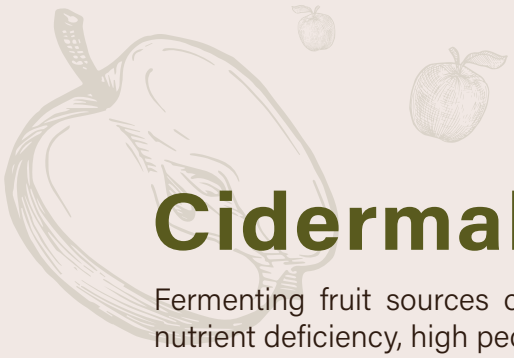
LAMOTHE-ABIET



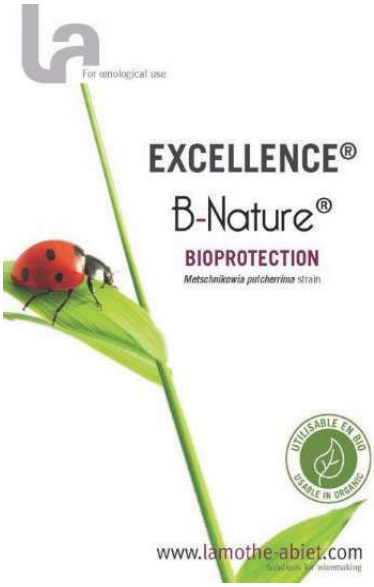
Cidermaking brochure

Fermenting fruit sources other than grapes can pose many challenges including nutrient deficiency, high pectin content, lower starting sugar, etc.

The most common challenges in cidermaking are settling and filtration, mitigating sulphur-off compounds production and other reductive compounds during fermentation as well as microbial management.

2023

// NON- SACCHAROMYCES YEASTS



EXCELLENCE® B-NATURE®

Pure *Metschnikowia pulcherrima* strain, used as bio-protection.

Lamothe-Abiet has selected Excellence® B-Nature®, an anti-microbial solution, used as alternative to SO_2 for microbial control. It inhibits, in the early stages of cidermaking, the development of spoilage microbes (non-*Saccharomyces*, *Brettanomyces*, as well as bacteria).

- Control microbiological flora
- Replace or complement the use of SO_2 on apples/juice
- Protect apples/juice from microbial contamination during processing
- Reduction of SO_2 combining compounds=> increase SO_2 efficiency
- Increased aromatic complexity of the cider

Dosage: 50 g/ton
Packaging: 500g
Application: At picking, transportation, storage, in juice

WHAT IS BIO-PROTECTION?

Bio-protection consists of using living organisms to colonize and occupy an ecological niche in order to limit the development of undesirable indigenous microorganisms. The concept is to manage the microbial population and always have positive or neutral microbes dominant, inhibiting the spoilage microbes ability to develop. In cidermaking, we use non-Saccharomyces yeasts selected for their ability to colonize the juice without inhibiting the desired micro-organisms (Saccharomyces) for fermentation. Bio-protection is often, but not only, used in the context of SO_2 reduction to ensure microbial control and prevention from contamination and spoilage.

WHY USE EXCELLENCE B-NATURE?

Excellence B-Nature can be used as alternative to SO_2 or as complement to SO_2 to control microbial development. It protects apples and juices from spoilage microbes and prevents VA, ethylacetate, volatile phenols production, prevents depletion of nutrients, thus improving *Saccharomyces* dominance, health and fermentation capacities.

WHEN TO USE BIO-PROTECTION?

Bio-protection is recommended in all cases: Apple storage, Juice storage, Transportation of fruits and/or juice, Maceration, Native Fermentation, Reduction of SO_2 (especially for canned ciders),

CAN I USE EXCELLENCE B-NATURE WITH SO2?

Yes, Excellence B-Nature can be used with SO2, up to 60 ppm.

HOW AND WHEN TO APPLY EXCELLENCE B-NATURE ?

Simply sprinkle it on the top of apples or juices, at 50 g/ton.

- At picking, during transportation, at reception before cold storage.
- At pressing, to protect juices from microbial spoilage before fermentation.
- During maceration to protect and prevent uncontrolled start of fermentation.
- Before yeast inoculation when juice is getting warmer to prevent VA, ethylacetate production

It is an essential tool to reduce SO_2, which is important for canned ciders.

DOES EXCELLENCE B-NATURE HAVE AN IMPACT ON SACCHAROMYCES YEAST?

No. Excellence B-Nature doesn't inhibit or compete with Saccharomyces. It will actually help and promote its development by reducing competition.

DOES EXCELLENCE B-NATURE FERMENT?

Excellence B-Nature doesn't have fermentative capacities and is inhibited above 3% alcohol.

DOES EXCELLENCE B-NATURE NEED ANY ADDITION OF NITROGEN?

No. As Excellence B-Nature doesn't ferment, there are no consumption of nitrogen or vitamins. No need to change the yeast nutrition.

Low SO2 Winemaking

// FERMENTING YEASTS

Yeasts are at the heart of Lamothe-Abiet's oenological expertise. Our yeasts are very rigorously selected and developed at the Institute of Vine and Wine Sciences (ISVV) of Bordeaux by our R&D teams. All our EXCELLENCE® yeasts are selected via breeding technique, which allow us to ensure:

- High implantation
- Short lag phase
- Resistance to difficult conditions and stress (high alcohol, wide range of temperature, wide range of turbidity, ...).
- Low production of VA, H2S
- POF (-) : no production of Phenolic Off-Flavors
- URE2 (-) : aromatic optimization, no catabolic repression

WHAT IS YEAST BREEDING?

Yeast breeding is a non-GMO technique of crossing yeast strains that have enological characteristics of interest. The resulting strain combines the performances of two or more different strains.
The choice of parental strains can be based on physiological criteria (fermentation performance, low VA and SO_2 production, release of aromas...). At genetic levels, we use Quantitative Trait Loci (QTL), which is a technique that localizes genes involved in complex yeast traits such as POF character, VA and SO_2 production,... Therefore, it is possible to search for yeast strains with specific genotypes of interest to use for breeding.

A BIT MORE ABOUT THE POF CHARACTER

Saccharomyces Cerevisiae strains can produce vinyl phenols from hydroxycinnamic acids which are naturally present in grapes. A strain can be characterised as POF+ (ability to produce vinyl phenols), or POF- (not able to produce vinyl phenols).
This is of concern as some yeasts such as *Brettanomyces bruxellensis* are able to convert vinyl phenols into ethyl-phenols which can be detrimental to cider quality.

DID YOU KNOW?

Saccharomyces Cerevisiae is a domesticated species and is often found in human environments and is associated with numerous fermented beverages. Fermentation activities, probably due to this microorganism were even detected in neolithic poteries (6000-7000BC) in China. Nowadays *S. Cerevisiae* are found in cellars, grapes, apples but they are thought to originally inhabit forests on tree bark transported by insects to colonise highly fermentable ecosystems.

HOW DO I PREPARE YEAST FOR INOCULATION?

One of the best ways to ensure a complete fermentation, with a clean aroma and maximum flavor development, is to follow a precise yeast preparation protocol. The use of OENOSTIM® is recommend to strengthen yeast cell walls and improve metabolism, thereby increasing resistance to alcohol, heat, and toxins while improving aromatics and flavors.

1. Suspend 2.5 lbs/1000 gal (30 g/hL) of OENOSTIM® in 20 times its weight of clean, chlorine free, 110°F (43°C) water.
2. Once the temperature of the solution has dropped to 104°F (40°C), add 2 lbs/1000 gal (25 g/hL) of active dried yeast. Stir gently to break up any clumps. Let suspension stand for 20 minutes, then stir gently again.
3. Slowly add some juice to the yeast suspension to drop temperature 18°F (10°C). This will help the yeast adjust to the cooler temperature of the juice and will help avoid cold shock caused by a rapid temperature drop. Wait 20 min. This acclimation step may need repeating for very low temperature juice.
4. Once yeast preparation temperature is within 18F of difference with the tank, add the yeast preparation to fermentation vessel and mix gently.

IMPORTANT PARAMETERS TO CHOOSE A YEAST

- Aromatic characteristics determined by enzymatic activities are important in the cider style; some yeasts are better at thiol production, ester production and/or terpene release.
- Choosing a POF(-) strain to minimizing the amount of precursors available to *B. bruxellensis*
- Alcohol, pH, and temperature tolerances should be taken into account.
- Understanding YAN and correct supplementation to ensure support for biomass production based on starting YAN, potential alcohol and nitrogen requirements of the yeast strain.

	VARIETAL	CHARACTERISTICS
EXCELLENCE® YEASTS	FTH	• Fresh, intense expression of thiolic compounds. Citrus, Lime, Grapefruit, boxwood aromas. • Lively, direct, fresh, and vibrant mouthfeel. • Recommendations: Fresh, citrus, easy to drink.
	TXL	• Complex expression of volatile thiols and esters. Citrus, fruity, and tropical fruits. • Complex, round, and rich mouthfeel. • Recommendations: Great for ageing on lees.
	STR	• Strong production of esters and acetates. Stonefruit, floral, 'sweet' tropical fruit notes. • Balanced, vibrant, and fresh mouthfeel. • Recommendations: Boost freshness, fruity aromatics.
	XR	• Terroir expression, aromatic complexity. Dark fruits, spices. • Complex, structured, and round mouthfeel. • Recommendations: Terroir, Complex, long ageing ciders.
L.A YEAST	BAYANUS	• Fresh, fruity, and clean aromatic profile. • Clean and rich mouthfeel. • Recommendations: Second fermentation, restart, neutral base cider.

Yeast

// NUTRIENTS AND YEAST DERIVATES

Nutrient management is an essential part of cidermaking; to ensure regular and complete fermentations, minimizing sulfur -off compound production, while enhancing positive sensory qualities. Yeast assimilable nitrogen (YAN) is composed of amino acids (organic nitrogen) and ammonium ions (inorganic nitrogen).
The ammonium ions can be assimilated easily and quickly by the yeast. The amino acids are consumed slowly but on a continued basis by the yeast. Organic nitrogen has been shown to be 3-5 times more efficient when compared to equivalent nitrogen values of DAP (ammonium ions).
When complex nutrient strategies include organic forms of nitrogen the kinetics are more controlled with less likelihood of heat spikes when compared to just straight DAP additions. Less stress on the yeast can help minimize off-aroma production during fermentation.

WHAT ARE THE NUTRITIONAL NEEDS OF YEAST?

Yeast Assimilable Nitrogen (YAN), vitamins (thiamine), and mineral salts (Mg, Zn) are essential for yeast activity. Additionally, yeasts need sterols and long-chain unsaturated fatty acids. They are elements which protect yeast and help them to survive in stressful conditions. The quantity and quality of these compounds play an essential role in yeast metabolism, fermentation kinetics and the organoleptic profile of cider.

WHAT IS YEAST ASSIMILABLE NITROGEN (YAN)?

YAN is the sum of ammonium ions and alpha amino acids (except proline). Yeast use nitrogen to build proteins, cell wall components, enzyme synthesis, for growth and sugar transport.

- Ammonium ions are quickly and preferentially assimilated by yeast. It is easy to pass through the cell membrane, and so the first component to be assimilated by yeast. It is used right away by the yeast.
- Amino acids require more energy from yeast to be assimilated. As alcohol inhibit the amino acids uptake, the yeast, strategically, takes up amino acids in the early stages of fermentation. Once transported inside the cell, they can be accumulated in the vacuole, where they are stored and consumed slowly as the yeast needs them.

WHAT ARE THE SOURCES OF YAN IN APPLES?

Fruits provide nitrogen in the form of proteins, peptides, alpha amino acids and ammonium ions, though to a lesser degree than grapes. Cider can be currently made from fresh apples of dual-purpose and dessert cultivars, juice and/or concentrate. Relative to grapes, apples tend to have lower endogenous YAN (Yeast Assimilable Nutrient) concentrations. YAN can be a variable across apple varieties, orchards, and even the age of the fruit. Clarified juice and juice from concentrate will always have lower nutrient levels than their fresh pressed counterparts.

HOW MUCH YAN IS NEEDED?

The range of YAN can vary depending on vintage conditions, culture practices, and selection of cultivated varieties. As a general rule, we recommend aiming for YAN's of 150–200 mg/L in cider-making.

A BIT MORE ABOUT YEAST CELL MEMBRANE…

The cell membrane is the protective barrier that allows yeast to grow and survive in the harsh environment of cider. It is composed of phospholipids with a matrix of long-chain fatty acids, sterols, and proteins. For proper function, the cell membrane must maintain its fluidity. The loss of membrane fluidity, due to the accumulation of alcohol, low sterol content, and less unsaturation of fatty acids, results in death of the cells. This deficiency stimulates yeast to produce lipids to reconstitute the membrane, which, in anaerobic conditions, accumulate into toxins such as acetic acid and medium-chain fatty acids. To summarize, the lack of long-chain unsaturated fatty acids and sterols is one of the major causes of stuck fermentations, VA production, and toxins accumulation. To maintain a constant fluidity of the membrane and prevent stuck fermentation, it is essential to provide sterols and long-chain unsaturated fatty acids to the yeast at the early stages of fermentation with OENOSTIM® and introduce oxygen during fermentation.

WHICH OTHER FACTORS SHOULD BE CONSIDERED REGARDING YEAST NUTRITION?

- Temperature: An increase in temperature stimulates yeast growth and fermentation rate, thereby requiring increased levels of nitrogen.
- Turbidity: Juice clarification can remove some nutrients, sterols, and fatty acids essential for yeast survival.
- Microbial contamination: The growth of indigenous microorganisms can cause the depletion of nutritional factors.
- Yeast strains: Each yeast strain has specific nutritional requirements.

WHAT ABOUT YEAST NUTRITION AND AROMAS PRODUCTION?

Amino acids can also be used by the yeast for production of aromas. Sulfur-containing amino acids such as glutathione and cysteine derivates are precursors of thiols. Other amino acids are used by the yeast as precusors of esters and acetates. These amino acids are usually harder to assimilate; they should be used at the early stage of fermentation.

- OPTITHIOLS® is a yeast nutrient rich in cystein derivates and glutathione, giving yeast precursors for thiolic compounds, thus increasing thiols aromatic potential in wines and an anti-oxidant protection. This double role of anti-oxidant and varietal aroma booster increases the wine's aromatic potential, leading to significantly greater quantities of thiols.
- OPTIESTERS® is a yeast nutrient composed of inactivated yeasts naturally rich in amino acids and ergosterols. The specific formulation of OPTIESTERS® gives to yeasts the precursors of higher alcohol acetates and fatty acid ethyl esters, contributing to fruity and floral aromas in wines. These fermentary esters are only formed by yeasts during the alcoholic fermentation and are optimized by the fermentation conditions: low temperature, low turbidity, yeast metabolism, and yeast nutrition.

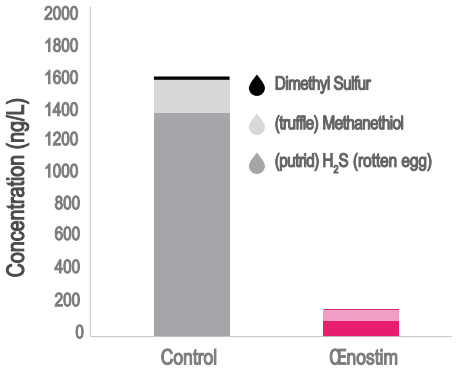
Nutrients

ŒNOSTIM®

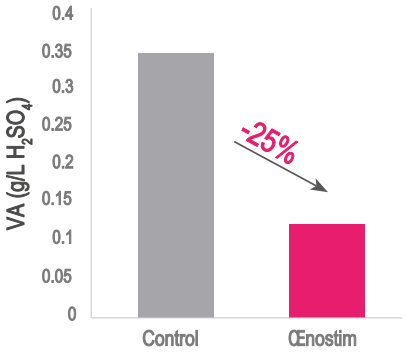
Inactivated yeasts naturally rich in growth factors (vitamins, mineral elements) and survival factors (sterols, unsaturated fatty acids).

- Reinforces yeast activity and metabolism, limits fermentation risks, prevents off-flavors production and increases aromatic production
- Ensures good yeast implantation and shortens lag phase
- Improves yeast cell wall health and increases yeast resistance to difficult conditions
- Regulates and helps completion of AF

Production of off-sulfur compounds



VA on finished wine



Dosage: 2.5 lbs/1000 gal (30 g/hL).
Packaging: 1kg, 5kg
Application: Yeast preparation

OPTIFLORE O®

Yeast nutrient, 100% organic nitrogen for an essential, and efficient nutrition. High nutritive power nutrient.

- Alternative to DAP and rich in easily assimilable amino acids as well as vitamins, minerals, and oligoelements.
- Qualitative and sustainable nutrition for yeast.
- Limit fermentation risks, off-flavors production and increase aromatic production.
- Maintain yeast cells in optimal physiological state.
- No overproduction of biomass.
- Acts as detoxifiant to reduce stress conditions.

Dosage: 1.6 – 3.2 lbs/1000 gal (20-40 g/hL).
Packaging: 1kg, 5kg
Application: At inoculation, first part of fermentation

OPTIFERM

Blend of inactivated yeast, amino acids (organic nitrogen), sterols, unsaturated fatty acids, and inorganic ammonium salts (DAP).

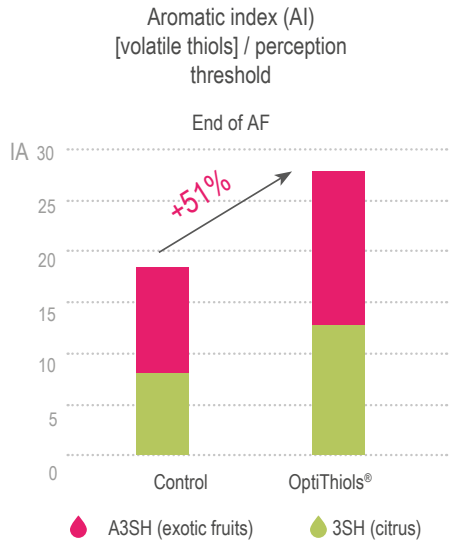
- Unsaturated fatty acids and sterols provided are important survival factors needed to maintain alcohol resistance and fermentation activity.
- The presence of both forms of nitrogen provides a complex and complete nutrition.
- The cell wall fractions absorb short and medium chain fatty acids that are toxic to the yeast. They also provide nucleation sites to help keep the yeast in suspension

Dosage: 1.6 – 3.2 lbs/1000 gal (20-40 g/hL).
Packaging: 1kg, 20kg
Application: During fermentation

OPTITHIOLS®

Inactivated yeast rich in Glutathione and Cystein derivates to increase thiolic compounds production and antioxidant potential

- Generate a very significant increase in aromas (30 - 120%)
- Increase thiolic compounds production by yeast
- Increases anti-oxidant wine potential

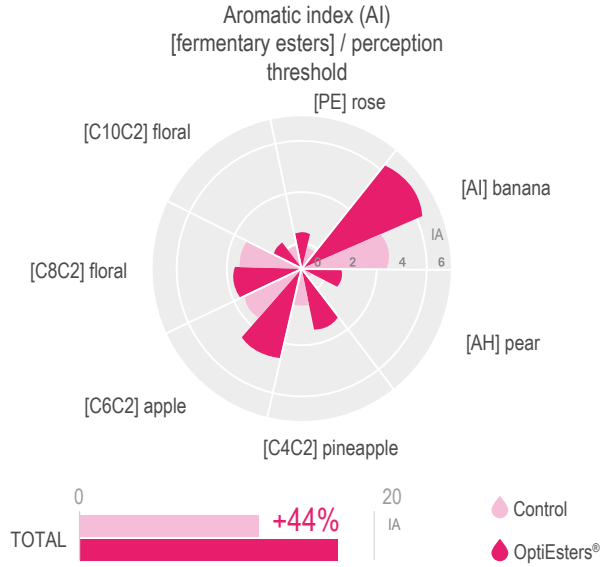


Dosage: 1.6-2.5 lbs/1000 gal (20-30 g/hL).
Packaging: 1kg.
Application: Early fermentation

OPTIESTERS®

Selection of amino acids and ergosterols to increase the aromatic intensity and freshness of wines

- Increase aromatic freshness and complexity
- Enhance stonefruits, fresh fruits, and floral notes
- Important impact on aromatic profile of the cider.

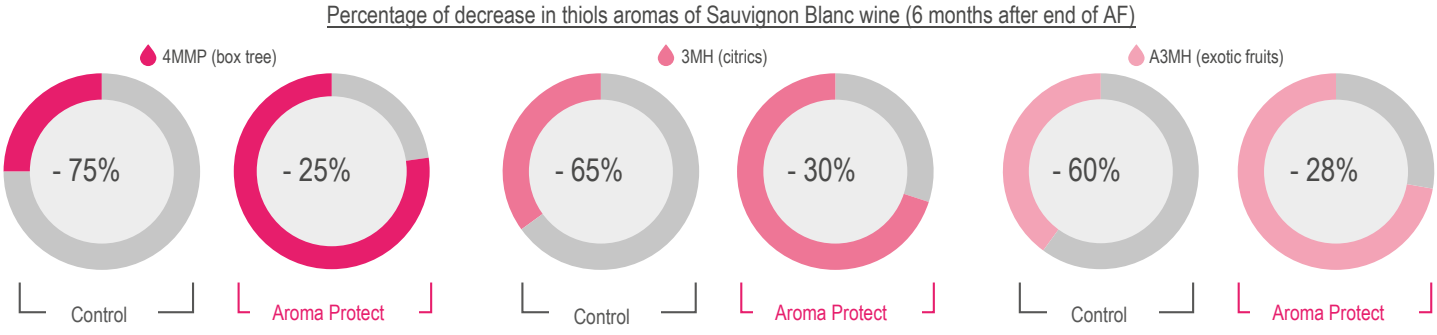


Dosage: 1.6-2.5 lbs/1000 gal (20-30 g/hL).
Packaging: 1kg.
Application: early fermentation

AROMA PROTECT®

Inactivated yeast rich in Glutathione and Cystein derivates to increase anti-oxidant resistance of the cider and control redox potential

Producing aroma is one challenge, protect them is another. AROMA PROTECT®, composed of inactivated yeasts naturally rich in glutathione and other reducing compounds, is an essential tool to address this challenge.



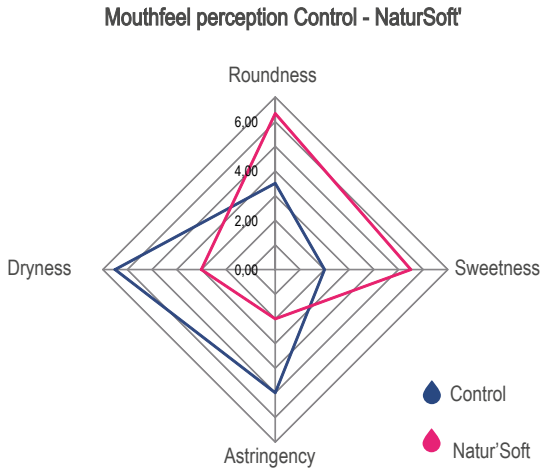
Dosage: 0.7 – 2.5 lbs/1000 gal (10-30 g/hL).
Packaging: 1kg
Application: During fermentation, post fermentation, ageing

NATUR'SOFT®

Preparation of specific yeasts hulls, selected for their high content of mannoproteins

- Increases cider complexity
- Reduces tannins perception
- Fills mid palate
- Mimic lees ageing
- Improve colloidal stability and bubble quality
- Enhances fruity characters

Dosage: 1.6 – 3.2 lbs/1000 gal (20-40 g/hL)
Packaging: 1kg, 5kg
Application: During fermentation, ageing.



ACTIBIOL®

Bioactivator of the alcoholic fermentation, made of yeast wall cells, inactivated yeasts and cellulose support elements

- Help yeast development and extends fermentation activity
- Help highly clarified juices as a yeast support
- Facilitate the restart of fermentations

Dosage: 1.6 - 3.2 lbs/1000 gal (20-40 g/hL).
Packaging: 1kg
Application: Fermentation, Restart

LAMOTHE-ABIET NUTRIENTS

	Cellulose	Ammoniacal nitrogen	Organic nitrogen	Vitamins / Minerals	Sterols	YAN increase for 20 g/hL	Aromatic Impact	Detoxification
OENOSTIM®						0		
OPTIFLORE® O						10		
OPTIFERM®						30		
ACTIBIOL®								
OPTITHIOLS®						0		
OPTIESTERS®						0		
NATURSOFT®						0		
AROMA PROTECT®						0		

// ENZYMES

Enzymes are biological catalysts of reactions and naturally present in all living systems. Highly specific, they act on one or a limited number of substrates to facilitate and accelerate reactions. Enological enzymes are usually blends based on pectinases, in which each enzyme's activity plays a role to reach a specific objective. In order to offer optimum quality and performance, all our enzymes undergo a **purification process to remove any potentially detrimental activities such as cinnamyl-esterase activity** (a side activity that puts wine at risk of aromatic spoilage through the production of vinylphenols), **anthocyanase** (side activity that causes color loss) **and oxidase** (side activity that promotes oxidation of polyphenols and aromatic compounds).

WHY USE ENZYMES?

Commercial enzyme preparations are mainly used to amplify and improve the spontaneous phenomena observed during the cidermaking process. The addition of exogenous enzymes is generally justified by the low level of activity of the enzymes found in the apples or yeast.

- Using pectolytic enzymes on **milled apples prior to pressing increases juice extraction rates,** especially for cold storage apples with high pectin level due to the breakdown of cellular walls.
- After pressing, it is important to apply **clarification enzymes to improve settling and dramatically improve filterability.** Pectins make up 1-1.5% of total solids in apple juice and are usually the cause of difficult clarification and filtration issues. Clarification enzymes also helps in precipitating microbes and reducing overall population.
- Enzymes can also be used for improving aroma extraction, as well as enhancing aromatic expression and improving mouthfeel. Apples contain aroma compounds that contribute fruity, floral, and spicy aromas to cider. The compounds most responsible for these aromas are esters and terpenes. Using an enzyme with B-glycosidase activity such as OENOZYM® FW will help express and release those varietal aromas.

WHAT ARE THE FACTORS INFLUENCING THE ENZYMATIC ACTIVITY IN CIDER?

- Temperature: Ideal temperature for enzyme activity is 50-86°F (10-30°C).When the temperature exceeds 140°F (60°C), the enzymes are denatured. Most of the enzymes gets inactivated below 5°C.
- Time of contact: The longer the enzyme is left to work, the more work it can do. Unfortunately, due to processing demands, time is often the limiting factor.
- pH: Almost all cidermaking enzymes are active at pH between 2.8 and 5.0
- Sugar content: Some enzymes, such as glycosidases (OENOZYM® FW) can be inhibited by glucose. We recommend to use them once sugar content < 50 g/L.

The dosage required varies depending on contact time, level of pectin, stage of production, and presence of inhibitory substances.

WHAT ARE ENZYMES EXTRACTED FROM?

Enological enzymes are produced by diverse species of fungi such as A*spergillus, Rhizopus, and Trichoderma*, except for lysozyme which is extracted from egg whites.

ARE ENZYMES DEACTIVATED BY SO_2?

Yes, enzymes can be inhibited by SO_2 when a very high amount of SO_2 is used (deactivation occurs around 500 ppm). It is okay to add enzymes after the SO_2 is adequately dispersed or to add the SO_2 after the enzymes are adequately dispersed. Do not mix SO_2 and enzymes together.

ARE THERE ANY NEGATIVE ENZYME ACTIVITIES?

What makes one commercial enzyme better than the other is fitness for purpose, and whether they are sourced appropriately and purified, free of undesirable side activity leading to the production of vinyl-phenols, off-flavors, or loss of color. Cinnamoyl Esterase (CE) is produced by some species and strains of Aspergillus. CE can convert hydroxy-cinnamoyl esters in juice to hydroxycinnamoyl acid that Phenolic Off Flavor positive POF(+) yeast strains will metabolize into vinyl phenols, giving off aromas of paint, leather, and vinyl. It is important to use enzymes that are purified and use Phenolic Off Flavor negative POF(-) yeast strains.

ARE THERE ANY INTERACTIONS TO AVOID WHEN USING ENZYMES?

There are two ingredient additions that can negatively impact enzyme activity; **bentonite and tannins.** Both bentonite and tannins can bind with proteins in the juice/cider. Enzymes are proteins, so they have the potential of being removed or inactivated by bentonite and tannin additions. In juice clarification, it is important to allow at least 6 hours for the enzyme to depectinize the juice before the bentonite addition.

CAN I USE SETTLING ENZYMES ON FINISHED CIDERS?

Yes, you can use OENOZYM® CLEAR on ciders to improve settling and lees compaction. It will require higher dosage and longer contact time than for juice settling. We always recommend to use enzymes as early as possible as a preventive.

WHY IS CIDER CLARIFICATION IMPORTANT?

So many of the challenges cidermakers face during production can be linked with overall cider clarification. There are two main stages impacted by improper clarification:

- Fermentation: Proper clarification prevents yeast stress during fermentation. High turbidity can cause yeast stress resulting in H_2S production. Ideally, juices should be clarified to 80-120 NTU or 1-2% solids.
- Filtration: Proper clarification prevents issues with filtration and stability. Poorly clarified ciders may prematurely clog filter media, making it very difficult to achieve sterile filtration. Clarification of cider for filtration should start before fermentation with the use of enzymes such as OENOZYM® CLEAR in juices.

Enzymes

ŒNOZYM® CRUSH

Enzymatic preparation specifically formulated for milled apples maceration, extraction, and pressing. Highly concentrated and purified from Cinnamoyl Esterase activity.

- Increase free-run juice yield at pressing
- Improve extraction of skin compounds:
  - Polysaccharides: improve colloidal stability, decrease astringency perception
  - Aromatic precursors
- Improve juice clarification and lees compaction

Dosage : 50 ml/ ton
Packaging: 1L
Application: Milled apples, at pressing

ŒNOZYM® CLEAR

Liquid enzymatic formulation to accelerate the clarification of juices before alcoholic fermentation. This enzyme can also be used on finished cider to improve filtrerability.

- Increase juice yield by compacting lees
- Accelerate settling time: fast depectinization and floculation
- Formulation active at low (<5°C) and high (<68°C) temperature
- Suitable for clarification by static settling and flotation

Dosage : 150-300 ml/ 1000 gal (4-8 mL/hL).
Packaging: 1L
Application: Juice, Finished cider

ŒNOZYM® THIOLS

Pectolytic enzyme preparation from *Aspergillus niger* free from cinnamyl-esterase activity used to increase thiolic compounds expression.

- Increase conversion rate of thiolic precursors and aromatic intensity and lifespan of aromas.
- Decrease the risks of losses through oxidation (pre-bottling).
- Increase freshness and aroamtic complexity: tropical, grapefruit, citrus, ...
- Can be used during fermentation or post fermentation

Dosage : 150-300 mL/1000 gal (4-8 g/hL).
Packaging: 250 mL.
Application : During fermentation, maturation, pre-bottling.

ŒNOZYM® FW

Preparation of pectolytic enzymes rich in glycosidase activity which can cut the glycosyl group from the precursors, thus expressing varietal aromatic molecules.

- Help clarification
- Boost aromatic potential of cider by liberation of varietal aromas
- Increase aromatic complexity: red fruits, berries, spices, floral characters

Dosage : 150-300 g/1000 gal (4-8 g/hL).
Stop enzymatic activity with 5-10 g/hL of Bentosol Poudre.
Packaging: 100 g.
Application : End of fermentation, maturation.

// FINING AND CLARIFICATION AGENTS

WHY FINING?

Fining agents can be used for many purposes in cidermaking, including clarification, filterability improvement, prevention of haze and sediment formation, organoleptic profile improvement, color adjustment, and removal of undesirable elements or flavors. The fining process is therefore a crucial stage in the production of all cider types.

Improve Clarification and Filterability

Solids removal can be achieved using enzymes, and/or fining agents. It can be done pre- and post-fermentation.

Improve Sensory Aspects:

Ciders with perceived astringency and bitterness may be improved with the use of protein-based fining agents that complex with polyphenols. Nowadays, correcting cider sensory imperfection can also be done in a less invasive method with the help of polysaccharides and tannins.

Reach Stability:

Fining agents can be used to remove elements that can cause haziness, sediment, and sensory defects after bottling/canning/kegging thus causing loss of cider value. Choice of the fining agent used depends on the nature of the instability factor.

- Oxidative Stability => CASEIMIX® (Potassium Caseinate), POLYMIX NATUR'® (Yeast extracts, PVPP, bentonite), GREENFINE® MUST (Pea protein), GREENFINE® X-PRESS (Pea protein, PVPP, Bentonite and Chitin-glucan)
- Protein Stability => BENSOSOL POUDRE (Sodium bentonite) or BENTOSOL FT (Calcium, sodium activated bentonite for cross-flow filtration)
- Microbial Stability => KILLBRETT® (Chitosan)

WHAT ARE THE DIFFERENT TYPES OF FINING AGENTS ?

- Protein fining agents :
    - Animal origin: gelatins, egg albumin, casein (CASEIMIX®) and potassium caseinate, fish fining (COLLE DE POISSON L.A®).
    - Vegetal origin: pea (GREENFINE® MUST) or potato.
- Fungal origin: chitin-glucan and chitosan KILLBRETT®) from Aspergillus Niger and protein extracts from *Saccharomyces Cerevisiae* yeast (NATUR'FINE PRESTIGE®).
- Mineral fining agents: Bentonite, kaolin, silica gel
- Synthetic fining agents: PVPP and PVI-PVP

VEGAN, ALLERGEN-FREE FINING AGENTS

Lamothe-Abiet has developed a range of products that can effectively replace albumin, casein, and potassium caseinate. These products can be based of yeast derivates and plant proteins.

WHAT IS A PLANT-BASED FINING AGENT ?

Plant-based fining agents for use in cidermaking generally come from peas or potatoes. Their origin gives them different properties and they are excellent alternatives to PVPP, gelatin, or casein.

WHY USE PEA PROTEIN?

The pea protein is more widely used because it is very versatile and it respects the qualities of juices and ciders. The pea protein fining is a great tool to correct and prevent oxidative evolution of the color, to reduce astringency and correct phenolic unbalance. Pea proteins have a very interesting clarifying power and ensure a good settling. Pea proteins also improve clarity and reduce tannic astringency without modifying the polyphenolic balance.

WHAT IS LAMOTHE-ABIET SELECTION CRITERIA FOR PEA PROTEIN?

As a plant-based fining agent, the quality of pea protein can vary greatly (depending on variety, harvesting location, climatic conditions, etc.). In order to provide a constant quality, Lamothe-Abiet selects the best pea protein resources and validates them according to many requirements such as the percentage of protein matter, efficiency on flocculation and sedimentation, appearance, smell, impact on taste. It is thanks to this criteria that our GREENFINE® range contains the best pea proteins on the market. In addition to being non-GMO, allergen-free, natural, and vegan, Lamothe-Abiet fining agents from GREENFINE® range are composed of high-quality pea protein (Pisium sativum) for fining, giving the best results.

HOW LONG CAN FINING AGENTS REMAIN IN CIDER?

Gelatin, casein, pea protein, and egg albumin should not remain in ciders for more than 10-15 days. Isinglass can remain 3-4 weeks. Bentonite, silica sol, chitosan, and PVPP can remain in ciders for a longer time.

Fining Agents

GREENFINE® MUST

GREENFINE® MUST is a high quality pure pea protein (*Pisium sativum*) for musts and ciders fining.

- Rapid and compact clarification
- Can be used for flotation
- Treat and prevent oxidation by removing easily oxidable and oxidized phenolic compounds
- Treat color by eliminating yellow shades
- Eliminate astringency without modifying the phenolic balance
- Reduce bitterness
- Clean aromas such as green notes, smoke, and mushroom-type aromas
- Versatile alternative to casein and PVPP

Dosage: 1.6 - 6.4 lbs/1000 gal (20 – 80 g/hL)
Packaging: 1kg
Application: Juice, Must, Cider.

GREENFINE® X-PRESS

Blend of pea protein, PVPP, calcium bentonite and chitin-glucan, GREENFINE® X-PRESS is a formulation created for the effective treatment of press fraction. It enables preventive and curative treatment of oxidation and off-flavors such as green characters, smoke, and moldy aromas. It gives a fast clarification and a very good lees compaction.

- Accelerate settling, good lees compaction, and can be used for flotation
- Treat browning, oxidation, and remove 'yellow' color.=
- Prevent oxidation by easily removing oxidable phenolic compounds
- Stabilize ciders from premature oxidation
- Reduce bitterness
- Remove off-flavors (moldy/green notes)
- Great vegan alternative to gelatin.

Dosage: 1.6 - 6.4 lbs/1000 gal (20 – 80 g/hL)
Packaging: 1kg
Application: Juice, Must, Cider

POLYMIX NATUR'®

Preparation of PVPP, yeast extracts and bentonite to prevent and treat oxidation. Vegan, allergen free fining agent, alternative to casein.

- Improve clarification
- Color adjustment
- Shelf life wine stability: removes easily oxidable phenolic compounds, precursors of oxidation
- Cleans up aromas (removes volatile phenols)
- Reduces bitterness and smooth harsh tannins

Dosage : 1.6 - 4.8 lbs/1000 gal (20-60 g/hL)
Packaging: 1 kg, 5 kg.
Application : Pre, during, or post fermentation.

CASEMIX®

Potassium caseinate instaneously soluble. CASEMIX® is a preventive and curative treatment of oxidation of juices and/or ciders. It is used to remove phenolic compounds (especially oxidized and easily oxidable polyphenols) and off-aromas.

- High purification and protein content : high efficiency
- Instantaneously soluble for an easy application
- Used in both juice and cider
- Treats oxidized phenolics and bitter compounds
- Helps to freshen cider and smooth mouthfeel

Dosage: 1.6 - 4.8 lbs/1000 gal (20-60 g/hL)
Packaging: 1kg
Application: Juice, Must, Cider

COLLE DE POISSON L.A.

Pure isinglass that has not undergone hydrolysis.It is commonly used for clarification, brightness, and shine of finished ciders.

- Easy to dissolve in water during the addition.
- Very effective in removing harsh tannins or bitterness, and in clarifying the ciders.
- Respectful of the cider's organoleptic quality.
- Incomparable brilliance and finesse to cider.
- Requires 2-3 weeks for settling for good compaction and to limit clogging effects at filtration.

Dosage : 0.08-0.24 lb/1000 gal (1-3 g/hL).
Packaging: 100 g.
Application : Finished ciders

BENTOSOL POUDRE

Natural sodium bentonite, selected among the purest natural bentonites, specifically for its strong deproteinizing ability, compacting properties (small amount of lees) and the preservation of ciders' aromas (little loss of aromas).

- High capacity to remove protein
- Good lees compaction to limit lees loss
- Low impact on aromas
- Can be used during clarification, fermentation, ageing.

Dosage : 0.85 - 16 lbs /1000 gal (10-200 g/hL).
Packaging: 1kg, 25kg
Application : Juice, Fermentation, Finished ciders

BENTOSOL FT

Purified calcium-sodium bentonite, graded and poor in crystalline silica, specifically developed for protein stability and crossflow filtration usage. Enables in-line injection of bentonite straight to the cross-flow filter, saving time and cider quality.

- High capacity to remove protein
- Low impact on aromas
- Low in crystalline silica, to prevent abrasion of the membrane and pumps of cross-flow filters;
- Reduce bentonite consumption, eliminate settling time after bentonite fining, and reduce cider waste and lees volumes.

Dosage : 0.85 - 16 lbs /1000 gal (10-200 g/hL).
Packaging: 15kg
Application : Finished ciders

LAMOTHE-ABIET FINING AGENTS

	Composition	Clarification	Astringency removal	Roundness	off-aroma removal	Protein removal	Oxidation treatment	Application	Dosage (g/hL)
GREENFINE® MUST	Pea protein	••	••	•	••		•	Juice/ Cider during AF	20 – 80
GREENFINE® X-PRESS	pea protein, PVPP, calcium bentonite and chitin-glucan	•••	••	•	••		••	Juice/ Cider during AF	20 – 80
NATURFINE PRESTIGE®	Inactivated yeasts, pectolytic enzymes	•	•••	••	••			Juice/ Cider during AF	5 - 40
POLYMIX NATUR'®	Yeast extracts, calcium bentonite, PVPP	••	••	•	•	•	••	Juice/ Cider during AF	20 - 60
CASEIMIX®	Potassium caseinate	•••			•		•••	Juice/ Cider during AF	20 - 60
COLLE DE POISSON LA	Isinglass	••		•	•		•	Cider	1-3
BENTOSOL® POUDRE	Sodium bentonite					•••		Juice/ Cider during AF	10-120
BENTOSOL® FT	Calco-sodic purified bentonite					••		Cider	10-120

Excess of polyphenols

CASEIMIX®: 15-80g/hL
GREENFINE® X-PRESS: 30-80 g/hL
GREENFINE® MUST : 10-80g/hL
POLYMIX NATUR'®: 30-80 g/hL
POLYMIX ®: 30-80 g/hL

Oxidized Color

GREENFINE® X-PRESS: 30-80 g/hL
GREENFINE® MUST : 10-80g/hL
CASEIMIX ®: 30-80 g/hL

Refining

COLLE DE POISSON LA : 0,5-1,5g/hL
NATUR'FINE® PRESTIGE: 10-30 g/hL
GREENFINE® MUST : 10-30g/hL

Brightness

COLLE DE POISSON LA : 1-3g/hL
POLYMIX ®: 15-30 g/hL

Protein stability

BENTOSOL® POUDRE
BENTOSOL® FT

// ML BACTERIA

Malolatic bacteria converts malic acid to lactic acid, but is not always desired in cider production. It can, however, have a direct impact on cider quality. Uncontrolled spontaneous malolactic fermentations or wild lactic acid bacteria can result in diminished varietal and fruit flavors, reduced esters, masked aromas and off-characters. The use of selected malolactic strains can contribute positively to ciders while minimizing risks. It is very important to know the status of the cider prior to inoculating with malolactic bacteria.

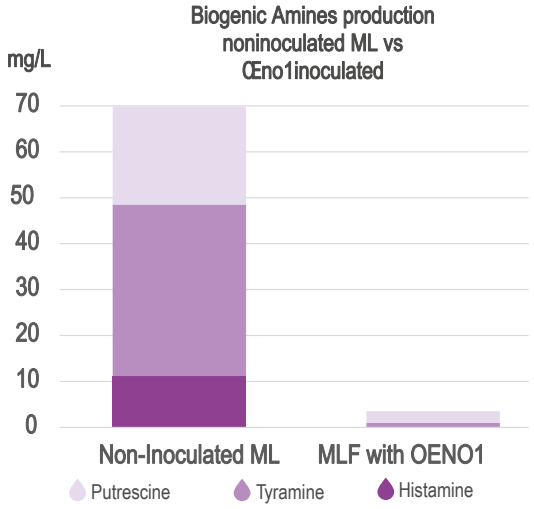
PRINCIPAL FACTORS INFLUENCING LACTIC ACID BACTERIA

MLF problems can arise when pH is low (<3.4), alcohol is high (>14.5%), temperature is low (<65°F) or high (>80°F), total SO_2 is high (>50 mg/L) and/or free SO_2 is high (>10 mg/L). These four parameters (pH, temperature, alcohol, and SO_2) have a negative synergistic effect, making the completion of Malolactic conversion difficult when combined. Compatibility between yeast and bacterial strains is another significant consideration. With minor impact, residual pesticides, initial malic acid and phenolic content can also be stress factors.

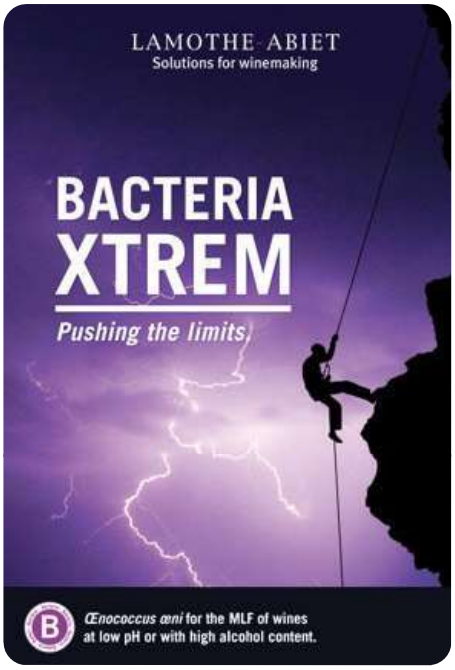
ŒNO 1®

Oenococcus oeni for MLF, adapted and resistant to difficult conditions.

- Freeze-dried *Oenococcus Oeni* strain, very easy to use, in direct inoculation
- Short lag phase, quick conversion of malic acid and strong resistance to difficult conditions
- Free of cinnamyl esterase activity, thus improving aromatic cleanliness and reducing risks of Brett taint
- Produces fruity, fresh ,and clean cider profile
- Low biogenic amines production
- Low VA, acetaldehyde and off-aromas production
- Low diacetyl production



Dosage: 1-2 g/hL.
Packaging: 2.5g, 25g, 100g, 250g
Application: Co-inoculation, Sequential inoculation, MLF restart, Direct addition



BACTERIA XTREM®

Oenococcus oeni for MLF, adapted to extreme conditions.

- Freeze-dried *Oenococcus Oeni* strain, very easy to use, in direct inoculation
- Short lag phase, quick conversion of malic acid and strong resistance to difficult conditions
- Free of cinnamyl esterase activity, thus improving aromatic cleanliness and reducing risks of Brett taint
- Resists to low pHs
- Low production of VA and biogenic amines
- Produce diacetyl. Tip: To block the production of diacetyl, add SO_2 about 48 hrs after the end of MLF

Dosage: 1-2 g/hL.
Packaging: 25g
Application: Sequential inoculation, MLF restart , Low pH, Direct addition

ML Bacteria

// MICROBIAL CONTROL

Ensuring microbial stability is fundamental for preserving cider quality and avoiding economic losses from spoilage. Microbial contamination can have major negative effects on cider quality. Capable of developing at any time during the cidermaking process, spoilage microbes are opportunist organisms which are difficult to control and eliminate.
Cider needs to be protected from spoilage. There are a variety of naturally ocurring yeasts and bacteria that can work alone or collectively to negatively impact quality or sensory characters. They do so by metabolizing compounds readily available in juice and finished cider. Refermentation is a spoilage concern when glucose and fructose are present or cider is backsweetened; however, metabolism of glucose and fructose can also lead to other spoilage concerns including acetic acid production and vinegar aroma. Additionally, there are other compounds in juice and cider (e.g., amino acids, malic acid) that support organism growth potentially resulting in spoilage. We are here to help you protect your cider from apple to bottle!

KEY POINTS OF MICROBIAL MANAGEMENT:

- Good cellar practices and sanitation
- Manage fermentation stages to reduce risks
- Fining and racking off heavy lees to eliminate cells
- SO_2 management
- Anti-microbial agent

HOW DO ANTI-MICROBIAL AGENTS WORK?

Removal, Inhibition, Destruction

- Microorganisms can be physically removed from the cider. Removal strategies include filtration, centrifugation, and fining followed by racking.
- Microbe replication is stopped or slowed but organisms are not necessarily killed. Microbes may start to grow and multiply once the inhibitory pressure is removed. Inhibition strategies include the use of bioprotection agents like selected yeast that outcompete spoilage organisms,or the use of sulfur dioxide at non-lethal concentrations.
- Microorganisms are killed and will not survive to replicate. Destruction strategies include KILLBRETT® (pure chitosan product).

WHAT ARE THE ANTI-MICROBIAL AGENTS AVAILABLE FOR CIDER MAKING?

ANTIMICROBIAL AGENT	PROS (+)	CONS (-)
SO2	Wide spectrum anti-microbial Can be use at any stage of cidermaking Cost of use	Not effective at pH>3.8 Allergenic Close organoleptic profile of cider Hardness on mouthfeel
LYSOZYME	Effective on Lactic Acid Bacteria Can be use at any stage of winemaking	Not effective on yeast and Acetic Acid bacteria Allergenic (egg protein) Requires bentonite fining Cost of use
CHITOSAN	Wide spectrum anti-microbial Effective at low dosage Can be use at any stage of cidermaking Vegan Allergen-free	Not effective on *Saccharomyces* Cost of use
DMDC	Effective on all yeast	Low effect on bacteria Pre-bottling application Requires special skills and equipment Cost of use
SORBATE	Effective on all yeast Cost of use	No effect on bacteria Risks of geranium taint if ML bacteria present Pre-bottling application

Killbrett

COEFF 2 & COEFF 5

Blend of potassium metabisulfite and potassium bicarbonate, self-dissolving and self-mixing, for sulfiting

- Self-mixing in barrels or small tanks while reducing time and labor needed for stirring
- Easy, fast, and safe to use : helps prevent overdose problems associated with traditional forms of SO_2
- No need of special permit, safety training, or respirator
- Accurate, precise dosage of SO_2

SO_2 contributions (mg/L) by COEFF-2 or COEFF-5 in volume of cider

SO_2 Dose	1 Liter	1 Gallon	60 Gallon	100 Gallon	1000 Gallon
Coeff 2	2,000	529	9	5	0.5
Coeff 5	5,000	1,321	22	13	1.3

Dosage : COEFF-2 releases 2 g of SO_2 ~ 9 mg/L in a barrel. COEFF-5 releases 5 g of SO_2 ~ 22 mg/L in a barrel.
Packaging: COEFF-2 cases of 48 tablets. COEFF-5 cases of 42 tablets.
Application : juice, maturation, pre-bottling.

KILLBRETT®

Pure chitosan, for microbiological stabilization of wines and ciders

Chitosan is a polysaccharide with a powerful and wide spectrum anti-microbial. It eliminates and prevents the contamination of *Brettanomyces*, Lactic Acid Bacteria, and Acetic Acid Bacteria. Chitosan causes the lysis of the cell walls of spoilage microbes and their sedimentation. It is used as a curative and/or preventive treatment. Easy-to-use and efficient at low dosage, KILLBRETT® is a pure chitosan fining agent, vegan and non-allergenic product, produced of 100 % fungal.

Dosage : 2-8 g/hL. Preventive: 4 g/hL. Treatment: add 6 g/hL
Packaging: 100g, 500g
Application : Full cidermaking process.

WHAT IS CHITOSAN?

Chitosan is an exciting non-allergenic and non-animal based tool for both traditional and vegan cidermaking. Chitosan is a polysaccharide with a powerful and wide spectrum anti-microbial. It eliminates and prevents the contamination of *Brettanomyces spp.,* Lactic Acid Bacteria, Acetic Acid Bacteria, and some non-*Saccharomyces* yeasts.

HOW DOES CHITOSAN WORK AS ANTI-MICROBIAL AGENT?

Chitosan, positively charged at cider pH, first reacts with microbial cell walls by charge interaction. It then blocks the cell's receptors, thus interrupting its metabolism, and creates a differential of pH between internal and external of the cell, resulting the perforation of the cytoplasmic membrane. Finally, chitosan acts as a fining agent and helps settling cells.
KILLBRETT® is a chitosan-based antimicrobial agents that can be used instead of lysozyme and/ or SO_2 to control spoilage caused by *Brettanomyces* spp., lactic acid bacteria, and acetic acid bacteria.

HOW TO USE KILLBRETT®?

- When used in preventive: Add 2-4 g/hL of KILLBRETT® during a transfer or racking to prevent any spoilage microbe's development. The anti-microbial effect of KILLBRETT® lasts about 4 months in contact with cider. Racking is not necessary when KILLBRETT® is used a preventive and low dosage
- When used as a curative treatment: First we recommend to rack the cider off lees. While racking, add KILLBRETT® at 6-8 g/hL according to the microbes and overall load. Rack cider back to cleaned barrels or tank after a week of settling.

//TANNINS

The cultivated variety of apples used for cider making determine the aromas, flavors, and mouthfeel characters of the final product. For apples that are lacking in textural tannins or acidity balance, it is possible to help build a great cider especially when dessert apples are used through the addition of certain products. The use of tannins, polysaccharides and yeast derivatives rich in mannoproteins helps to design the organoleptic profile and balance mouthfeel during fermentation and maturation. Tannins used in cidermaking come from a variety of sources, including oak, grapes, exotic woods, and gall nuts. They have many applications in cidermaking depending on their origin and production method: anti-oxidant, anti-oxidasic, protein removal, redox potential regulation, reduce green characters perception and reductive notes, increase structure, and balance mouthfeel. The tannins Lamothe-Abiet offers for cider can be used during the fermentation, or after fermentation during maturation up to 48 hours pre-bottling. Common objectives for tannins when used during fermentation are to enhance structure and mouthfeel, to protect from browning, and to limit the consequences of mold or rot.

WHY USE 'SACRIFICIAL' TANNINS?

When apples are crushed, proteins are released and bind first with tannins to precipitate. The first tannins available are the skin tannins, which are usually the most interesting for future cider structure and mouthfeel. Sacrificial tannins are added on apples and react with proteins, thus preventing the freshly extracted skin tannins from precipitating.

WILL ADDING TANNIN TO MY CIDER HELP WITH PROTEIN STABILITY?

Fermentation and ageing tannins can certainly help with protein stability. At cider pH, tannins are negatively charged and have an affinity for positively charged proteins, thus improving protein stability. Finishing tannins may improve protein/heat stability and should be done prior to the addition of bentonite to improve the effectiveness or reduce the amount needed of the bentonite. For this purpose, we recommend using TANNIN GALLIQUE A L'ALCOOL in juice.

CAN I TREAT REDUCTION WITH TANNINS?

Mercaptans are sulfur compounds responsible for negative odors such as cabbage and onion. Tannins, particularly ellagitannins, can reduce mercaptan content juice via a direct condensation reaction. TAN&SENSE® VOLUME showed very good results in removing mercaptans and treating 'reductive' ciders.

ADDITIONS WITH 1% SOLUTION

wine sample (mL) / rate (g/hL)	50	100	125	375	750
5	0.3	0.5	0.6	1.9	3.8
7	0.4	0.7	0.9	2.6	5.3
15	0.8	1.5	1.9	5.6	11.3
20	1.0	2.0	2.5	7.5	15.0

HOW TO REDUCE GREEN CHARACTER?

Certain finishing tannins are more suitable for reducing 'green' qualities by promoting more fruit to show in a cider and masking with oak. SOFTAN SWEETNESS® is an excellent example of this kind of tannin.

CAN I REDUCE SO2 BY USING TANNINS DURING AGEING?

Absolutely. Tannins play a vital role as an effective antioxidant in ciders, making them a great tool for lowering the need for SO2 as part of a comprehensive strategy.

HOW LATE BEFORE BOTTLING AND FILTRATION CAN I ADD FINISHING TANNINS?

Finishing tannins should be integrated prior to bottling filtration before the polishing crossflow or pad filtration. Lamothe-Abiet finishing tannins can be added up to two days pre-bottling.

WHY USE FINISHING TANNISN IN CIDER?

Finishing agents can be valuable tools for perfecting a cider. Bench trials are a very important step to determine the right fit for any of these products. Finishing aids are very helpful to:

- Mask pyrazines/greenness
- Maximize fruit
- Fill mid-palate
- Increase aromatic intensity, perception of sweetness and body
- Brighten acid
- Reduction of sulphur-off compounds
- Impart oaky characters

CAN TANNINS REFRESH A TIRED OR OXIDIZED WINE?

TAN&SENSE® FORTE AND TAN&SENSE® VOLUME are excellent tools for helping bring a tired cider back to its full potential. These are specific ageing and/or finishing tannins that will refresh a wine that has lost aromatics through oxidation, either in barrels, tanks, flex cubes, kegs, and other containers if not sealed or topped properly.

HOW TO CHOOSE WHICH FINISHING TANNINS FOR YOUR CIDER?

Ask us for a sample kit to set up bench trials. We are here to help you and can set up bench trials for you!

HOW TO SET UP BENCH TRIALS?

A bench trial is a small-scale test that stimulates the effect of a treatment. Bench trials are essential to evaluate the efficiency of treatments and determinate the proper dose rate. See below some help to set up bench trials.

ADDITIONS WITH 2% SOLUTION

wine sample (mL) / rate (g/hL)	50	100	125	375	750
25	0.6	1.3	1.6	4.7	9.4
30	0.8	1.5	1.9	5.6	11.3
40	1.0	2.0	2.5	7.5	15.0
50	1.3	2.5	3.1	9.4	18.8

Tannins

// FERMENTATION TANNINS

TANNIN GALLIQUE À L'ALCOOL

Pure gallic tannin, extracted by alcohol and granulated. Protection from oxidation and mouthfeel enhancement.

- Used on fruit and juice
- Inhibits laccase and oxidative enzyme, thus protecting ciders from oxidation
- Help protein stabilisation and clarification
- Treat and prevent reductive notes
- Used to reduce, complement or replace SO2 use as antioxidant.

Dosage : 0.85-1.6 lbs/1000gal (10-20 g/hL).
Packaging: 1 kg
Application : on apples and juice.

// AGEING/FINISHING TANNINS

MATURATION TANNINS	COMPOSITION	REDOX POTENTIAL	STRUCTURE	ROUNDNESS	HARMONY	TIMING	DOSAGE g/hL
Vinitan® Advance	*100% grape tannins*	•	•••	••	•••	Maturation Pre-bottling	5 - 25
Tan&Sense® Volume	*Pure ellagitannins of untoasted oak*	•••	•	••	••	Maturation Pre-bottling	5 - 20
Tan&Sense® Origin	*Pure ellagitanins of lightly toasted oak*	•	•	•••	•••	Maturation Pre-bottling	5 - 20
Tan&Sense® Expression	*Pure ellagitanins of medium toasted oak and grape skin tannins*	•	••	•••	••	Maturation Pre-bottling	5 - 20
Tan&Sense® Forte	*Pure ellagitannins of toasted oak*	••	•••	•	••	Maturation Pre-bottling	3 - 10
Tan'Excellence®	*Grape tannins and oak ellagitannins*	•••	•••		••	Maturation	10 - 30
Softan® Sweetness	*Fresh heated oak tannins bounded to polysaccharides*	••	•••	•••	•••	Maturation	5 - 20
Softan® Power	*Proanthocyanidic tannins bounded to polysaccharides*	•	•••	•••	••	Maturation	5 - 20
Softan® Finition	*Oak tannins bounded to polysaccharides*	••	••	•••	•••	Pre-bottling	5 - 20

// POLYSACCHARIDES

In cidermaking, polysaccharides can be derived either from yeast or plant. They are used to stabilize color, aroma and colloids, extend cider shelf life, increase volume sensation and reduce astringency. The most common polysaccharides found in ciders are pectins derivates (arabinogalactan proteins (AGP) and rhamnogalacturonans (RG-II) coming from apples), mannoproteins (coming from yeast cell walls) and arabic gums.

These polysaccharides participates to colloidal stability of the cider, as well as mouthfeel balance. They also have a crucial role on bubbles and foam quality. Polysaccharides acts as bubble stabilizer, improving bubble retention and size. The entire process of cidermaking will impact the content and type of polysaccharides presents in the finished cider.

HOW TO GET THE POLYSACCHARIDES FROM APPLES?

The primary source of polysaccharides in apple is the fruit. The cell walls and pectin structures release polysaccharides when they break down. The most common polysaccharides coming from the fruit are arabinogalactan proteins (AGP) and rhamnogalacturonans (RG-II). The addition of **pectic enzymes and maceration** are ways to increase the extraction of polysaccharides from the fruit. Adding apple peel to your fermentation is another easy way to increase these key compounds in your cider.

HOW TO INCREASE THE CONTENT IN YEAST MANNOPROTEINS?

The other source of polysaccharides in cider is from the yeast. The most common polysaccharides coming from yeast are mannoproteins, glucans, and mannans. Yeast cell walls can release these during the various fermentation phases as well as during ageing via their autolysis. This process is enhanced by ageing cider on the lees, especially the fine lees.

The yeast selection will impact the type and amount of polysaccahrides released into cider. Lees ageing is the moment where the yeast cells are autolysing and releasing their content, such as cell walls and mannoproteins. This process can take few months at cider's pH. To go faster, you can use products rich in mannoproteins, such as NATURSOFT, or MANNOSENSE that contains ready to be released mannoproteins, making their effect instantaneous.

LAST MINUTE ADJUSTMENT...

It's also possible to adjust the cider profile last minute. The finishing polysaccharides Lamothe-Abiet offers for cider can be used up to 48 hours pre-bottling to enhance and elongate mouthfeel and improve roundness and smoothness. **Ask us a sample kit to set up bench trials.**

Stability

EXCELGOM

Pure powdered arabic gum from Acacia Seyal for colloidal structure and limpidity

- Results from a very strict selection made from the best gums, obtained from an original process developed by our research laboratory
- Instantly soluble into water or cider and doesn't contain SO_2
- Participate to the colloid structure of the cider, preserving its limpidity
- Improve organoleptic qualities by increasing volume and roundness

Dosage: (3.2 - 9.6 lbs/1000 gal (40-120 g/hL)
Packaging: 1 kg.
Application: pre-filtration, pre-bottling/ canning/kegging.

SUBLI'SENSE®

Blend of yeast mannoproteins and arabic gum which have been specially selected to add softness, smoothness, and balance the tannins.

- Participate to the colloid stability of the cider
- Preserve cider's limpidity
- Improve organoleptic qualities by increasing volume and roundness
- Reduce tannin dryness
- Instant effect, fully soluble, and filtrable.

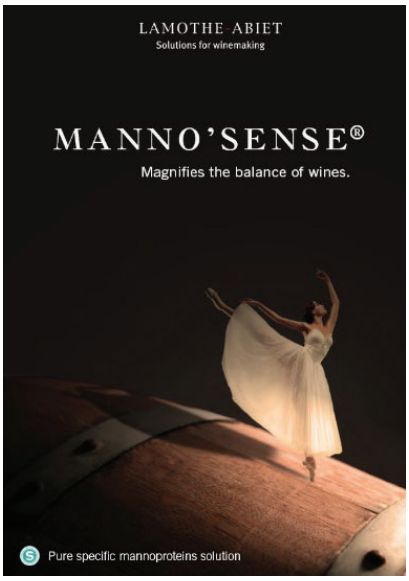
Dosage: 50 - 200 mL/hL
Packaging: 5 L, 20 L.
Application: pre-filtration, pre-bottling/ canning/kegging.

MANNO'SENSE®

Formulation of highly purified and selected yeast mannoproteins rich in sapid peptides (HSP12), playing a crucial role in the perception of sucrosity.

- Significantly increase roundness, sweetness, and volume.
- Participates to the colloid stability of the cider.
- Preserves cider's limpidity.
- Reduces tannin dryness.
- Adds balance and freshness to the palate.
- Natural solution to improve the organoleptic qualities and length of aromas.
- Instant effect, fully soluble, and filtrable.

Dosage : 50 - 200 mL/hL.
Packaging: 5 L.
Application : pre-bottling, after stabilization.



A BIT MORE ABOUT HSP12 PEPTIDE

The gustatory balance of a cider comes not only from its tannin structure and its acidity, but also from its sweetness. The high sapid peptide content identified as HSP12 was discovered through years of research in a study focused on 'sweetness in dry whites'. It has been found that this specific peptide (HSP12) extracted from specific *Saccharomyces Cerevisiae* yeast cell walls mannoprotein, was highly correlated to sweetness perception in dry white wines.

// OAK

WHY THERE IS SO MUCH VARIATION IN OAK AROMAS?

There are many causes of variation and many of them interact to form a wide array of potential aroma profiles.

- Source of the oak: oak species, geographic origin, growing conditions, and age can strongly affect wood structure and composition.
- Staves position on a trunk has been shown to influence its aroma composition.
- Staves seasoning and drying: Kiln drying or air drying, time, humidity…
- Cooperage processes add a considerable layer of variability.

WHAT IS THE EFFECT OF TOASTING?

Toasting oak during barrel processing modifies the structure and chemical properties of wood. Increasing temperature and length of toasting will:

- Reduce oak lactone content that contributes to “fresh oak” and coconut aromas.
- Increase “vanilla”, “caramel-like”, and “roasted coffee” aromas associated with vanillin, furfural, 4-methylfurfural and maltol.
- At heavy toast levels these compounds decrease and are replaced by “spicy” (eugenol, isoeugenol, 4-methylguaiacol) and “smoky” characters (4-methylguaiacol, guaiacol, 2-methylphenol).

HOW TO FIND THE RIGHT OAK ALTERNATIVE?

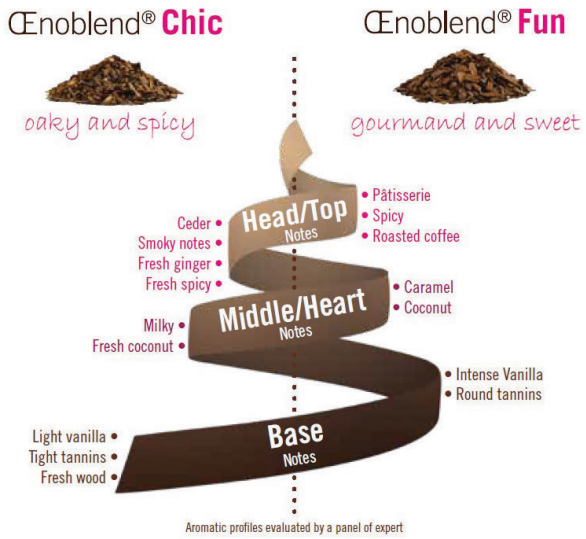
Define the targeted cider profile, the time available for ageing, and the budget. Lamothe-Abiet offers trial kits containing small bags of oak chips to soak in cider for few weeks to run bench trials and understand the what is the right product or blend for you.

OENOBLEND® CHIPS

OENOBLEND® is a unique range of chips created by blending oaks. Developed by a team of aromaticians and enologists, this range makes use of the sensorial pyramid. Their profiles are a perfect illustration of the alliance of aromatic precision with modern styles. Œnoblend® can be used during fermentation and ageing of ciders.

- OENOBLEND® CHIC : Oaky & Spicy – Empyreumatic, Cedar, Spicy, Cinnamon, Ginger and Fresh coconut notes
- OENOBLEND® FUN : Gourmand & Sweet - Pastry, Crème brulee, Roasted coffee, Toffee, Coconut and Vanilla notes

Dosage: 0.5 to 4 g/L
Packaging: 12 kg bags
Application: During Fermentation, MLF, Ageing.



OENOBOIS® 18 MM STAVES & BLOCKS

French oak toasted with a double toast process for intense and complex aromatic profiles: the first toast is slow and works evenly on the whole wood mass; the second toast is superficial to increase aromatic complexity. The resulting profiles are characterized by intense and complex aromas that emphasize cider's finesse and length on the palate. OENOBOIS® 18mm Blocks are made from OENOBOIS® 18mm Staves. Their small size allows cider with shorter maturation to benefit from a new dimension of organoleptic complexity.

ORIGIN

The "lightest" toasting profile
Freshness of the fruit, coconut, and vanilla aromas
Sweetness and roundness

EXPRESSION

The most "moderate" toast
Notes of vanilla, caramel, crème brulée, and roasted coffee
Complexity and lenght

ABSOLUTE

The toast with the most "character" Intense aromas of roasted coffee, mocha, smokiness, licorice and eucalyptus
Freshness and tension

// CIDER STYLE AND GUIDELINES

There are many factors that can affect final cider taste and quality. Major contributors are apple type (culinary vs. cider) and processing method (fresh fruit, stored fruit, bulk juice, or concentrate). However, fermentation decisions can also strongly impact cider flavor profile. Yeast, Enzymes, Nutrient as well as temperature and juice turbidity are essential parameters to manage to orientate and control your cider style.

- AROMAS FROM APPLES: Apples contain aroma compounds that contribute fruity, floral, and spicy aromas to cider. The compounds most responsible for these aromas are esters and terpenes. Not all aroma compounds are present in their odor-active form. Some yeast have enzymes that can convert odorless compounds into their odor-active form. Yeast strains differ in how much of these enzymes they produce, and therefore how effective they are at converting these aroma compounds. To express varietal aromas and increase aromatic complexity, the use of specific enzyme is also essential. OENOZYM FW and OENOZYM THIOLS can strongly help with expressing aromatic compounds from apples.
- AROMAS DERIVED FROM YEAST: Not only are esters present in apples, esters can also be produced by yeast during fermentation via either carbon metabolism (sugar breakdown) or nitrogen metabolism (nutrient use). The amount and type of esters produced and their relative ratios will vary depending on the genetic makeup of the yeast, the precursors present, and the fermentation conditions. The yeast nutrition strongly impacts yeast metabolism and the amount of aromatic precursors available to the yeast. OPTIESTERS and OPTITHIOLS are specific nutrients developed and used to give aromatic precursors to yeast, thus increasing aromatic intensity and complexity of the cider.

	FRUITY/TERPENES	FRUITY/TROPICAL	TERROIR	'RESERVE'
Clarification	**Œnozym® Clear**, 150-300 mL/1000 gal (4-8 mL/hL) **Tannin Gallique a l'alcool**, 0.8 lbs/1000 gal (10 g/hL) **Polymix Natur'®**, 1.8-3.6 lbs/1000 gal (20-40 g/hL)			
Turbidity	100 NTU	200 NTU	200-250 NTU	250 NTU
Fermentation Temperature	53-57°F	58-62°F	60-64°F	
Yeast	**Excellence® STR,** 2 lbs/1000 gal (25 g/hL)	**Excellence® FTH,** 2 lbs/1000 gal (25 g/hL)	**Excellence® XR,** 2 lbs/1000 gal (25 g/hL)	**Excellence® TXL,** 2 lbs/1000 gal (25 g/hL)
At yeast rehydration	**Œnostim®,** 2.5 lbs/1000 gal (30 g/hL)			
At inoculation	**OptiEsters®,** 2.5 lbs/1000 gal (30 g/hL)	**OptiThiols®,** 2.5 lbs/1000 gal (30 g/hL)	**OptiEsters® +OptiThiols®,** 1.6 lb/1000gal (20 g/hL) of each product	
	OptiFlore O®, 2.5 lbs/1000 gal (30 g/hL)			
		Œnozym® Thiols, 230 mL/1000 gal (6 mL/hL)	**Œnozym® Thiols,** 150 mL/1000 gal (4 mL/hL)	**Œnozym® Thiols,** 230 mL/1000 gal (6 mL/hL)
1/3 fermentation	**OptiFerm®,** 2.5 lbs/1000 gal (30 g/hL)			
	Natur'Soft®, 1.6 lbs/1000 gal (20 g/hL)		**Natur'Soft®,** 2.5 lbs/1000 gal (30 g/hL)	
				Tan&Sense Volume®, 0.4-1.6 lbs/1000 gal (5-20 g/hL)
	Œnozym® FW, 230 g/1000 gal (6 g/hL)		**Œnozym® FW,** 150 g/1000 gal (4 g/hL)	**Œnozym® FW,** 230 g/1000 gal (6 g/hL)
	Bentosol Poudre			
MLF if desired			**Bacteria XTREM,** 1-2 g/hL	
End of AF	SO_2 **Killbrett®**, 0.4 lbs/1000 gal (4 g/hL) **Aroma Protect®**, 1.8 lbs/1000 gal (20 g/hL)			

// PROTOCOLS

Promote fast and effective clarification

1. To protect from oxidation and improve settling and filtration, add **Tanin Gallique a l'alcool** at 0.8 lb/1000 gal (10 g/hL).
2. Use **Œnozym® Clear** at 114–230 mL/1000 gal (3-6 mL/hL) in the juice to improve settling speed and yield.
3. Juice fining with **Polymix® Natur'** (PVPP + bentonite + yeast derivates) at 1.8 – 3.6 lbs lb/1000 gal (20-40 g/hL) to eliminate oxidized and oxidable phenolic compounds and improve lees compaction.

Turbidity:
100-150 NTU to optimize the production of esters. 200-250 NTU to favor varietal characteristics.

Alcoholic fermentation: ensure good yeast nutrition

1. **Proper yeast rehydration is one of the most important steps to help ensure a strong and healthy fermentation.**
   - Suspend 2.5 lbs/1000 gal of **ŒnoStim®** in 20 times its weight of clean, chlorine free,110°F water, to reinforce yeast activity, limit fermentation risks, reduce H_2S production and increase aromatic production.
   - Once temperature has dropped to 104°F, add 2 lbs/1000 gal of yeast. Let suspension stand for 20 minutes, then stir gently.
   - Slowly add some juice to the yeast suspension to drop temperature of maximum 18°F This helps the yeast adjust to the cooler temperature of the juice and will help avoid cold shock caused by a rapid temperature drop. Wait 20 min. Repeat.
   - Once temperature is at 18°F of difference with tank, add the yeast preparation to the fermentation tank and mix gently.
2. Ensure good yeast nutrition and reduce off-flavors production with **Optiflore O®** at 2.5 lbs/1000 gal (30 g/hL) at the beginning of fermentation + **OptiFerm** at 2.5 lbs/1000 gal (30 g/hL) at 1/3 of fermentation.
3. Add natural yeast derivatives such as **OptiThiols®** and **OptiEsters®**, at the beginning of the fermentation will boost the aromatic production and help defining cider style.
   - Boost esters, fruity, fresh and floral aromas production, add **OptiEsters®** at 2.5 lbs/1000 gal (30 g/hL).
   - Boost thiolic compounds, citrus, tropical, floral aromas production, add **OptiThiols®** at 2.5 lbs/1000 gal (30 g/hL).
4. Add **Natur' Soft®** at 1.8 lbs/1000 gal (20 g/hL), yeast derivates rich in mannoproteins to improve stability, bubbles quality, and mouthfeel.
5. To stabilize protein, add at 1/3 fermentation, **Bentosol Poudre** at 1.8-3.6 lbs/1000 gal (20-40 g/hL).

Fermentation temperature:
53-57°F to promote fruity, fresh and floral aromas; 60-65°F to promote 'terroir' and varietal profile.
Malolactic Fermentation:
If MLF is desired, add 1 g/hL of **Œno 1®,** 72 hours after yeast or 1 g/hL of **Bacteria XTREM** post fermentation

Ageing

1. If lees are clean and free from off-odors, you can age cider on lees to gain texture, complexity, and mouthfeel. Otherwise, rack 24 hours after fermentation is finished.
2. Add SO_2 and **KillBrett®** at 0.4 lb/1000 gal (4 g/hL) to eliminate any spoilage microbes.
3. Add **Aroma Protect®** at 1.8 lbs/1000 gal (20 g/hL) to protect from oxidation, maintain cider freshness during ageing.
4. Finishing agents can be valuable tools for perfecting a cider. Ask us for samples to set up bench trials.

At any time, you can also watch the recordings
on our dedicated YouTube channel, or website at :

https://www.bvnorthamerica.com/webinars

LAMOTHE-ABIET

Solutions for winemaking

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