor.co.za / 021 534 1351

The shortest member of our team at 1.5 m, Farieda makes up for it by never leaving home without 10 cm high heels (minimum height requirement). She is extremely fond of seafood and Kitty, her cat. Dislikes include untidiness and tickling.

Orders and Deliveries: Sebastian Petersen
Joined: October 2003
spetersen@anchor.co.za / 021 534 1351

The friendly voice on the other side of the line ready to take your order belongs to Sebastian. He is always in a happy-go-lucky mood and when he is not helping to organise your next order, he adores spending time with his two children, Asher and Leo.
What exactly is fermentation?
Fermentation occurs in the cytosol of yeast cells and is the mechanism by which the yeast produces energy (ATP) in an anaerobic environment like must.

Glucose undergoes glycolysis (via the EMP pathway) and produces two pyruvate molecules. Pyruvate is converted to acetaldehyde with the release of CO₂. Acetaldehyde is reduced to ethanol.

This process involves 12 enzymes.

**FACTORS INFLUENCING FERMENTATION:**

- **Vineyard:** The nutrient status, pesticides, fungicides, fruit maturity, cultivar, rootstock, crop load and the season can play a role.
- **Sanitation of grapes:** Spontaneous microbes deplete nutrients and can produce toxins and/or inhibitors.
- **Yeast rehydration:** According to manufacturer specifications and avoid temperature shock (within 10°C of inoculation medium).
- **Strain selection:** Selection based on fermentation capabilities, nitrogen requirements and style preferences.
- **Yeast population:** Use the required population (≥10⁵ CFU/mL; increased inoculation rate at higher concentration will ensure the required population (≥10⁶ CFU/mL) increased inoculation dosage required for extreme parameters.
- **Nutrition:** Ensure sufficient nitrogen content (±250 mg/L required for healthy fermentation) and supplement with a balanced source of DAP, amino acids, minerals and vitamins.
- **Rate of fermentation:** Steady rate desired.
- **Oxygen/SO₂:** Oxygen is an essential nutrient as lipids and sterols are produced with slight aeration. The SO₂ concentration will perform an anti-oxidative and anti-microbial function and efficacy is pH dependent.
- **Sugar concentration:** Influences the osmotic pressure. Consider the osmotolerance of the yeast strain (increased inoculation rate for high sugar must (≥26%B)). Grapes consist of glucose and fructose in approximate 1:1 ratio with traces of sucrose. A too high sugar concentration can delay the onset of fermentation (long lag phase), reduce cell viability and increase sensitivity to ethanol. This can also lead to increased acetic acid production, therefore increasing the likelihood of a stuck fermentation.
- **Fructose concentration:** The ratio of glucose to fructose can potentially cause stuck fermentation, so select a fructophilic yeast if necessary.
- **Alcohol concentration:** It influences the yeast membrane integrity and ability to uptake sugar and nitrogen.
- **Fermentation temperature:** Increase the inoculation rate at higher and lower fermentation temperatures. Temperature has a direct influence on the alcohol tolerance of the yeast strain. The growth rate of the yeast is strongly dependent on temperature.
- **Low fermentation temperatures:** In white and red wines, can cause retarded growth but increased yeast viability. Results in a slower fermentation, more alcohol production, more ester production, retention of fruit esters and overall more flavour.
- **Higher fermentation temperatures:** In red wines it influences the extraction of tannins and anthocyanins. It results in a shorter lag phase and earlier extraction and could cause higher concentrations of acetic acid and acetaldehyde, as well as lower esters.
- **Yeast hulls:** These stimulate fermentation by detoxification, by supplying unsaturated fatty acids as an oxygen substitute and the addition of amino acids.
- **Pesticides/heavy metals:** These can cause the production of stress metabolites and prevent/inhibit fermentation. The effect differs due to sensitivity differences between strains.
- **pH and acidity:** Yeast cells work over a wide pH range (typically 3.4). The pH has more of an impact on SO₂ efficacy. There is a slight influence on pH and acidity due to alcohol and the change in buffer capacity. Important acids to consider are tartaric, malic, acetic and succinic acids.
ORDERS, DELIVERIES AND TECHNICAL SUPPORT

Send your order to Kathy, Sebastian or your Technical Sales Manager.
Share/send your order form (that includes your order number and preferred delivery date) via:
Telephone: 021 534 1351 or Email: oenology@anchor.co.za

WHEN DOES IT GET DELIVERED?
• Tuesdays
• Thursdays
• Every second Friday
• Daily: Other major areas

EMERGENCY DELIVERIES:
Speak to the Technical Consultant in your area.

CONSULTANT / AREAS

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<td>Payment terms (account holders)</td>
<td>30 days from account statement</td>
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THE FINE PRINT

• Open an account before the harvest season to allow adequate time for a credit check.
• No unused product will be taken back after the season.
• Products have adequate shelf-life if stored correctly.
• For all certification and documentation, contact your Technical Consultant.

ANCHOR S.O.S TRUCK FOR EMERGENCY DELIVERIES

We want to make it possible for you to get the product you need… when you need it most!
A special truck will be armed with all your favourite Anchor products, driven by the man with the smile, Patrick Khumalo and will be covering the following areas:
• Robertson
• Bonnievale
• McGregor
• Worcester
• Breedekloof

WE ARE BRINGING PRODUCTS RIGHT TO YOUR DOORSTEP! WE ARE HERE FOR YOU!
Normal terms and conditions apply for all account holders, otherwise COD.

INTRODUCING THE NEW ANCHOR YEAST WEBSITE

We have a brand new website, now with the datasheets of all your favourite products.
See our new website at: www.anchor.co.za

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CHAPTER 1: YEAST

ANCHOR YEAST GLOBAL FOOTPRINT

- Argentina
- Australia
- Bosnia
- Austria
- Bulgaria
- Canada
- Chile
- Croatia
- Czech Republic
- France
- Georgia
- Germany
- Greece
- Hungary
- India
- Italy
- Japan
- Kenya
- Mexico
- Moldavia
- New Zealand
- Poland
- Portugal
- Romania
- Russia
- Serbia
- Slovakia
- Slovenia
- South Africa
- Spain
- Switzerland
- Thailand
- Turkey
- Ukraine
- United Kingdom
- Uruguay
- USA
**FACTORS INFLUENCING YEAST CELL METABOLISM:**

**Sugar**

Hexoses are the fermentable sugars (glucose and fructose), whilst pentoses are utilised by non-Saccharomyces. High sugar concentrations result in osmotic stress and higher ethanol concentrations results in more toxicity. Sugar transporters also have a lower affinity for fructose, often causing an imbalance in the glucose-fructose ratio.

**Nitrogen**

Nitrogen is required for protein synthesis, including enzymes for the glycolytic pathway, essential for fermentation. Reduced nitrogen results in lower cellular activity and less biomass. Yeast assimilable nitrogen (YAN) refers to the nitrogen sources readily assimilated by the yeast: ammonia and amino acids.

**Ethanol**

Yeast strains display a difference in ethanol tolerance. High levels potentially lead to stuck/slugish fermentations and inhibit yeast growth and cell viability. This is a direct result of the inhibition of amino acid permease and glucose transport systems, whereby ethanol influences the integrity of the yeast plasma membrane. Ethanol also increases the toxicity of other compounds like medium chain fatty acids.

**Sulphur dioxide (SO₂)**

Sulphur dioxide plays both an antiseptic and anti-oxidative role. The anti-microbial action of molecular SO₂ is influenced by pH, temperature and time of exposure. Sulphur dioxide is taken up by the yeast: ammonia and amino acids.

**Oxygen (O₂), sterols and unsaturated fatty acids**

Oxygen is required for the synthesis of cellular compounds and efficient growth, not for energy production. Yeast cells require 5-10 mg/L O₂ for cell growth. Reduced oxygen levels result in reduced biomass and reduced glycolysis due to the inhibition of fatty acid and sterol synthesis. Sterols and long chain unsaturated fatty acids act as survival factors, anaerobic growth factors and oxygen substitutes. These compounds are responsible for maintaining cell membrane integrity and permeability for cellular metabolism (enhanced ethanol tolerance and cell viability when ethanol increases). After crushing, there is usually sufficient dissolved oxygen in the must.

**Medium chain fatty acids**

The most influential of these are octanoic and decanoic acids. Factors influencing their production include strain dependency, O₂ addition, fermentation temperature and degree of must clarification. These compounds decrease the maximum growth rate and biomass production of S. cerevisiae. This extends the lag phase.

**Acetic acid**

Acetic acid in fermenting cells, pyruvate is reduced to ethanol and ethanol is oxidised to acetaldehyde, which can be further oxidised to acetic acid. The most important factor influencing the acetic acid concentration is the yeast strain. Secondary factors include the presence of non-Saccharomyces yeast, nitrogen content, fermentation temperature and excessive clarification of the must.

**Vitamins and minerals**

Vitamins serve as co-factors in enzymatic conversions and deficiencies can be created due to: high SO₂ concentration, pasteurization, ion exchange, mother tanking and mould infestations on grapes. Mould infestation may also result in decreased mineral availability, which in turn results in decreased yeast metabolism and biomass.

**Temperature**

Extreme temperatures affect yeast growth and metabolism and have an impact especially during the budding phase of the yeast. Very low temperatures reduce the fluidity of the yeast plasma membrane, which can result in stuck or sluggish fermentations. Higher fermentation temperatures in red wine enhance the negative impact of ethanol. Even small temperature fluctuations during the budding phase (rehydration and lag phase) could have a negative impact causing the production of heat shock proteins.

**Clarification**

This can result in delayed fermentations and the production of volatile acidity. Clarification deprives the yeast of unsaturated fatty acids and synthesising them from pyruvate is only possible under aerobic conditions. Under anaerobic fermentation conditions, acetate is formed.

**Fungicides, pesticides and copper**

There are maximum residue levels, limits and withholding periods in place. Whilst copper is an essential heavy metal to all organisms, there is a very narrow optimum concentration range. Copper results in rapid loss of cellular K⁺ levels and permeabilization of the plasma membrane. Copper sensitivity is strain dependent.

**Non-Saccharomyces species**

Their concentration usually varies from 10⁹ – 10⁷ CFU/berry, depending on climate. Some species survive normal SO₂ dosages and are later killed by ethanol. These species use nutrients at the expense of inoculated starter cultures. These species also tend to produce acetic acid and possibly proteinaceous killer toxins.

**Acetic acid bacteria**

These bacteria are able to survive and grow in anaerobic conditions. They have a negative effect on yeast growth and fermentation efficiency (directly or indirectly). The production of acetic acid is toxic to yeast and can also lower the glucose to fructose ratio that can result in problematic fermentations.

**Lactic acid bacteria and mould**

The amount of lactic acid bacteria is dependent on climate, region, SO₂ dosage and wine pH. Fungi like Aspergillus and Botrytis can produce toxic substances.
### YEAST SELECTION

#### WHITE WINE STRAINS

<table>
<thead>
<tr>
<th>Application</th>
<th>iconic wines</th>
<th>ester production</th>
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<th>complex wines</th>
<th>fruity wines</th>
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- **Cold tolerance**: 18°C, 12°C, 12°C, 12°C, 10°C, 13°C
- **Alcohol tolerance**: 15.5%, 15.5%, 15.5%, 15.5%, 17%, 14.5%
- **Nitrogen demand**: average, average, average, low, low, complex

**Sensory descriptors**
- exotic fruits
- stone fruits
- floral
- mouthfeel
- fruity
- floral
- guava
- tropical
- citrus
- pineapple
- muscat
- grapefruit
- guava
- passion fruit
- gooseberry
- floral
citrus
tropical
pineapple
muscat
grapefruit
guava
passion fruit
gooseberry

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<th>sweet wines</th>
<th>sparkling base wines</th>
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- **Cold tolerance**: 11°C, 14°C, 11°C, 12°C, 14°C, 15°C
- **Alcohol tolerance**: 16%, 15%, 16.5%, 15%, 15.5%, 18%
- **Nitrogen demand**: low, high, low, low, average, average

**Sensory descriptors**
- tropical fruit
citrus
tropical
neutral
minerality
lemon grass
pear
citrus
apricot
passion fruit
body

**Vegetal character**
# Yeast Selection

## Red Wine Strains

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<th>complex wines</th>
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<th>fruit</th>
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<th>blackcurrant</th>
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<th>prune</th>
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<th>blackberry</th>
<th>blackcurrant</th>
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<table>
<thead>
<tr>
<th>Application</th>
<th>wines with floral characters</th>
<th>wines to be aged</th>
<th>fruity, spicy wines</th>
<th>structured wines</th>
<th>smooth wines</th>
<th>restart fermentation</th>
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<tbody>
<tr>
<td>Also suitable for rosé</td>
<td></td>
<td></td>
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<tr>
<td>Blend</td>
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<td>Hybrid</td>
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<td></td>
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<tr>
<td>Natural isolate</td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td>Restart stuck fermentation</td>
<td></td>
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<tr>
<th>Cold tolerance</th>
<th>16°C</th>
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<th>20°C</th>
<th>22°C</th>
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<td>24.5°B</td>
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<td>Alcohol tolerance</td>
<td>15%</td>
<td>15.5%</td>
<td>15%</td>
<td>15.5%</td>
<td>15.5%</td>
<td>18%</td>
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<td>low</td>
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<td>++</td>
<td>n/a</td>
</tr>
</tbody>
</table>

| Sensory descriptors | red berry | floral | blackcurrant | prun | cherry | spice | structure | blackberry | blackcurrant | raspberry | chocolate | soft tannins | cherry | plum | blackcurrant | blackcurrant | red fruit | black fruit | low astringency | roundness | varietal | character |
|---------------------|-----------|--------|-------------|------|--------|--------|-----------|-------------|-------------|-----------|-----------|---------------|--------|------|-------------|-------------|-----------|-------------|-------------|-----------|---------|----------|---------|

| MLF compatibility | ++ | ++ | ++ | ++ | ++ | n/a |

| Sensory descriptors | red berry | floral | blackcurrant | prun | cherry | spice | structure | blackberry | blackcurrant | raspberry | chocolate | soft tannins | cherry | plum | blackcurrant | blackcurrant | red fruit | black fruit | low astringency | roundness | varietal | character |
|---------------------|-----------|--------|-------------|------|--------|--------|-----------|-------------|-------------|-----------|-----------|---------------|--------|------|-------------|-------------|-----------|-------------|-------------|-----------|---------|----------|---------|

| MLF compatibility | ++ | ++ | ++ | ++ | ++ | n/a |
**PRODUCT CATALOGUE**

Anchor Oenology provides you with two distinct ranges of yeast: Anchor and Fermivin. Anchor is selected and developed for the South African industry and the new-world style of wine production. Fermivin provides the winemaker with a more traditional option, focusing on yeast strains that were mainly selected from Europe and for producing more varietal-style wines.

### FOR THE PRODUCTION OF WHITE WINES

#### EXOTICS SPH
- **Institute for Wine Biotechnology, Stellenbosch University**
  - *S. cerevisiae x S. paradoxus hybrid*
- **ICONIC BARREL FERMENTED WHITE AND ROSÉ WINES WITH INTENSE MOUTHFEEL**
  - DESCRIBERS: guava, granadilla, grapefruit, tropical fruit salad and stone fruit aromas
  - APPLICATIONS: Chardonnay, Chardonnay, Viognier, Riesling and Pinot gris

#### VIN 2000
- Institute for Wine Biotechnology, Stellenbosch University
  - *S. cerevisiae x S. cerevisiae hybrid*
- **FULL-BODIED WINES WITH GOOD MOUTHFEEL**
  - DESCRIBERS: fresh pineapple, papaya, grapefruit, tropical and citrus aromas, floral and fruity aromas
  - APPLICATIONS: Chardonnay, Chenin blanc and Viognier
- NOTES:
  - Slower, reliable fermentation rate.
  - High alcohol tolerance.
  - Fructophilic.
  - Highly suitable for barrel fermentations.
- DOSAGE: 20 g/hL
- SKU: 1 KG

#### VIN 13
- Stellenbosch University
  - *S. cerevisiae subsp. cerevisiae x S. cerevisiae subsp. bayanus hybrid*
- **AROMATIC AND ROSE WINES**
  - DESCRIBERS: fresh fruit salad, pineapple, floral and fruity (white wines); strawberry and raspberry (rosé wines)
  - APPLICATIONS: all white varieties and rosé wines
  - NOTES:
    - Robust and aromatic.
    - Fast fermentation rate.
    - Extremely sugar, alcohol and cold tolerant.
    - Restart stuck fermentations.
  - DOSAGE: 20 g/hL
  - SKU: 1 KG
  - SKU AVAILABLE ON PRE-ORDER: 5 KG / 10 KG

#### VIN 7
- Natural triploid hybrid isolated from nature
  - *S. cerevisiae (diploid) x S. kudriavzevi (triploid) hybrid*
- **THIOLIC WHITE AND ROSE WINES**
  - DESCRIBERS: guava and granadilla, grapefruit and gooseberry
  - APPLICATIONS: Sauvignon blanc, Chenin blanc, Colombard and thiol-style rosé wines
  - NOTES:
    - Can foam and produce volatile acidity under stress conditions.
    - Ensure sufficient complex nutrition and temperature control.
  - DOSAGE: 20 g/hL
  - SKU: 1 KG
  - SKU AVAILABLE ON PRE-ORDER: 5 KG

#### NT 116
- Agricultural Research Centre, Nietvoorbij
  - *S. cerevisiae x S. cerevisiae hybrid*
- **CRISP, AROMATIC WHITE WINES**
  - DESCRIBERS: tropical fruit salad, zesty citrus and volatile thiols like guava and gooseberry aromas, enhances neutral varieties
  - APPLICATIONS: Chenin blanc, Chardonnay, Colombard and Pinot gris
  - NOTES:
    - High sugar, alcohol and cold tolerance.
  - Intense ester production.
  - DOSAGE: 20 g/hL
  - SKU: 1 KG
  - SKU AVAILABLE ON PRE-ORDER: 5 KG / 10 KG

#### WE 14
- Agricultural Research Centre, Nietvoorbij
  - *S. cerevisiae subsp. bayanus*
  - **MINERAL, FRESH, AROMATIC WHITE WINES**
  - DESCRIBERS: intense, exotic fruit, guava, passion fruit, well-balanced and round on the palate
  - APPLICATIONS: all white varieties and wines to be aged on fine lees, as well as full-bodied rosé wines
  - NOTES:
    - Suitable for secondary fermentation with Charmat method.
  - DOSAGE: 20 g/hL
  - SKU: 500 G

#### LVCB
- Selected by the French Vine and Wine Institute (IFV), Loire Valley - France
  - *S. cerevisiae subsp. bayanus*
  - **AROMATIC WHITE AND ROSÉ WINES WITH A LONG FINISH**
  - DESCRIBERS: intense, exotic fruit, guava, passion fruit, well-balanced and round on the palate
  - APPLICATIONS: all white varieties and rosé wines to be aged on fine lees
  - NOTES:
    - Suitable for secondary fermentation with Charmat method.
  - DOSAGE: 20 g/hL
  - SKU: 500 G

#### N96
- Agricultural Research Centre, Nietvoorbij
  - *S. cerevisiae*
  - **4F9**
  - **CHAMPION**
  - **Restarting stuck fermentations**
  - **Sample pack available**

---

**APPLICATIONS:**
- Rosé
- Restart
- Sample pack available

---

**NOTES:**
- Fermenting highly clarified must.
- Suitable for secondary fermentation with Charmat method.
- For improvement of wine body and volume.
- Suitable for secondary fermentation with Charmat method.

**DESCRIPTORS:**
- Neutral sensory contribution
- Neutral sensory contribution allows varietal character to dominate
- Suitable for cider production.
- Suitable for secondary fermentations of MCC wines.

**DOSAGE:**
- 20 g/hL

**SKU:**
- 1 KG
  - SKU AVAILABLE ON PRE-ORDER: 5 KG
FOR THE PRODUCTION OF RED WINES

**EXOTICS SPH**

Institute for Wine Biotechnology, Stellenbosch University

**ICONIC RED WINES**

**APPLICATIONS:** Shiraz, Merlot and Pinotage

**NOTES:**
- Fermentations above 18°C.
- High glycerol production.
- Good mouthfeel.
- Fructophilic.
- Partially degrades malic acid.

**DESCRIPTORS:**
- INTENSE FRUIT RED WINES
- Yeast blend

**SKU:** 1 KG

**DOSAGE:** 20-60 g/hL

**APPLICATIONS:**
- red fruit aroma intensity like cherry, raspberry, blackberry and blackcurrant, all red varieties

**NOTES:**
- Enhances varietal character.
- Suitable with or without barrel ageing.
- High glycerol concentration softens the mouthfeel.
- Not suitable for cold soaking.

**DESCRIPTORS:**
- FULL-BODIED RED WINES FOR BARREL MATURATION
- Yeast blend

**SKU AVAILABLE ON PRE-ORDER:** 5 KG / 10 KG

---

**NT 202**

Agricultural Research Centre, Nietvoorbij

**SKU:** 1 KG

**APPLICATIONS:**
- Cabernet Sauvignon and Shiraz
- Cabernet Sauvignon and Merlot
- Pinotage, Merlot and Cabernet Sauvignon

**NOTES:**
- Fruity, expressive wines with soft tannins, cherry, raspberry, blackberry, plum and spices
- Suitable with or without barrel ageing.
- High glycerol concentration softens the mouthfeel.
- Not suitable for cold soaking.

**DESCRIPTORS:**
- RED WINES TO BE AGED
- Yeast blend

**SKU AVAILABLE ON PRE-ORDER:** 5 KG

---

**NT 50**

Agricultural Research Centre, Nietvoorbij

**SKU:** 1 KG

**APPLICATIONS:**
- Cabernet Sauvignon, Pinotage, Merlot, Shiraz and Tempranillo

**NOTES:**
- Stable with or without barrel ageing.
- Suitable for cold soaking.
- Masks green characters.
- High glycerol concentration softens the mouthfeel.

**DESCRIPTORS:**
- FRUITY AND ROUGH RED WINES
- Yeast blend

**SKU AVAILABLE ON PRE-ORDER:** 5 KG

---

**WE 372**

Isolated from nature

**SKU:** 1 KG

**APPLICATIONS:**
- Cherry, raspberry, blackberry, plum and spices

**NOTES:**
- Respects varietal character.
- Adsorbs astringent tannins and reduces wine astringency.

**DESCRIPTORS:**
- FRUITY AND SPICY RED WINES
- Yeast blend

**SKU AVAILABLE ON PRE-ORDER:** 5 KG

---

**VR5**

Selected in Burgundy - France

**SKU:** 1 KG

**APPLICATIONS:**
- Red and black fruits, low astringency and roundness on the palate

**NOTES:**
- Absorbs astringent tannins and reduces wine astringency.

**DESCRIPTORS:**
- RED WINES TO BE AGED
- Yeast blend

**SKU AVAILABLE ON PRE-ORDER:** 5 KG / 10 KG

---

**MT 48**

Selected by the French Vine and Wine Institute (IFV), Bordeaux – France and Bordeaux Wine Council

**SKU:** 1 KG

**APPLICATIONS:**
- Red and black fruits, low astringency and roundness on the palate

**NOTES:**
- Absorbs astringent tannins and reduces wine astringency.

**DESCRIPTORS:**
- RED WINES TO BE AGED
- Yeast blend

**SKU AVAILABLE ON PRE-ORDER:** 5 KG

---

**A33**

Selected by the University of Chile

**SKU:** 1 KG

**APPLICATIONS:**
- Expressive wines with soft tannins, cherry, raspberry, blackberry, plum and spices

**NOTES:**
- Suitable for wines matured for short periods.
- High concentration of glycerol produced.

**DESCRIPTORS:**
- FRUITY AND ROUGH RED WINES
- Yeast blend

**SKU AVAILABLE ON PRE-ORDER:** 5 KG

---

**XL**

Selected by the University of Santiago - Chile

**SKU:** 1 KG

**APPLICATIONS:**
- Expressive wines with soft tannins, cherry, raspberry, blackberry, plum and spices

**NOTES:**
- Suitable for wines matured for short periods.
- High concentration of glycerol produced.

**DESCRIPTORS:**
- FRUITY AND ROUGH RED WINES
- Yeast blend

**SKU AVAILABLE ON PRE-ORDER:** 5 KG

---

**CHAMPION**

Selected by the French National Institute for Agricultural Research (INRA), Languedo - France

**SKU:** 1 KG

**APPLICATIONS:**
- Absorbs astringent tannins and reduces wine astringency.

**NOTES:**
- Respects varietal character.

**DESCRIPTORS:**
- RED WINES TO BE AGED
- Yeast blend

**SKU AVAILABLE ON PRE-ORDER:** 5 KG
Generating new sensory data on VIN 13, Alchemy I and Alchemy II.

IN AROMATIC WHITE WINES
Sauvignon blanc: French Vine and Wine Institute - Val de Loire
Riesling: French Vine and Wine Institute - Alsace
Chenin blanc: French Vine and Wine Institute - Val de Loire
Fermentation performed at two different temperatures (15°C and 18°C) to study the impact on thiol and ester production.

Generating data on the use of Alchemy III and IV on rosé and lighter-style red wines.

ROSE:
Centre du Rosé - France

PINOT NOIR:
French Institute for Vine and Wine - Beaune
San Michele - Italy

IN THE SPOTLIGHT
ALCHEMY:
THE PRODUCTION OF ULTRA-PREMIUM WHITE AND RED WINES
Alchemy yeast blends have been developed specifically for the production of New World style aromatic white and red wines: ester and thiol enriched white wines and complex and intense fruit-driven red wines.

Anchor has developed, in collaboration with the Australian Wine Research Institute, four yeast blends for the increased aromatic intensity, flavour and complexity of white and red wines. These yeast blends are also highly robust and can withstand the rigours and challenges of modern winemaking, including temperature, alcohol and sugar tolerance.


When comparing the production of some of the most important volatile compounds (esters and volatile thiols), Alchemy I and II compared to other commercial strains, consistently produced the highest concentrations of the highly aromatic volatile aroma compounds. These include the volatile thiols 3MH, 3MHA and 4MMP and the esters isomethyl acetate, phenylethyl acetate and 2-methylbutyl acetate.

Volatile aroma compounds enhanced with Alchemy I and II

ESTERS:
- Isoamyl acetate
- Phenylethyl acetate
- 2-Methylbutyl acetate

VOLATILE THIOLS:
- 4MMP
- 3MH
- 3MHA

Volatile aroma compounds enhanced with Alchemy III and IV

ESTERS:
- Isoamyl acetate
- Phenylethyl acetate
- 2-Methylbutyl acetate

VOLATILE THIOLS:
- 4MMP
- 3MH
- 3MHA

Following trials in 2015 in 6 countries, 48 cellars, 16 cultivars, 15 000 hl fermented must and 450 kg of each product, Alchemy III and IV were successfully launched in 2016. Alchemy III for the production of complex red wines and Alchemy IV for the production of intense, fruit-driven red wines. The clear enhancement in the complexity and/or fruit profile of the wine is a direct result of the increased production of aromatic compounds. In conjunction, a decrease in methoxypyrazines mask green characters.

VOLATILE AROMA COMPOUNDS ENHANCED WITH ALCHEMY I AND II

**ESTERS:**
- Isoamyl acetate: Banana, pear, fruity, sweet
- Phenylethyl acetate: Floral, rose, honey
- 2-Methylbutyl acetate: Fruity, banana, candy

**VOLATILE THIOLS:**
- 4MMP: Blackcurrant, box wood
- 3MH: Grapefruit, passion fruit, guava
- 3MHA: Passion fruit, box wood, guava

**VOLATILE AROMA COMPOUNDS ENHANCED WITH ALCHEMY III AND IV**

**ESTERS:**
- Isoamyl acetate: Banana, pear, fruity, sweet
- Phenylethyl acetate: Floral and fruity
- 2-Methylbutyl acetate: Fruity

**VOLATILE THIOLS:**
- 4MMP: Blackcurrant, box wood
- 3MH: Grapefruit, passion fruit, guava
- 3MHA: Passion fruit, box wood, guava
**TESTIMONIALS**

Based on the successful launch of Alchemy III and IV in 2016 in the Northern Hemisphere, we have asked the winemakers to share their experiences with the two new products and the wines they have produced.

“I trialled the new strains in 2015 and based on my experience, I decided to buy the product when it was launched in 2016.”

“It is so easy to understand the difference between the two products: the complexity you get with Alchemy III and the fruit aroma intensity you get with Alchemy IV.”

“Alchemy III gave us excellent results in slightly greener or less ripe wines and reduced the methoxypyrazines and green characteristics.”

“Alchemy III really created wines with a large amount of mouthfeel, structure and complexity.”

“With Alchemy IV, we got really clean wines, a lighter mouthfeel compared to Alchemy III, with loads of fruit intensity.”

“When I used Alchemy IV, I found that it did not necessarily change, but rather enhanced the varietal character and complexity.”

“When I used Alchemy IV on Cabernet Sauvignon and Petit Verdot, I definitely noticed a reduction in the pyrazines.”

“Alchemy IV gave me fast fermentation kinetics, a lot of fruit and even more floral aromas.”

“In Merlot and Shiraz, Alchemy IV gave me fresh aroma, full bodied and rounded wines, with loads of fresh, black fruit notes.”

The results speak for themselves. In fact, you the winemakers, have confirmed the success of the blends year after year. These blends are unique in terms of their enhancement of the quality, aroma and complexity of white and red wines to a larger extent than a single individual yeast strain. Besides the aromatic and quality benefits, these yeast blends are robust and created to provide a secure fermentation in a wide range of conditions. This means you are guaranteed an efficient and successful fermentation.
CHAPTER 2: NUTRIENTS

INTRODUCTION

What is a nutrient?

**nutrient**

noun

_ a substance that provides nourishment essential for the maintenance of life and for growth

The majority of the energy required by an organism to function on a metabolic level, is found in macronutrients. The necessary cofactors for metabolism are provided by micronutrients. Both are essential for fermentation and biomass production. Nutrients essential for fermentation include the following:

- Carbon source (glucose and fructose)
- Nitrogen source (ammonia and amino acids)
- Phosphate
- Vitamins and minerals
- Long chain fatty acids and sterols (survival factors)

NITROGEN

Nitrogen is required to produce proteins required for fermentation and biomass production. These include enzymes in the glycolytic pathway responsible for fermentation and permeases responsible for transporting components into the cells. The absolute minimum nitrogen requirement is approximately 150 mg/L, whilst the preferred concentration usually varies from 225 - 275 mg/L. The requirement is influenced by the fermentation parameters, yeast strain nutritional needs and the initial nitrogen composition of the must. Some factors that can influence the nitrogen composition of the must include: vineyard fertilisation, berry maturation, vine water status, soil type and composition, cultivar and rootstock, climate, irrigation and other vineyard management practices.

Yeast assimilable nitrogen (YAN) refers to the fraction of nitrogen available for uptake by the yeast.

YAN = ammonium ions and amino acids.

A shortage of YAN could lead to the production of off flavours like hydrogen sulphide, mercaptans and sulphur-containing compounds (rotten egg smell), sluggish or stuck fermentations.

The most important amino acids (quantity) in must include proline, arginine and glutamine. Other amino acids of importance include glutamate, alanine, serine and threonine.

- Glutamine and glutamate: preferred for yeast growth.
- Asparagine, aspartate, serine, alanine: most support of rapid growth.
- Proline: not metabolised under anaerobic conditions.

VITAMINS

Vitamins can be synthesised or be taken up from the must. These compounds are used as co-factors in enzymatic conversions and are usually found in sufficient concentrations in the must. The most important vitamins are thiamine, biotin and pantothenate. Biotin and thiamine increase the viable yeast count and fermentation rate. Mold infestation and propagation reduce the vitamin content. Thiamine can be synthesised by yeast, but this results in slow fermentation, less biomass production and sluggish/stuck fermentation.

MINERALS

Minerals are used as co-factors in enzymatic requirements. Magnesium plays a key role in metabolic control, growth, proliferation and stabilising nucleic acids, proteins, polysaccharides and lipids.

SURVIVAL FACTORS

Survival factors are only formed in the presence of oxygen and are therefore known as oxygen substitutes. These include sterols and long chain unsaturated fatty acids. These compounds are responsible for ensuring the correct cell membrane integrity and permeability for cellular metabolism. Grape must usually contains sufficient oxygen after crushing for adequate synthesis of these factors. Active dried yeast produced under aerobic conditions are high in these factors, so are inactivated yeast cells/cell walls. On the other hand, propagation, excessive clarification and ascorbic depletes these survival factors.
1. Use the recommended dosage of active dried yeast culture. This will ensure a yeast population rich in stress protecting factors like glycogen and trehalose, as well as sterols, unsaturated fatty acids, vitamins and minerals. Increase the dosage in more challenging conditions.

2. Allow the fermentation to start with only a small addition of nitrogen. This will facilitate the uptake of amino acids without the overstimulation of yeast growth.

3. More stressful conditions require a more complex nutritional approach and addition at the start and during fermentation.

4. Nitrogen supplementation: 20-30% into the fermentation and gradually supply further additions.

5. Avoid a late addition as yeast will not respond. Timing of the addition is dependent on must and yeast strain.

### Yeast Cell

<table>
<thead>
<tr>
<th>Component:</th>
<th>Composition:</th>
<th>Function:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cell wall</td>
<td>Mannoproteins and glucans</td>
<td>Form physical barrier and provide shape</td>
</tr>
<tr>
<td>Periplasmic space</td>
<td>Glucan and chitin chains</td>
<td>Enzymes regulating yeast metabolism</td>
</tr>
<tr>
<td>Cell membrane</td>
<td>Sterols and lipids</td>
<td>Regulate what enters and exits the cell</td>
</tr>
<tr>
<td>Cytoplasm</td>
<td>Organelle</td>
<td>Metabolic reactions: e.g., fermentation</td>
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### Yeast Nitrogen Requirements of Our Yeast Portfolio

<table>
<thead>
<tr>
<th>Yeast Nitrogen Requirement (mg/L)</th>
<th>Sugar Concentration of the Must</th>
<th>Yeast Strains</th>
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<tbody>
<tr>
<td>Low</td>
<td>22-24°B 24-26°B &gt;26°B</td>
<td>VIN 2000; VIN 13; NT 116; N96; LVCB; VR5; MT48</td>
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<tr>
<td>Medium</td>
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<td>Exotics; Alchemy I, II, III and IV; 4F9; Champion NT 202; NT 112; WE 372; XL</td>
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<tr>
<td>High</td>
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<td>VIN 7; WE 14; NT 50; A33</td>
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### Nutrient Selection

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Retraction</th>
<th>Complex</th>
<th>Aroma enhancing</th>
<th>Detoxifying</th>
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</thead>
<tbody>
<tr>
<td>Yeast Nitrogen Requirement at 20 g/L dosage</td>
<td>2 mg/L</td>
<td>30 mg/L</td>
<td>26 mg/L</td>
<td>5 mg/L</td>
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Use in conjunction with additional nitrogen source.

### Nutrient Management and Commercial Products

**NUTRIENTS 26**

**NUTRIENT MANAGEMENT AND COMMERCIAL PRODUCTS**

**NUTRIENTS 27**

**NUTRIENT REQUIREMENTS OF OUR YEAST PORTFOLIO**

**NUTRIENT SELECTION**

**NUTRIVIN**

**NATUFERM**

**EXTRAFERM**

**ANCHORFERM**

**NUTRIVIN SUPER**

**CONTAINS:**

- Inactivated yeast
- Di-ammonium phosphate
- Ammonium sulphate
- Thiamine
- Autolysed yeast
- Yeast hulls

**Use in conjunction with additional nitrogen source**
PRODUCT CATALOGUE

ANCHORFERM
Rehydration nutrient consisting of inactivated yeast to increase yeast viability and fermentation capabilities.

REHYDRATION
APPLICATION:
• Thiamine stimulates yeast growth and metabolism.
• Inactivated yeast are rich in vitamins and minerals and other trace elements required for optimum yeast performance, as well as reducing the risk of stuck fermentation and off-odours.
• Sterols and long chain fatty acids improve alcohol tolerance.

USAGE: Add to rehydration mixture together with yeast.

DOSAGE: 20 g/hL
SKU: 1 KG / 10 KG

NUTRIVIN
Complex nutritional supplement to adjust the yeast assimilable nitrogen.

STANDARD FERMENTATION CONDITIONS
APPLICATION:
• Complex nutrition will stimulate yeast growth and metabolism.

USAGE: Use after the start of fermentation to allow for the uptake of amino acids before addition. Another addition later in the fermentation could be beneficial. Avoid addition at the end of fermentation.

DOSAGE: 20 g/hL
SKU: 1 KG / 10 KG

NUTRIVIN SUPER
Thiamine-enriched complex nutrition formulated for increased stress conditions like high sugar must, low nutrient status and infected grapes.

CHALLENGING FERMENTATION CONDITIONS
APPLICATION:
• Complex nutrition will stimulate yeast growth and metabolism.

USAGE: Use after the start of fermentation to allow for the uptake of amino acids before addition. Another addition later in the fermentation could be beneficial. Avoid addition at the end of fermentation.

DOSAGE: 20 g/hL
SKU: 1 KG / 10 KG

NATUFERM®
A unique formulation rich in available amino nitrogen and trace elements. Its composition promotes fermentation effectiveness and actively contributes to obtaining wines with excellent aromatic and analytical qualities.

ENHANCING THE AROMATIC CAPABILITIES OF THE YEAST
APPLICATION:
• Promotes the production of aromatic fermentation esters and thiols.
• Increases yeast viability at the end of the fermentation.
• Improves the organoleptic profile of the wine.

USAGE: Addition at the beginning of fermentation will allow for the uptake of amino acids by the yeast.

DOSAGE: 20-30 g/hL
SKU: 1 KG

EXTRAFERM®
Consists of pure yeast hulls able to support fermentation and improve wine quality by adsorbing toxic compounds and off-flavours from must and wine.

DETOXIFYING MUST AND IMPROVING YEAST VIABILITY
APPLICATION:
• Removal of yeast inhibitory compounds like medium chain fatty acids.
• Removal of toxic compounds like ochratoxin A.
• Removal of anisoles (TCA, TRA and PCIA) and dibutyl phthalates.
• Improve yeast viability and alcohol tolerance.

USAGE: Use at the beginning of fermentation in challenging must conditions (overly clarified). Use at the end of fermentation to increase yeast viability or to treat sluggish or stuck AF or MLF. Use as a detoxifying agent and proceed to rack the wine after treatment.

DOSAGE:
• 20 g/hL (prior to fermentation)
• 30 - 40 g/hL (sluggish or stuck fermentation)
• 20 - 40 g/hL (detoxifying)
SKU: 1 KG

INNOVATIONS OF TOMORROW

Investigating the impact of a new rehydration agent on the fermentation and aroma enhancing capabilities of yeast.

ARC NIETVOORBIJ, STELLENBOSCH
Chenin blanc: VIN 7, NT 116 and VIN 13
Shiraz: NT 50, NT 202 and WE 372

Treatments with the new rehydration nutrient displayed higher cell counts and percentage viability, even towards the end of fermentation, compared to a treatment with no rehydration nutrient (control).

This resulted in a slightly faster fermentation rate compared to the control sample.

AVERAGE SUGAR CONCENTRATION IN °B DURING FERMENTATION OF SHIRAZ GRAPE MUST (ALL TREATMENTS WERE REHYDRATED WITH THE NEW PRODUCTS, EXCEPT THE CONTROL)

Investigating the impact of a new specific inactivated yeast product on wine quality and sensory properties.

SOUTH AFRICA
All varieties.

Available for trial purposes this vintage.

CONTACT YOUR TECHNICAL CONSULTANT IF YOU WOULD LIKE TO PARTICIPATE IN A TRIAL IN THE 2018 VINTAGE.
IN THE SPOTLIGHT

NATUFERM®

Natuferm is a product consisting of 100% autolysed yeast. This product is rich in free amino acids and trace elements: a high concentration of amine acid precursors for ester and thiol production and a naturally low concentration of amine acid precursors for biogenic amine production.

AMINO ACIDS CAN BE CLASSIFIED:

<table>
<thead>
<tr>
<th>YEAST PREFERRED</th>
<th>AROMA PRECURSORS</th>
<th>SULPHUR CONTAINING</th>
<th>NOT PREFERRED</th>
<th>NOT METABOLIZED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arginine</td>
<td>Glutamine</td>
<td>Methionine</td>
<td>Alanine</td>
<td>Histidine</td>
</tr>
<tr>
<td>Asparagine</td>
<td>Leucine</td>
<td>Methionine</td>
<td>Glycine</td>
<td>Lysine</td>
</tr>
<tr>
<td>Aspartic acid</td>
<td>Phenylalanine</td>
<td>Methionine</td>
<td>Serine</td>
<td>Proline</td>
</tr>
<tr>
<td>Asparagine</td>
<td>Tyrosine</td>
<td>Methionine</td>
<td>Threonine</td>
<td>Methionine</td>
</tr>
<tr>
<td>Glutamic acid</td>
<td>Valine</td>
<td>Methionine</td>
<td>Methionine</td>
<td>Methionine</td>
</tr>
</tbody>
</table>

NATUFERM:
- 100% autolysed yeast rich in organic nitrogen (free amino acids and peptides).
- High concentration of free amino acids (preferred and aroma precursors), peptides and proteins: higher compared to competitor products and pure yeast hulls.
- Promotes a healthy yeast population.
- Increases the production of aromatic fermentation esters and thiols.

Application:
- Add Natuferm at the beginning of fermentation and then add ammonium salts or complex yeast nutrients two to three days later as needed.
- Easily dispersible in water or must.
- Composition promotes fermentation effectiveness and actively contributes to obtaining wines with excellent aromatic quality.

IMPACT ON AROMA COMPOUND PRODUCTION

Investigation of the impact of Natuferm (20 g/hL) on the aroma production ability of Exotics SPH and NT 202, compared to DAP addition (30 g/hL) in Shiraz.

TOTAL 2-PHENYLETHANOL AND 2-PHENYLETHYL ACETATE CONCENTRATION (mg/L): FLORAL AND ROSE AROMAS

TOTAL HIGHER ALCOHOL (ETHYL HEXANOATE, ETHYL OCTANOATE, ETHYL DECANOATE) CONCENTRATION (mg/L): FRUITY AROMAS

TOTAL TERPENE (LINALOOL, NEROL, GERANIOL, CITRONELLOL, ALPHA-TERPINEOL) CONCENTRATION (µg/L): COMPLEX, LITCHI AND ROSE AROMAS

In all cases, the treatment with Natuferm resulted in increased aroma compound production compared with other treatments.
**CHAPTER 3:**

**BACTERIA**

**INTRODUCTION**

What is bacteria?

*bacterium*

*a member of a large group of unicellular microorganisms which have cell walls but lack organelles and an organized nucleus*

**MALOLOACTIC FERMENTATION**

Lactic acid bacteria (LAB) in wine are responsible for the process of malolactic fermentation (MLF). This process has three main effects:
- Increased pH due to the de-acidification of malic to lactic acid.
- Increased microbial stability due to the removal of malic acid as a carbon substrate.
- Sensory modification of the wine via bacterial metabolism.

Lactic acid bacteria species from the general Leuconostoc, *Pediococcus, Lactobacillus* and *Denococcus oeni*, are responsible for the changes to the wine matrix during MLF. Most commercial starter cultures comprise of *O. oeni*, but research in recent years has brought to light the beneficial impact of *Lactobacillus plantarum*, especially on the sensory characteristics of the wine. *Lactobacillus* are ideal as starter cultures as they are homofermentative and thus produce no volatile acidity, as well as having complex enzymatic profiles that allow for increased aroma production and/or release.

**FACTORS INFLUENCING MLF**

**Yeast bacteria interactions**

These interactions are influenced by the following three factors: strain specific characteristics of the yeast and bacteria; uptake and release of nutrients (sterols, amino acids, vitamins and mannnoproteins) by the yeast; and the production of yeast-derived stimulatory/inhibitory compounds e.g. ethanol, sulphur dioxide, medium chain fatty acids, etc. The most important consideration for a winemaker is selecting the right combination of yeast and bacteria.

**Ethanol, sulphur dioxide & medium chain fatty acids**

Ethanol has an instant effect on the membrane integrity and viability of the bacteria cell and can result in cell death. The molecular fraction of SO₂ is the only fraction that can cross the bacterial cell wall via diffusion and therefore plays an anti-microbial role by inhibiting growth and disrupting proteins and co-factors. Medium chain fatty acids inhibit cell growth and malic acid metabolism. The mechanism includes the inhibition of ATPase activity which means the bacteria cannot maintain its intracellular pH. This results in a lack of a proton gradient and thus no transport of metabolites across the membrane is possible.

**pH**

The pH does not only influence the anti-microbial fraction of SO₂ present in the wine, but can also have a direct influence on the LAB species present in the must and/or wine by impacting on the growth rate, viability and metabolism of the bacteria. The optimum wine pH for bacteria is 3.5, but most commercial cultures can ferment at a wider pH range.

**Temperature**

The fermentation temperature directly impacts the growth rate, length of lag phase and population size of the LAB. The optimum temperature for bacteria is from 18-22°C, but the bacteria can survive and perform across a wider range (15-30°C).

**Phenolic compounds**

Both the flavonoid and non-flavonoid fractions of phenolic compounds can stimulate or inhibit LAB. This occurs via an interaction of the phenolic compounds with cellular enzymes and/or the adsorption of phenols to the cell walls. These compounds can also be metabolised by LAB to form other compounds, either positive or negative.

**Diacetyl**

Diacetyl is responsible for the “buttery character” that arises during MLF. Produced during MLF, diacetyl is an aroma compound. One of the most important aroma compounds produced during MLF, is diacetyl. The compound is responsible for the butyric character that arises during MLF.

**Diacetyl**

**INFLUENCING FACTOR:**

<table>
<thead>
<tr>
<th>INFLUENCING FACTOR</th>
<th>IMPACT ON DIACETYL</th>
</tr>
</thead>
<tbody>
<tr>
<td>bacteria strain</td>
<td>select strain with high or low production</td>
</tr>
<tr>
<td>wine type</td>
<td>higher production in red wine</td>
</tr>
<tr>
<td>inoculation rate</td>
<td>lower inoculation rate favours production</td>
</tr>
<tr>
<td>lees contact</td>
<td>reduces diacetyl content</td>
</tr>
<tr>
<td>oxygen</td>
<td>favours production of diacetyl</td>
</tr>
<tr>
<td>SO₂</td>
<td>binds diacetyl and reduces sensory impact</td>
</tr>
<tr>
<td>citric acid concen.</td>
<td>favours diacetyl production</td>
</tr>
<tr>
<td>temperature</td>
<td>lower temperature favours production</td>
</tr>
<tr>
<td>pH</td>
<td>lower pH favours production</td>
</tr>
<tr>
<td>sugar conc.</td>
<td>residual sugar reduces diacetyl production</td>
</tr>
<tr>
<td>stabilisation</td>
<td>stabilisation after MLF increases diacetyl</td>
</tr>
</tbody>
</table>

**Esters**

The most important esters produced during malolactic fermentation are ethyl lactate (fruity, buttery, creamy aromas and mouthfeel), as well as diethyl succinate, contributing fruity and melon aromas. The esterase activity of LAB are strain dependent.

**Grape-derived compounds**

Terpenes and norisoprenoids are released from their glycoside-bound precursors by LAB that display glycosidase activity under winemaking conditions. Selecting the appropriate bacteria culture can release this potential aroma pool, adding fruity and floral aromas to the wine.

**Lysozyme**

Lysozyme can be used to inhibit LAB and delay/prevent the onset of MLF. See Chapter 6 for more details.
COMMERCIAL BACTERIA STARTER CULTURES

Criteria for selection:
• Tolerance to low pH, high ethanol and SO₂ concentrations.
• Good growth characteristics under winemaking conditions.
• Compatibility with Saccharomyces cerevisiae.
• Ability to survive the production process (especially freeze-drying).
• Inability to produce biogenic amines.
• The lack of off-flavour or off-odour production.
• Production of compounds that favourably contribute to the wine sensory profile.

Types of starter cultures:
• Acclimatisation: bacteria and activator rehydrated over a period of time before inoculation.
• Frozen: direct inoculation, but causes transport and storage challenges.
• Freeze-dried: direct inoculation with/without rehydration.

Freeze-dried bacteria are more robust and better able to withstand the harsh environment of the grape must.

Timing of inoculation:
• Sequential: bacteria inoculated after the completion of alcoholic fermentation.
• During: bacteria inoculated during the course of alcoholic fermentation.
• Co-inoculation: inoculation together with the start of alcoholic fermentation.

Co-inoculation can also be divided into three methods: preventative inoculation to prevent spoilage by inoculating before alcoholic fermentation; inoculating together with the yeast culture based on proven yeast-bacteria combinations; inoculating 24 hours after yeast inoculation to ensure minimal negative interactions between yeast and bacteria. Co-inoculation suppresses the formation of diacetyl which results in wines that show less buttery characters, but more fruit intensity.

BACTERIA SELECTION

<table>
<thead>
<tr>
<th>Application</th>
<th>fruity and spicy notes</th>
<th>mouthfeel and softness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Co-inoculation/Sequential</td>
<td>co-inoculation</td>
<td>co-inoculation</td>
</tr>
<tr>
<td>Freeze-dried</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Red wine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>White wine</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Oenococcus oeni</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lactobacillus plantarum</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Co-Inoculant Bacteria</th>
<th>Optimum temperature</th>
<th>Alcohol tolerance</th>
<th>pH tolerance</th>
<th>SO₂ tolerance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oenococcus oeni</td>
<td>18-28°C</td>
<td>16%</td>
<td>≥3.5</td>
<td>50 ppm</td>
</tr>
<tr>
<td>Lactobacillus plantarum</td>
<td>15-28°C</td>
<td>15%</td>
<td>≥3.2</td>
<td>50 ppm</td>
</tr>
</tbody>
</table>
ANCHOR CO-INOCULANT BACTERIA

Department of Viticulture and Oenology, Stellenbosch University
Bacteria blend of Oenococcus oeni x Lactobacillus plantarum

ENHANCED FRUITY AND SPICE NOTES

APPLICATION:
• Enhanced aroma intensity.
• Red fruit characters via ester production.
• Enhanced spicy notes.
• Increases terpenes and norisoprenoids that enhance fruity and floral characteristics.

USAGE: Co-inoculation - inoculate on the same day as the yeast.
Rehydration in chlorine-free water for no more than 15 minutes.

DOSAGE: 1 g/L
SKU: 25 G

ANCHOR CO-INOCULANT BACTERIA 3.2

Institute of Viticulture and Oenology, Stellenbosch University
Bacteria blend of Oenococcus oeni x Lactobacillus plantarum

ENHANCED MOUTHFEEL AND SOFTNESS

APPLICATION:
• Enhanced mouthfeel.
• Decreased green characters.
• Reduced astringency.
• Enhanced dark fruit aromas.

USAGE: Co-inoculation - inoculate on the same day as the yeast.
Rehydration in chlorine-free water for no more than 15 minutes.

DOSAGE: 1 g/L
SKU: 25 G

INNOVATIONS OF TOMORROW

Evaluation of a new bacteria for sequential malolactic fermentation compared to competitor cultures.

CHARDONNAY:
VITEC Technological Innovation Centre – Spain

WHITE AND RED VARIETIES:
Spain, France and Germany

Results in Languedoc, France in Shiraz. Sequential inoculation at pH 3.5 and 12.5% alcohol. The new bacteria strain completed malolactic fermentation in 10 days (malic acid concentration < 0.3 g/L), compared to other commercial cultures (15-20 days or stuck fermentation).

MALIC ACID DEGRADATION OF NEW BACTERIA STRAIN COMPARED TO COMMERCIAL CULTURES (COMM. 1 TO 3)
IN THE SPOTLIGHT

BACTERIA AS A TOOL FOR ENHANCING WINE QUALITY

Anchor Oenology now provides you with two bacteria cultures, both enhancing the wine quality during malolactic fermentation, with the use of a mixed bacteria culture of Oenococcus oeni and Lactobacillus plantarum. In 2016 we collaborated with our research partner VITEC in Spain, to investigate two scenarios: the impact of tannin usage during co-inoculation on the quality of Cabernet Sauvignon and the impact of using French oak chips during co-inoculation on the quality of Chardonnay.

THE IMPACT OF TANNIN USAGE DURING CO-INOCULATION

Experiment

- Cabernet Sauvignon (22°Brix, pH 3.45, malic acid 1.76 g/L).
- Anchor Yeast NT 202 co-inoculated with the Co-Inoculant Bacteria or the Co-Inoculant Bacteria 3.2.
- Presence or absence of commercial fermentation tannins (30 g/hL).
- Fermentations conducted at 22°C.
- Macro-oxygenation treatment and micro-oxygenation as needed.
- Finished wines underwent sensory analysis (trained panel: indicating relative intensity of a descriptor on a line scale) and aroma compound analysis.

Results

- Alcoholic fermentation completed within seven days after inoculation.
- Malolactic fermentation completed within nine days.
- Average maximum acetic acid concentration after the completion of AF/MLF: 0.3 g/L.
- Presence or absence of tannins had no impact on the fermentation performance of the yeast or the bacteria.
- The addition of the tannin had a positive impact on the sensory profile of the wine.

Both bacteria cultures enhance the overall sensory quality of the wine. The Anchor Co-Inoculant bacteria increases fruity (red fruit, candied fruit and dried fruit) and spicy notes. The Anchor Co-Inoculant Bacteria 3.2 has more of an impact on the structural properties of the wine (colour intensity and tannin intensity), increasing volume, finish and persistence of the mouthfeel.

THE IMPACT OF USING FRENCH OAK CHIPS DURING CO-INOCULATION

Experiment

- Chardonnay (22°Brix, pH 3.5, malic acid 2.68 g/L).
- Anchor Yeast Exotics SPH co-inoculated with the Co-Inoculant Bacteria and compared with a commercial O. oeni culture.
- Treatment with commercial French oak chips (medium toast) at 2 g/L.
- Fermentations conducted at 15°C.
- Macro-oxygenation treatment and micro-oxygenation as needed.
- Finished wines underwent sensory analysis (trained panel: indicating relative intensity of a descriptor on a line scale).

Results

- Alcoholic fermentation completed within 15 days after inoculation.
- Malolactic fermentation completed within six (commercial O. oeni culture) to nine (Co-Inoculant 3.2) days.
- Average maximum acetic acid concentration reached 0.3 g/L after the completion of AF/MLF.
- No negative effects of the oak chips on either the yeast or the bacteria.
- Co-Inoculant Bacteria 3.2 with the addition of commercial French oak chips, resulted in wines with more toasted characters and volume, whilst the perception of acidity and bitterness were reduced.
- Wines were found to be softer with better mouthfeel.

Both products are two excellent tools at the disposal of the discerning winemaker. This means you are not just interested in the completion of the malolactic fermentation, but also in using the process to enhance the aromatic and sensory profile of the wine, as well as increasing the final quality.
CHAPTER 4: ENZYMES

INTRODUCTION

What are enzymes?

**Enzyme**

a substance produced by a living organism which acts as a catalyst to bring about a specific biochemical reaction

Enzymes are proteins that, whilst they do not get transformed themselves, can either facilitate or accelerate metabolic reactions and are substrate specific.

THE GRAPE CELL WALL

- Mainly consists of cellulose, hemicellulose and pectin.
- Responsible for filterability, clarity and viscosity of wines.
- Pectin, a structural polysaccharide consisting of a chain of various sugar molecules.
- Glucan, of which cellulose is an example, a polysaccharide consisting of glucose chains.
- Hemicellulose are shorter chain versions of cellulose and include sugars other than glucose.

Berries themselves contain enzymes, mostly involved in the ripening process, but these are not very active under winemaking conditions. The same applies to yeast-derived enzymes that are responsible for the fermentation process itself. Therefore commercial enzyme preparations can be utilised to enhance wine processing and/or quality. These enzymes are usually fungi-derived. Fungi produce a broader range of enzymes capable of polysaccharide degradation, as well as being active under winemaking conditions.

COMMERCIAL ENZYME PREPARATIONS

The addition of enzymes should occur as early as possible during the production process.

- Enzymes are not affected by 'normal' wine SO₂ levels or average wine pH levels.
- Enzymes are active at wine temperatures, but the activity increases with an increase in temperature, which will influence the dosage.
- Bentonite inhibits enzymes and should only be added after enzyme activity is no longer required.

Commercial enzyme preparations allow for more extracted and aromatic wines and accelerated winemaking processes.

**Pectinases (extracted from Aspergillus niger)**

Pectinases aid in extraction and include pectin lyase, pectin methyl esterase and polygalacturonase. These enzymes are responsible for:

- Breaking down cell walls
- Increasing anthocyanins and tannins
- Increased juice yield
- Enhanced settling, clarification and pressing
- Improved must quality
- Increased polyphenol content

**Glucanases (extracted from Trichoderma harzianum)**

These enzymes facilitate improved yeast autolysis and increase the quantity of yeast cell wall compounds that are released. This will result in increased mouthfeel, polysaccharide and mannoprotein release that increase wine flavour and complexity.

**Side activities: hemicellulase, cellulase, cinnamoyl esterase and anthocyanase**

Side activities are produced as by-products during the production process of commercial enzyme preparations. These activities can either be beneficial or detrimental to the wine quality. Hemicellulase and cellulase are side activities as a result of pectinase production and are beneficial as enzymes that support the breakdown of the cell wall. Unwanted enzyme activities include cinnamoyl esterase (CE) that release precursors for volatile phenol production and anthocyanase that can result in colour loss in red wines.

**DSM as a world-leader in enzyme supply**

Rapidase enzymes specific to winemaking, are produced by DSM Food Specialties, a leading global manufacturer of food enzymes. The liquid and granulated enzymes in our range are produced in Seclin, in the north of France, a production facility with more than 100 years of production experience.

THE RAPIDASE BRAND

- Accelerators of winemaking processes - results and time saving.
- Tested and validated products - partnerships with important research institutes.
- One enzyme, one application - ease of choice and specific actions.
- A DSM product - traceability, quality, reproducibility.
- A historical brand - proud to be a pioneer, since 1922.

The Rapidase brand also consists of purified enzymes. The unwanted side activities produced as by-products during the production process are removed. There are negligible levels of CE and anthocyanase in Rapidase commercial enzyme preparations.
**ENZYMES**

<table>
<thead>
<tr>
<th>White wine</th>
<th>Red wine</th>
<th>Liquid</th>
<th>Granulated</th>
</tr>
</thead>
</table>

**PRIMARY ACTIVITY:**
- Pectinases (primary chains)
- β-Glucanases

**SECONDARY ACTIVITY:**
- Pectinases (side chains)
- Hemicellulases
- Rhamnogalacturonases

- Arabinosidases Rhamnoidases Apiosidases

**ENZYME SELECTION**

<table>
<thead>
<tr>
<th>Rapidase清 酯化</th>
<th>Rapidase清 纯化</th>
<th>Rapidase清 极致</th>
<th>Rapidase清 表面活性</th>
</tr>
</thead>
<tbody>
<tr>
<td>Flotation</td>
<td>Extra Color</td>
<td>Extra Fruit</td>
<td>Fast Color</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rapidase清 酯化</th>
<th>Rapidase清 纯化</th>
<th>Rapidase清 极致</th>
<th>Rapidase清 表面活性</th>
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<tbody>
<tr>
<td>Flotation</td>
<td>Extra Color</td>
<td>Extra Fruit</td>
<td>Fast Color</td>
</tr>
</tbody>
</table>
PRODUCT CATALOGUE

ENZYMES FOR WHITE WINE APPLICATION

EXPRESSION AROMA

An enzyme for fast, early aroma precursor extraction in white grape must. Increased thiol extraction and complexity. Rapidase Expression Aroma allows for targeted extraction of aroma precursors, such as thiols contained in grape skins, without extracting unwanted compounds. Sufficient skin integrity is maintained to ensure effective downstream processing.

APPLICATION:

- Aroma precursor extraction

CLARIFICATION IN DIFFICULT CONDITIONS

APPLICATION:

- Skin and pulp cell wall degradation.
- Reduces maceration time.
- Replaces more oxidative mechanical methods.
- Increased thiol extraction.

USAGE: Add as early as possible at the crusher, in maceration or in the press. Use the maximum dosage for thick skinned grapes or early harvested fruit. Dilute 10 times prior to addition. Active from 10-45°C and the activity increases with temperature. Active within the wine pH range and normal concentrations of SO₂. Eliminated by bentonite.

DOSAGE: 1.5-2.5 ml/100 kg
SKU: 100 G
SKU: 5 L

CLEAR EXTREME

An enzyme for fast, efficient clarification of grape must in difficult and extreme conditions. The use of this enzyme allows for more compact lees and clearer must when settling conditions are difficult, including low temperatures, pH and/or hard to settle varieties.

APPLICATION:

- Enzymatic clarification
- Improved precipitation

USAGE: Add as early as possible after pressing. Use the maximum dosage at temperatures below 10°C. Dilute 10 times prior to addition. Active from 10-50°C and the activity increases with temperature. Active within the wine pH range and normal concentrations of SO₂. Eliminated by bentonite and charcoal.

DOSAGE: 1-4 g/100 kg
SKU: 100 G
SKU: 20 L

CLEAR

This is an enzyme for fast and efficient grape must and wine clarification. Rapidase Clear decreases the viscosity allowing for more compact lees and clearer must and wine.

CLARIFICATION OF GRAPE MUST

APPLICATION:

- Skin and pulp cell wall degradation.
- Reduces maceration time.
- Replaces more oxidative mechanical methods.
- Increased thiol extraction.

USAGE: Available in granulated or liquid formulation. Dilute 10 times prior to addition. Active from 10-45°C and the activity increases with temperature. Active within the wine pH range and normal concentrations of SO₂. Eliminated by bentonite and charcoal.

DOSAGE: 1-3 g/Hl / 1-4 ml/Hl
SKU: 100 G / 1 L / 20 L

EXTRA PRESS

Enzyme for fast, efficient pressing of white grapes. Use of this enzyme allows for the release of juice from white grapes by weakening grape skins and reducing pectin water retention capacity.

EFFICIENT GRAPE PRESSING

APPLICATION:

- Pectin and insoluble proteopectin degradation.
- Increases juice yield.
- Allows for softer and shorter pressing cycles and thus preserves grape must from oxidation.
- Increased percentage of free-run and press juice.

USAGE: Add as early as possible on grapes upon reception or after crushing in non-oxidative conditions. Avoid immediate draining after enzyme addition to allow distribution of the enzyme on the grapes. Use maximum dosage on whole cluster grapes. Dilute 10 times prior to addition. Active from 10-45°C and the activity increases with temperature. Active within the wine pH range and normal concentrations of SO₂. Eliminated by bentonite.

DOSAGE: 1.5-2.5 ml/100 kg
SKU: 20 L

FLOTATION

Enzyme for fast, efficient flotation of white grape must. The use of this enzyme enables rapid viscosity decrease, allowing for faster migration of solid particles.

GRAPE MUST FLOTATION

APPLICATION:

- Soluble pectin degradation.
- Reduces flotation time.
- Promotes more compact foam by facilitating the accumulation of haze particles.
- Decrease in the percentage lees and turbidity.

USAGE: Add as early as possible after pressing. Use the maximum dosage for must with high pectin content and low maturity at harvest. Dilute 10 times prior to addition. Active from 10-45°C and the activity increases with temperature. Active within the wine pH range and normal concentrations of SO₂. Bentonite or silica gel should only be used as a flotation aid after allowing sufficient time for depectinization.

DOSAGE: 1-2 ml/L
SKU: 5 L

BATONNAGE

Enzyme for fast, early release of colloids in wines matured on lees.

ENHANCING YEAST AUTOLYSIS TO RELEASE MANNOPROTEINS

APPLICATION:

- Yeast cell wall degradation.
- Enhanced release of manno- and other beneficial colloids like poly saccharides.
- Increases the mouthfeel and balance of the wine.

USAGE: On white wines (3 g/Hl) and red wines (5 g/Hl) with daily batonnage for a minimum of 30 days. Enhanced results can be obtained with an addition of 20 g/Hl. Extramarine yeast hulls. Dilute 10 times prior to addition. Active from 10-55°C and the activity increases with temperature. Active within the wine pH range and normal concentrations of SO₂. Eliminated by bentonite and charcoal.

DOSAGE: 3-5 g/Hl
SKU: 100 G
ENZYMES FOR RED WINE APPLICATION

EXTRA COLOR

Enzyme for fast, early colour extraction in red grape maceration. This enzyme allows for targeted extraction of colour and polyphenols contained in grape skins and reduces the requirement for more mechanical methods like punch-downs.

COLOUR AND POLYPHENOL EXTRACTION IN QUALITY MACERATION

APPLICATION:
- Grape skin cell wall degradation.
- Increased anthocyanin extraction.

USAGE: Add as early as possible at the crusher or in maceration. Use the maximum dosage for thick skinned grapes or early harvested fruit. Dilute 10 times prior to addition. Active from 10-50°C and the activity increases with temperature. Active within the wine pH range and normal concentrations of SO₂. Eliminated by bentonite.

DOSAGE: 2-4 g/100 kg
SKU: 100 G/1 KG

EXTRA FRUIT

Enzyme for fast, early aroma precursor extraction in red grape maceration. This enzyme allows for targeted extraction of aroma precursors contained in red grape skins that enhance fruity characteristics.

AROMA PRECURSOR EXTRACTION IN RED WINES

APPLICATION:
- Skin and pulp cell wall degradation.
- Reduced maceration time.
- Increased roundness, raspberry and cherry characteristics.
- Reduced astringency and herbaceous characters.

USAGE: Add as early as possible during maceration. Use the maximum dosage on thick skinned grapes or in pre-ferment cold soaking (8-12°C) conditions. Best results will be obtained when adding an additional 1 g/100 kg two days after the initial dosage. Dilute 10 times prior to addition. Active from 10-50°C and the activity increases with temperature. Active within the wine pH range and normal concentrations of SO₂. Eliminated by bentonite.

DOSAGE: 2-4 g/100 kg
SKU: 100 G

FAST COLOR

Enzyme for fast colour and polyphenol extraction in short maceration processes. This enzyme has been specifically designed to process wines with a short maceration period. The subsequent processes of draining, pressing and clarification are also facilitated.

FAST COLOUR AND POLYPHENOL EXTRACTION DURING SHORT MACERATION

APPLICATION:
- Degradation of grape skin cell walls.
- Increase in anthocyanin concentration.

USAGE: Add as early as possible at the crusher or in maceration. Use the maximum dosage for grapes harvested early and less than three day maceration period. Active from 10-50°C and the activity increases with temperature. Active within the wine pH range and normal concentrations of SO₂. Eliminated by bentonite.

DOSAGE: 1-3 ml/L
SKU: 5 L

RAPIDASE FILTRATION

A new enzyme development, in the trial phase, for easier and more efficient filtration of wine. A concentrated liquid formulation containing different enzyme activities, including a broad range of polysaccharide hydrolase activities that degrade the polysaccharides that slow down filtration.

APPLICATION:
- Red, white and rosé wine.
- Young and problematic wines.
- To prevent and/or treat filtration issues.
- Improve yields, flow rates and membrane shelf life.

USAGE: As soon as possible before bottling. Young wines, 4-6 months old. Compatible with all filtration systems except cellulose filters.

DOSAGE: 5 ml/L
CONTACT TIME: 2-5 days (temperature dependent)
Available for trial purposes this vintage.

CONTACT YOUR TECHNICAL CONSULTANT IF YOU WOULD LIKE TO PARTICIPATE IN A TRIAL IN THE 2018 VINTAGE.
RAPIDASE ENZYMES FOR RED WINE MACERATION: RAPIDASE EXTRA COLOR, EXTRA FRUIT AND FAST COLOR

RAPIDASE EXTRA COLOR
A Rapidase micro-granulated enzyme used for many years and an icon of efficacy and quality.

VITEC Technological Innovation Centre in Spain investigated the role of Rapidase Extra Color in enhancing anthocyanin and polyphenol extraction during 6-10 days of maceration in Cabernet Sauvignon. Fermentations were done under standard mini-vinification conditions and the enzyme treatment compared with a control (no enzyme added).

The treatment with the enzyme displayed increased colour intensity and total polyphenol index at the end of malolactic fermentation.

RAPIDASE EXTRA FRUIT
A unique micro-granulated enzyme with activities ideal for maceration focused on combined extraction of color and aromas. Rapidase Extra Fruit has a decisive impact on the extraction of grape aromatic compounds and also the quality of the colour.

Feedback from winemakers:
• "This enzyme differs from all others, and allows us to enhance the grape fruitiness."
• "In a week-long maceration, it helps to get wines with intense, bright colour, while maintaining the varietal aromas."
• "A reliable tool that helps in vintages when grapes do not achieve full aromatic expression, respecting the delicate aroma compounds and enhancing the extraction."

A trial at VITEC Technological Innovation Centre in Spain compared Rapidase Extra Fruit (30 g/T) with a control treatment (no enzyme) in Tempranillo, after maceration (12 days) and the impact on the colour intensity. The Extra Fruit treatment resulted in a 15% increase in the colour intensity (measured as total of absorbance at 420, 520 and 620 nm).

RAPIDASE FAST COLOR
Launched in 2016, this innovative liquid enzyme most advantageous for short maceration, is described by users as:
• "Allowing for faster rotation of maceration tanks, with a better management of the winery, particularly useful in the peak part of the season."
• "The ideal enzyme for short macerations (max. 3 days) of young red wines."
• "The solution for the maceration of red aromatic grapes."
• "Easy to use, perfect for large volume tanks."

Rapidase Fast Color (15 g/T) compared to a control treatment (no enzyme) in Croatina (a native Northern Italian variety). The enzyme treatment resulted in a 62% increase in total anthocyanin content (mg/L) and 48% increase in total polyphenol content (mg/L) after one day of maceration with pump-overs.
There are three classes of flavonoids in grapes and wine: anthocyanins, flavonols, and tannins. Tannins include a range of polyphenolic compounds and add bitterness and astringency, body and mouthfeel and influences colour stability by forming polymeric complexes with anthocyanins.

There are two types of tannins: hydrolysable (usually found in commercial tannin products) and condensed tannins that are grape-derived. Grape-derived tannins see their main synthesis happening in the seeds immediately after fruitset and reaching a maximum concentration at veraison.

The influence of winemaking practices on the phenolic structure:

<table>
<thead>
<tr>
<th>ACTION</th>
<th>EFFECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>crushing vigorous crushing favours extraction of astringent and bitter tannins</td>
<td></td>
</tr>
<tr>
<td>whole cluster or destemmed berries whole cluster fermentation increases total polymeric phenol content</td>
<td></td>
</tr>
<tr>
<td>carbonic maceration decreased phenol extraction</td>
<td></td>
</tr>
<tr>
<td>cold maceration increased anthocyanin:tannin ratio</td>
<td></td>
</tr>
<tr>
<td>yeast strain no significant effect on phenol composition</td>
<td></td>
</tr>
<tr>
<td>maceration temperature increased temperature increases colour extraction: 30°C is optimal for extraction of anthocyanins and formation of stable polymers</td>
<td></td>
</tr>
<tr>
<td>fermentation cap management mechanical punch-down and pump-overs enhance extraction of all phenolic compounds compared to manual punch-downs; rotor treatments result in higher total polyphenol content and quality compared to pump-overs</td>
<td></td>
</tr>
<tr>
<td>SO₂ levels at crushing no significant impact on anthocyanin content</td>
<td></td>
</tr>
<tr>
<td>processing enzymes enzyme treatments may increase the initial release of pigments during fermentation; the use of a purified enzyme will minimise the risk of anthocyanase that could reduce colour</td>
<td></td>
</tr>
<tr>
<td>extended maceration increased polyphenol extraction with increased skin contact time; need to balance complexity and colour intensity with acceptable bitterness and astringency</td>
<td></td>
</tr>
<tr>
<td>addition of grape tannin addition of seed tannin increases colour stability, colour intensity and free anthocyanins</td>
<td></td>
</tr>
<tr>
<td>fining treatments PVP, gelatine and bentonite reduce phenolic levels</td>
<td></td>
</tr>
<tr>
<td>micro-oxygenation results in higher total phenols concentration retained by stabilisation of anthocyanins through polymerisation; tannins evolve and soften and add body to lightly structured wines</td>
<td></td>
</tr>
</tbody>
</table>

When grape tannins are found to be insufficient, possible commercial tannin sources include:

- Oak (American, European, toasted and untoasted)
- Chestnut
- Grape (skin and seed)
- Exotic wood
- Gall nuts

Ellagic tannins refer to those tannins from an oak/chestnut source, whereas proanthocyanidins refer to tannins sourced from grapes or exotic woods. During the development of commercial tannins like the Scott'Tan range, it is imperative to understand, especially via tasting, the mouthfeel, relative astringency and roundness imparted by a specific tannin.

TIMING OF ADDITION

Tannins should be added early in the fermentation. For red wine production addition at the crusher or first pump-over will depend on the sanitary state of the grapes (anti-oxidative application). For better integration (enhancing structure and colour stability application), addition during fermentation is advised. Add tannins to white wine fermentations at the crusher or during mixing.

Tannins for white wine applications can be added to juice (fermentation tannins) and wine (cellaring and ageing tannins) and can:

- Remove off-odours
- Facilitate clarification
- Inhibit oxidising enzymes like laccase
- Act as anti-oxidant
- Improve mid-palate, structure and softness

Similarly, tannins for red wine applications can:

- Increase colour stability
- Enhance phenolic structure
- Limit oxidation, also during barrel maturation
- Increase structure and freshness
- Facilitate SO₂ management
# Tannin Selection

<table>
<thead>
<tr>
<th>Scott'Tan FT Blanc</th>
<th>Scott'Tan FT Blend Soft</th>
<th>Scott'Tan FT Blend Citrus</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Composition</strong></td>
<td>Gallotannin (oak gall nut)</td>
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</tr>
<tr>
<td><strong>Properties</strong></td>
<td>Reactive with proteins prevents browning</td>
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<tr>
<td><strong>Application</strong></td>
<td>Improves clarification and structure, minimizes reductive odours, inhibits laccase (Botrytis) enhances mouthfeel</td>
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<th>White</th>
<th>Rosé</th>
<th>Red</th>
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<tr>
<td>Promotes colour, body and fruit</td>
<td>Protects from oxidation</td>
<td>Enhances mouthfeel</td>
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<tr>
<td>Enhances structure</td>
<td>Enhances mid-palate volume</td>
<td>Stabilises colour</td>
</tr>
<tr>
<td>Enhances fruit character</td>
<td>Protects against rot</td>
<td>Enhances ageing potential</td>
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<tr>
<th>Scott'Tan FT Rouge</th>
<th>Scott'Tan FT Blend Soft</th>
<th>Scott'Tan FT Rouge Berry</th>
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<tr>
<td><strong>Composition</strong></td>
<td>Proanthocyanidins and ellagic tannin (oak and chestnut hardwood)</td>
<td>Proanthocyanidins and ellagic tannin (oak)</td>
</tr>
<tr>
<td><strong>Properties</strong></td>
<td>Highly reactive with proteins promotes colour stability enhances structure and ageing potential, strong anti-oxidant</td>
<td>Reactive with proteins promotes colour stability enhances structure and ageing potential, anti-oxidant</td>
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<td><strong>Application</strong></td>
<td>Stabilises colour and enhances structure inhibits laccase (Botrytis) and protects anthocyanins from rot</td>
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PRODUCT CATALOGUE

FERMENTATION TANNINS FOR WHITE WINE

**FT BLANC**
This is a white gall nut tannin specifically formulated for use on grapes with mould or rot (Botrytis).

**PROTECTS FROM OXIDATION**
- Protects juice from browning.
- Inhibits laccase activity.
- Can help remove proteins in protein-rich varieties like Sauvignon blanc.
- Potentially contributes mineral notes.

**APPLICATION:**
- Protects juice from browning.
- Inhibits laccase activity.
- An effective anti-oxidant on healthy grapes.
- Can help remove proteins in protein-rich varieties like Sauvignon blanc.
- Potentially contributes mineral notes.

**USAGE:** Add by sprinkling directly on the grapes at crushing or add to the juice or wine during a tank mixing.

**DOSAGE:** 5-15 g/hL

SKU: 1 KG

**FT BLANC CITRUS**
This is a mixture of condensed tannins extracted from citrus wood and gallic tannins. When used in combination with yeast strains that display marked β-glycosidase activity (Alchemy II, VIN 2000 and VIN 13), it allows for the development of enhanced aromatic potential.

**DEVELOPS ENHANCED AROMATIC POTENTIAL**
- Intense aromas of lemon, grapefruit, apple and white flower.
- Complements varietal and fermentation aromas.
- Protects must and wine from oxidation.

**APPLICATION:**
- Enhances texture and perception of sweetness on the palate.
- Complements varietal aromas produced during fermentation.
- Protects must and wine from oxidation.

**USAGE:** Add during alcoholic fermentation, within 24-48 hours after yeast inoculation.

**DOSAGE:** 2-15 g/hL

SKU: 1 KG

**FT BLANC SOFT**
Similar to FT Blanc in application, but also enhances softness and improved mouthfeel.

**PROTECTS FROM OXIDATION AND ENHANCES MOUTHFEEL**
- Enhances texture and perception of sweetness on the palate.
- Contributes to minerality in wine.

**APPLICATION:**
- Reactive with natural grape proteins and helps promote optimal colour and colour stability.
- Enhances structure.
- Improves mouthfeel and roundness.
- Reduces bitter characters.
- Anti-oxidative.

**USAGE:** Gradually sprinkle directly on grapes at the crusher or add to the juice or wine during a tank mixing. A small addition (2.5-5 g/hL) may help mask the perception of bitterness in finished wines.

**DOSAGE:** 20-50 g/hL

SKU: 1 KG / 5 KG

FERMENTATION TANNINS FOR RED WINE

**FT ROUGE**
This is a proprietary tannin that is a blend of highly reactive tannins derived from exotic woods and chestnut. This acts as a ‘sacrificial’ tannin allowing for the preservation of the grape’s natural tannins so they can combine with anthocyanins to create optimal color stability.

**PROMOTES COLOUR, BODY AND FRUIT**
- Optimal colour stability.
- Anti-oxidative.
- Inhibits oxidative enzymes like laccase and prevents browning.

**APPLICATION:**
- Optimal colour stability.
- Anti-oxidative.
- Protects must and wine from oxidation.

**USAGE:** Add at the first pump-over or punch-down or 24-48 hours after yeast inoculation. Dissolve in 10 times its weight in water before adding.

**DOSAGE:** 2-15 g/hL (rosé) and 5-20 g/hL (red)

SKU: 1 KG / 5 KG

**FT ROUGE SOFT**
This is a proprietary tannin specifically formulated for its gentle impact. It is particularly suited for Pinot noir and early release wines.

**PROMOTES COLOUR, BODY AND FRUIT AND IMPROVES MOUTHFEEL AND ROUNDNESS**
- Reactive with natural grape proteins and helps promote optimal colour and colour stability.
- Enhances structure.
- Improves mouthfeel and roundness.
- Reduces bitter characters.
- Anti-oxidative.

**APPLICATION:**
- Optimal colour and colour stability.
- Enhances structure.
- Improves mouthfeel and roundness.
- Reduces bitter characters.
- Anti-oxidative.

**USAGE:** Gradually sprinkle directly on grapes at the crusher or add to must during pump-over. If subsequent additions are desired, add in increments of 5 g/hL.

**DOSAGE:** 20-50 g/hL

SKU: 1 KG

**FT ROUGE BERRY**
This is a mixture of condensed tannins extracted from the wood of red berry fruit. Its use in combination with yeast strains with a marked β-glycosidase activity like NT 116, allows for the development of enhanced red berry characteristics.

**PROMOTES RED BERRY NOTES**
- Intense aromas of cherry, strawberry and blueberry.
- Complements varietal aromas produced during fermentation.
- Promotes stabilisation of colour.
- Prevents oxidation of primary aromas.

**APPLICATION:**
- Optimal colour and colour stability.
- Enhances structure.
- Improves mouthfeel and roundness.
- Reduces bitter characters.
- Anti-oxidative.

**USAGE:** Gradually sprinkle directly on grapes at the crusher or add to must during pump-over. If subsequent additions are desired, add in increments of 5 g/hL.

**DOSAGE:** 20-50 g/hL

SKU: 1 KG

Keep an eye out for our ageing and finishing tannin portfolio in the next edition. Coming to you in time for putting that final stamp of quality on your wines before bottling.
**IN THE SPOTLIGHT**

**FT BLANC CITRUS AND FT ROUGE BERRY**

Both of these tannins allow for the enhanced aromatic potential of the wine by applying them either as fermentation tannins or finishing tannins.

**FT BLANC CITRUS COMPARED TO A GALLOTANNIN AND A CONTROL TREATMENT RECEIVING NO TANNIN ADDITION**

- Tannins added during fermentation at 20 g/L.
- Sauvignon blanc and Chardonnay.
- Relative intensity of descriptors described by trained panel.

**FT ROUGE BERRY COMPARED TO A GALLOTANNIN AND A CONTROL TREATMENT RECEIVING NO TANNIN ADDITION**

- Tannins added during fermentation at 20 g/L.
- Cabernet Sauvignon and Pinot noir.
- Relative intensity of descriptors described by trained panel.

---

FT Blanc Citrus significantly enhances wine quality by increasing the citrus aromas, global intensity and freshness. FT Rouge Berry has a similar effect in red wine fermentation by enhancing red fruit aromas and global intensity, but at the same time decreasing green characters and/or bitterness in the wine.
**CHAPTER 6: WINE PRESERVATIVES**

**INTRODUCTION**

Lysozyme is an:
- Enzyme (protein) isolated from egg whites.
- Lyse gram-positive bacteria and thereby inhibiting their growth.
- Lactic acid bacteria (LAB), Oenococci, Lactobacilli and Pediococci are gram-positive.
- Acetic acid bacteria are gram-negative and are unaffected by lysozyme.
- Lysozyme also has no influence on wine yeast or fungi.

Factors influencing lysozyme activity:
- pH, temperature and bacterial cell counts.
- Only impact on populations < 1x10⁵ cells/mL.
- Concentration of enzyme added.
- Timing of addition.

**LYSOZYME ACTIVITY OVER TIME**

Lysozyme activity in wine is unstable. It decreases faster in red wine than in white wine due to the presence of polyphenols. If lysozyme is added at the start of a red wine fermentation there will be no activity after 7 - 14 days. If lysozyme is added after fermentation then residual activity can be present, even after a few months.

**IMPACT ON RED WINE COLOUR**

Lysozyme can have an influence on red wine colour since it is able to bind polyphenols. The effect can differ from wine to wine and is dependent on the tannin concentration and the dosage of lysozyme used (100 – 200 mg/L has no effect). It is therefore necessary to conduct laboratory trials before the addition of lysozyme to a finished wine. When lysozyme is used during fermentation then the effect on colour will be negligible.

**USING BENTONITE AND LYSOZYME**

Since lysozyme is a protein it cannot be used in the presence of bentonite. The use of lysozyme can also increase the protein instability. The following components will bind to lysozyme and precipitate it: tannins and polyphenols, wood chips, activated carbon and silica sol. Lysozyme is thus not a permanent preservative and cannot replace SO₂ since it has no anti-oxidative function. It is merely an aid to control LAB in situations where SO₂ alone is not effective.

**DELVOZYME**

Delvozyme is an enzyme preparation based on lysozyme. Delvozyme can be applied on red, white and rosé wines.

**RECOMMENDED DOSAGE**

<table>
<thead>
<tr>
<th>LYSOZYME APPLICATION</th>
<th>DOSAGE</th>
<th>IMPACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>prevents bacterial spoilage during alcoholic fermentation</td>
<td>100-150 mg/L before fermentation</td>
<td>avoids and limits proliferation of spoilage bacteria and reduce the risk of increased volatile acidity, production of unpleasant tastes or aroma compounds and nutritional competition</td>
</tr>
<tr>
<td>preventing spoilage at the end of lagging or sluggish alcoholic fermentation</td>
<td>250-350 mg/L at the sign of a lagging fermentation</td>
<td>prevents LAB growth and volatile acidity formation in sluggish fermentations</td>
</tr>
<tr>
<td>controlling the onset of malolactic fermentation</td>
<td>100 mg/L before fermentation delay MLF by ±10 days</td>
<td>minimises the risk of MLF starting before AF; vinification of whole grape clusters or maceration with high pH</td>
</tr>
<tr>
<td>complete inhibition of MLF</td>
<td>300-500 mg/L after settling</td>
<td>prevents MLF</td>
</tr>
<tr>
<td>microbiological stabilisation after MLF</td>
<td>150-250 mg/L after MLF</td>
<td>controls LAB population and avoid unwanted organoleptic defects</td>
</tr>
<tr>
<td>preventing LAB spoilage during barrel ageing</td>
<td>100-150 mg/L at the beginning of barrel ageing</td>
<td>kills LAB and prevents the increase of volatile acidity during ageing</td>
</tr>
</tbody>
</table>

**USAGE:** Dissolve Delvozyme in 10 times the amount of warm water (20°C) and allow to stand for 40 to 45 minutes and then mix thoroughly. Evenly distribute in the treated must. Allow for one week of contact time and one week before bottling after Delvozyme treatment.

**DOSAGE:** 100-500 mg/L

**SKU:** 1 KG
CHAPTER 7: PROTOCOLS

OPTIMAL YEAST REHYDRATION PROTOCOL

Yeast rehydration is one of the most important steps in winemaking. It ensures a string and healthy fermentation. The recommended inoculation dosage for active dried wine yeast is 20-30 g/hL to ensure a viable yeast population of approximately 3-4 x 10^6 viable yeast cells per millilitre of must. After inoculation there is a slight increase in yeast biomass after which the fermentation starts. Increased inoculation rates are required for more challenging fermentation conditions.

RESTART STUCK FERMENTATION PROTOCOL

The probability of a stuck fermentation increases due to:
- Low turbidity
- High sugar concentrations
- Low assimilable nitrogen
- Late anti-Botrytis treatments
- Difficult to ferment cultivars

1. Add 40-60 g/hL of Extraferm 24-48 hours prior to restart.
2. After 24-48 hours, rack the wine off the Extraferm lees.
3. Add a complex yeast nutrient to the stuck wine:
4. STUCK WINE SUGAR CONCENTRATION: DOSAGE OF COMPLEX YEAST NUTRIENT TO ADD:
   - >3°B
   - 1-2°B
   - <1°B
5. Add Devezyme at 100 mg/L to reduce the bacteria population.
6. Create a mother tank containing 1% of the stuck wine volume and an equal amount of chlorine-free water.
7. In a separate vessel:
   a. Dissolve Anchorferm at 20 g/hL in 20 times its weight in chlorine-free hot water (43°C). Stir to disperse and let the mixture cool to 37°C.
   b. Select a vigorous, alcohol tolerant strain like Fermivin Champion or Anchor VIN 13.
   c. Slowly add the yeast (30-60 g/hL) to the rehydration mixture. Stir gently. Let the suspension stand for 20 minutes.
7. Allow the yeast suspension to cool down to within 10°C of the wine/water mixture in the mother tank.
8. Add the yeast suspension to the mother tank. Wait 20-30 minutes.
9. Add 10% of the stuck wine to the mother tank. Wait 20-30 minutes.
10. Add 20% of the stuck wine to the mother tank. Wait 20-30 minutes.
11. Repeat step 8. Then add the remaining stuck wine to the mother tank.