SCOTT LABORATORIES

2022|2023 CIDERMAKING HANDBOOK

PREMIUM PRODUCTS FOR CIDERMAKING

WELCOME

YOU HAVE A FRIEND AT SCOTT LABS

Welcome to the 2022 edition of the Scott Labs' Cidermaking Handbook! The purpose of this publication is to bring you the best fermentation and cidermaking products while delivering the best product support and application know-how. This handbook is just one of the ways we share our expertise and it complements the year-round, personal support provided by our team.

Through the pandemic, we have really missed seeing you and seeing each other but have learned that we can maintain our connection even if we are physically distant. In that spirit, we look forward to seeing you in person or by video chat, talking with you by phone, answering your emails, and (especially) drinking your products.

You have many friends at Scott Labs. Your success is our success and we love being part of your community.

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YEAST

Scott Labs: Celebrating 89 Years of Commercial Yeast Production

Scott Labs loves yeast! We were founded as a yeast company in 1933 and were instrumental in bringing active dried yeast to the fermented beverage industry in North America. In 1974, we partnered with Lallemand to produce our yeasts and that partnership continues today. After nearly a century of yeast research & development, Scott Labs and Lallemand know yeast better than any other yeast producer and are uniquely positioned to assist cidermakers in matching strains to their goals and challenges.

Yeast convert sugar to alcohol, but they do so much more than that. At Scott Labs, our focus has always been on introducing reliable yeast strains that also optimize quality, aromas, and flavors.

SELECTING YEAST FOR SUCCESS

Every cider fermentation presents different challenges and opportunities. **Selecting the right yeast can help ensure a successful outcome. Most strains sold at Scott Laboratories are compatible with fermentation conditions of almost all ciders**. Still, there are a few important parameters to consider:

FERMENTABLE SUGAR/POTENTIAL ETHANOL

Yeast vary in their ability to tolerate ethanol. Most yeasts in this handbook have ethanol tolerances greater than 13% and will be suitable for most cider fermentations. **If fermenting a high gravity cider or apple wine, yeast ethanol tolerance may be a consideration**. Remember that not all sugars are fermentable, and *Saccharomyces* yeasts can only ferment glucose and fructose.

TEMPERATURE

Yeast strains vary in their temperature tolerance. **Yeast will become stressed if fermenting at the upper or lower end of the recommended range**. Choose a yeast that is compatible with your typical fermentation temperatures or ensure you can control fermentation temperature to match that of your chosen strain. When working with high sugar fermentations, lower fermentation temperatures are recommended.

SENSORY IMPACT

Yeast contribute to cider aroma, flavor, and mouthfeel. They can release aromas from fruit as well as produce aromatic compounds (learn more about this on pg 8). Certain strains also produce polysaccharides and other compounds increasing mouthfeel. Select yeast with traits best suited for your intended cider style.

AVOIDING H_2S AND OTHER SULFUR OFF-ODORS

Yeast can produce sulfur off-odors, especially in low-nutrient environments. The amount of sulfur off-odors produced varies by yeast strain and fermentation conditions. Some yeast strains have been selectively bred to produce low or no H_2S even under stressful conditions. To do this, Lallemand Oenology naturally breeds yeast using a non-GMO technique and verifies their lack of H_2S production on the genetic level using a process called Quantitatve Trait Loci (QTL). **Look for the QTL logo in the yeast descriptions to identify strains that do not produce H_2S**.

SELECTING A YEAST STRAIN

We have several other tools in this book to help you select the best yeast strain for your fermentations.

See pg 16 for our protocol, Change Flavor Profiles with Fermentation Decisions.

See pgs 6-7 for our yeast choosing chart which compares yeasts' fermentation characteristics and sensory parameters.

See pgs 9-19 for detailed descriptions of each yeast.

QUICK GUIDE TO CHOOSING A YEAST STRAIN

Recommended	*Saccharomyces*												
	58W3	71B	ALCHEMY I	BA11	CROSS EVOLUTION	CVW5	DV10	EC1118	ELIXIR	EXOTICS MOSAIC	ICV D21	ICV D47	ICV OKAY
Page	*9*	*9*	*9*	*10*	*10*	*10*	*10*	*11*	*11*	*11*	*11*	*12*	*12*
S. cerevisiae cerevisiae	✓	✓		✓							✓	✓	
S. cerevisiae bayanus						✓	✓	✓					
Yeast hybrid					✓				✓	✓			✓
Yeast blend			✓										
Non-*Saccharomyces* yeast													
Sensory Impact - Neutral							✓	✓					
Sensory Impact - Fruity Esters	✓	✓	✓	✓	✓	✓			✓	✓	✓	✓	✓
Sensory Impact - Floral Esters	✓		✓	✓	✓				✓			✓	
Sensory Impact - Mouthfeel	✓			✓	✓				✓	✓	✓	✓	
Low to No H_2S Production													✓
Alcohol Tolerance (% v/v)	14	14	15.5	16	15	15	17	18	15	15.5	16	15	16
Temperature Tolerance (°F)	54-77	59-85	56-61	59-77	58-68	57-82	50-95	50-86	57-77	64-83	61-86	60-82	54-86
Fermentation Speed	moderate	moderate	fast	moderate	moderate	fast	fast	fast	slow	moderate	moderate	moderate	moderate

QUICK GUIDE TO CHOOSING A YEAST STRAIN

Saccharomyces											Non-*Saccharomyces*			
ICV OPALE 2.0	IOC BE FRUITS	K1 (V1116)	NT 116	QA23	R2	RHÔNE 4600	R-HST	SENSY	VIN 13	W15	BIODIVA	FLAVIA	INITIA	LAKTIA
12	*13*	*13*	*13*	*14*	*14*	*14*	*14*	*15*	*15*	*15*	*18*	*18*	*19*	*19*
		●				●	●			●				
				●	●									
●	●		●					●	●					
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●	●	●	●	●	●	●		●	●		●	●		
		●		●	●				●			●		
●			●			●	●	●		●	●			
●	●							●						
14	14	18	16	16	16	15	15	15	17	16	6	2	2	2
59-86	54-75	50-95	54-83	59-90	50-86	56-72	50-86	54-64	54-61	50-81	>61	59-71	39-64	57-82
moderate	moderate	fast	fast	fast	moderate	moderate	moderate	moderate	fast	moderate	mildly fermentative	non-fermentative	non-fermentative	mildly fermentative

ARTICLE

OPTIMIZE CIDER AROMA THROUGH YEAST SELECTION

Yeast selection can have a strong influence over cider aroma. **Many aroma compounds originate either from apples or are produced by yeast**. Furthermore, yeast can act upon aroma compounds from apples and influence their character in the final product. Yeast selection can be important in maximizing aromas from both sources:

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. Non-*Saccharomyces* yeasts are often able to impact cider aroma more significantly than *Saccharomyces* yeasts because they can convert more aroma compounds into an odor-active form.

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).

There are two main classes of esters produced by yeast: acetate esters and ethyl esters. 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.

SELECTING A YEAST

Although aromas exist and can be perceived in juice, **selecting the correct yeast strain can help to elevate the aromatic intensity and complexity of the cider**. For assistance selecting a yeast:

See pg 16 for our protocol, Change Flavor Profiles with Fermentation Decisions.

See pgs 6-7 for our yeast choosing chart which compares all yeasts' fermentation characteristics and sensory parameters.

See pgs 9-19 for detailed descriptions of each yeast.

SACCHAROMYCES YEAST

58W3

LALLEMAND YSEO

Creates spicy, fruity, and well-balanced ciders

#15630	500 g
#15631	10 kg

VITILEVURE 58W3™ contributes an overall well-balanced mouthfeel with spicy, floral, and fruity aromas.

Allows for the release of bound terpenes due to the strain's beta-glucosidase activity. This enhances classic apple aromas.

Due to 58W3's fermentation kinetics, especially in high sugar juice, a balanced nutrient strategy and good fermentation practices should be followed.

This strain was isolated during a five-year study by the INRA (National Agricultural Research Institute) in Alsace, France.

Alcohol Tolerance: 14%	Nitrogen Needs: MEDIUM	Temp. Range: 54-77°F

71B

LALLEMAND YSEO

Enhances fruity characters and degrades malic acid

#15059	500 g
#15078	10 kg

LALVIN 71B™ is known for producing fruity ciders with long-lived aromas due to the synthesis of relatively stable esters and higher alcohols.

Softens high acid juices by partially metabolizing malic acid. Sensitive to competitive factors and may have difficulty competing with wild microflora. Careful rehydration with GO-FERM PROTECT EVOLUTION™ and early inoculation will help 71B dominate in competitive conditions.

This strain was isolated and selected by the INRA (National Agricultural Research Institute) in Narbonne, France.

Alcohol Tolerance: 14%	Nitrogen Needs: LOW	Temp. Range: 59-85°F

ALCHEMY I

Blend of yeast strains for fruity and floral esters

#15174	1 kg

ALCHEMY I produces fruity and floral esters which can be useful in relatively neutral apples.

ALCHEMY I is a fast fermenter with low foam production.

Temperature control is advised, and barrel fermentations should be avoided.

ALCHEMY I is a specific blend of *S. cerevisiae* yeast strains developed in collaboration with the Australian Wine Research Institute (AWRI) in South Australia.

Alcohol Tolerance: 15.5%	Nitrogen Needs: MEDIUM	Temp. Range: 56-61°F

BA11

Aromatic complexity and mouthfeel

#15117 500 g

LALVIN BA11™ fermentations result in clean aromas with subtle notes of spice, orange blossom, pineapple, and apricot.

Lees stirring releases polysaccharides which increase mouthfeel and integrate acidity.

This *S. cerevisiae cerevisiae* strain was selected in 1997 near the Estação Vitivinicola de Barraida in Portugal and is suitable for relatively neutral varietals or dessert apples.

Alcohol Tolerance: 16%	Nitrogen Needs: HIGH	Temp. Range: 59-77°F

CROSS EVOLUTION

Natural yeast hybrid to enhance aromatics and mouthfeel

#15640 500 g
#15641 10 kg

CROSS EVOLUTION™ increases fresh fruit and floral aromas resulting in aromatic ciders.

This strain also increases mouthfeel, so ciders are well-balanced. CROSS EVOLUTION is a strong fermenter and ideal for aromatic ciders that have a high alcohol potential.

This hybrid yeast is from a unique breeding program at the Institute for Wine Biotechnology at the University of Stellenbosch in South Africa.

Alcohol Tolerance: 15%	Nitrogen Needs: LOW	Temp. Range: 58-68°F

CVW5

Production of stable esters

#15237 500g
#15210 10 kg

CVW5™ is a high producer of fruity aromas (esters) and a low producer of volatile acidity and SO_2.

CVW5 has the lowest nitrogen demand of the Lallemand Oenology yeast strains and is a strong fermenter even under difficult conditions, including low temperature and low turbidity.

This *S. cerevisiae bayanus* strain was selected from the Lallemand Oenology yeast strain collection and is a daughter strain of Lalvin EC1118™

Storage: 4-11°C(39-52°F)

Alcohol Tolerance: 15%	Nitrogen Needs: LOW	Temp. Range: 57–82°F

DV10

Strong fermenter for crisp, clean ciders

#15062 500 g
#15106 10 kg

LALVIN DV10™ is well known for crisp, clean fermentations that respect apple character while avoiding bitter sensory contributions associated with other, more one-dimensional, 'workhorse' strains such as Prise de Mousse (PM).

Strong fermentation kinetics. Recognized for low foaming, low VA production, and very low H_2S and SO_2 production. *Saccharomyces cerevisiae bayanus* strain from Epernay, France.

Alcohol Tolerance: 17%	Nitrogen Needs: LOW	Temp. Range: 50-95°F

EC1118 (PRISE DE MOUSSE)

Sensory neutral fermentor

#15053	500 g
#15076	10 kg

LALVIN EC1118™ is the original, steady, low-foaming yeast strain. This sensory neutral strain ferments cleanly and efficiently at low temperatures and flocculates well resulting in compact lees.

Alcohol Tolerance: 18%	Nitrogen Needs: LOW	Temp. Range: 50-86°F

ELIXIR

Increased floral and fruity aromas

#15214	500 g

VITILEVURE ELIXIR™ releases terpenes optimizing cider apples' aromatic potential.

Ciders produced are aromatically complex with fruity and floral flavors and a well-balanced mouthfeel. Suitable for use in highly clarified juice.

ELIXIR is a low SO_2, H_2S, and volatile acidity producer but good nutrition and proper temperature control are required.

ELIXIR is a hybrid yeast from the yeast hybridization program at the Institute for Wine Biotechnology at the University of Stellenbosch in South Africa.

Alcohol Tolerance: 15%	Nitrogen Needs: MEDIUM	Temp. Range: 57-77°F

EXOTICS MOSAIC

(formerly known as EXOTICS SPH)

Hybrid yeast for fruity ciders with mouthfeel

#15213	250 g
#15220	5 kg

EXOTICS MOSAIC produces ciders with exotic aromas and flavors, and a well-balanced mouthfeel.

This strain can degrade some malic acid.

Ciders fermented with EXOTICS MOSAIC can take time to mature. Therefore, this yeast is an excellent choice for ciders destined for aging.

Steady fermenter but sensitive to cold temperatures. Can produce elevated levels of glycerol (9–13 g/L) which potentially leads to lower alcohol. Low volatile acidity and SO_2 production.

Storage: 5-15°C(41-59°F)

Alcohol Tolerance: 15.5%	Nitrogen Needs: MEDIUM	Temp. Range: 64–83°F

ICV D21

Freshness and mouthfeel for mature apples

#15143	500 g
#15163	10 kg

ICV D21 can be used with ripe apples, developing stable fresh fruit aromas, good volume, and perceived acidity.

Noted for its good fermentation performance and low hydrogen sulfide production. In highly clarified apple juice, maintain fermentation temperatures above 16°C(61°F) and supplement with proper nutrition.

Suitable for barrel fermentation.

ICV D21 was isolated from the Languedoc region of France by the Institut Coopératif du Vin's (ICV) Natural Micro-Flora Observatory and Conservatory.

Alcohol Tolerance: 16%	Nitrogen Needs: MEDIUM	Temp. Range: 61-82°F

ICV D47

Complex ciders with citrus and floral expression

#15642	500 g
#15643	10 kg

LALVIN ICV D47™ can produce full-bodied, complex ciders with fruity and floral notes.

ICV D47 is a high polysaccharide and ester-producing strain suitable for both tank and barrel fermentations. This yeast has a short lag phase and regular fermentation rate. Can tolerate a fermentation temperature range of 15-28°C(60-82°F). However, a temperature of 17-20°C(63-68°F) is preferred, especially during the last ⅓ of fermentation.

This yeast was isolated from Suze-la-Rousse in the Côtes du Rhône region of France.

Alcohol Tolerance: 15%	Nitrogen Needs: LOW	Temp. Range: 60–82°F

ICV OKAY

Sulfur compound management and fruity esters

#15221	500 g
#15222	10 kg

LALVIN ICV OKAY™ is recommended for fresh and aromatic ciders with good fruit intensity.

This strain is especially suitable for cider-makers who have had a challenge with sulfur-like off odors due to its inability to produce H_2S via primary pathways.

Very short lag phase with steady fermentation kinetics, good fermentation security, and low foam production.

This *S. cerevisiae* hybrid was selected in collaboration with INRA, SupAgro Montpellier, ICV and Lallemand Oenology for its no to low SO_2, H_2S, and acetaldehyde production.

Alcohol Tolerance: 16%	Nitrogen Needs: LOW	Temp. Range: 54–86°F

ICV OPALE 2.0

Sulfur compound management for aromatic apples

#15065	500 g

LALVIN ICV OPALE 2.0™ respects and complements varietal characteristics while producing intense and complex apple and pear aromas, and delicate aromas of apple blossom.

Ciders fermented with ICV OPALE 2.0 initially give the impression of volume and softness, followed by a round, intense mid-palate and balanced finish, which can mask astringency.

ICV OPALE 2.0 has excellent fermentation qualities with a short lag phase, even in high sugar fruit, with no to very low SO_2, H_2S and acetaldehyde production.

Alcohol Tolerance: 14%	Nitrogen Needs: LOW	Temp. Range: 59–86°F

IOC BE FRUITS

Sulfur compound management and fruity esters

#15241 500 g

IOC BE FRUITS™ produces fruity esters without overwhelming apple flavors.

Optimal conditions for fruity ester production are achieved when juice is clarified to 80 NTU ±20, and fermentation is conducted between 12–15°C(54–59°F). However, the strain can withstand warmer temperatures not exceeding 24°C(75°F).

This yeast strain has a short lag phase, initiates fermentation quickly and is a low producer of volatile acidity and acetaldehyde (the main SO_2 binding compound).

BE FRUITS was selected by INRA for very low to no hydrogen sulfide production making it an ideal choice for fruity ciders where hydrogen sulfide has been a challenge.

Alcohol Tolerance: 14%	Nitrogen Needs: LOW	Temp. Range: 54-75°F

K1 (V1116)

Ester production under challenging conditions

#15063 500 g
#15077 10 kg

LALVIN K1 (V1116)™ is one of the highest ester producing strains in our portfolio. When fermented at low temperatures 16°C(61°F) with proper nutrition, it is a strong floral ester producer, especially in neutral or high-yielding varieties.

Can also produce stone fruit and citrus notes.

K1 (V1116) performs well in difficult conditions such as extreme temperatures, high alcohol (18% v/v), and low turbidity.

Alcohol Tolerance: 18%	Nitrogen Needs: LOW	Temp. Range: 50–95°F

NT 116

Fresh and zesty ciders

#15185 1 kg
#15226 10 kg

NT 116 has the ability to produce esters which makes it suitable for aromatic ciders that are crisp and fresh with citrus and zesty aromas.

It is especially suitable for pear-based ciders due to its release of varietal aromas, glycerol, and mannoproteins, giving aromatic complexity and roundness.

Temperature control is advised when using this low foaming but vigorous strain.

This hybrid strain of *S. cerevisiae* is a product of the yeast hybridization program of Infruitec-Nietvoorbij, the wine and vine institute of the Agricultural Research Council in Stellenbosch, South Africa.

Alcohol Tolerance: 16%	Nitrogen Needs: MEDIUM	Temp. Range: 54-83°F

QA23

Fruity expression in highly clarified juice

#15652 500 g
#15653 10 kg

LALVIN QA23™ produces large amounts of the enzyme beta-glucosidase during growth which allows for the release of bound terpenes responsible for floral and spicy notes in aromatic varieties. In non-aromatic apples, QA23 produces ciders with enhanced fruits for a fresh style.

QA23 has low nutrient and oxygen requirements and can ferment juice with low turbidity at low temperatures, making QA23 suitable for cool fermentations in highly clarified juice.

This strain was selected in Portugal by the University of Trás-os-Montes and Alto Douro (UTAD) in cooperation with the Viticultural Commission of the Vinho Verde region.

Alcohol Tolerance: 16%	Nitrogen Needs: LOW	Temp. Range: 59–90°F

R2

Expression of varietal aromas at cold temperatures

#15071 500 g

LALVIN R2™ can enhance varietal characters due to the enzymatic release of aroma precursors producing intensely aromatic ciders with heightened fruity and floral aromas.

Has excellent cold temperature properties and has been known to ferment in conditions as low as 5°C(41°F). Tends to produce VA without proper nutrition or when stressed.

This *Saccharomyces cerevisiae bayanus* strain was isolated in the Sauternes region of Bordeaux, France.

Alcohol Tolerance: 16%	Nitrogen Needs: MEDIUM	Temp. Range: 50-86°F

RHÔNE 4600

Aromatic and elegant ciders

#15171 500 g

LALVIN RHÔNE 4600™ produces ciders with complex aromas and flavors. Noted for elevating fresh fruit aromas (apple and pear) this strain is ideal for fruit-forward ciders. It can produce ethyl esters (apricot and tropical fruit flavors) when fermented in high-sugar, balanced-nutrient juice even at cool temperatures.

Higher roundness with diminished bitterness makes this strain a good choice for easy drinking ciders. RHÔNE 4600 has a short lag phase but may produce low levels of SO_2 and H_2S under conditions of stress.

Isolated in the Côtes du Rhône region of France in collaboration with Inter-Rhône technical department.

Alcohol Tolerance: 15%	Nitrogen Needs: LOW	Temp. Range: 56-72°F

R-HST

Crisp, fresh ciders with well-balanced mouthfeel

#15130 500 g

LALVIN R-HST™ retains fresh varietal characters while contributing structure and mouthfeel. It can produce crisp, premium ciders that are well suited to aging. Highly suitable for ice cider production.

Tolerates fermentation temperatures as low as 10°C(50°F), but allow the temperature to increase toward the end of fermentation for a clean finish. R-HST has a short lag phase and generation time, even at cold temperatures where it dominates and persists over spoilage yeast such as *Kloeckera apiculata*.

Alcohol Tolerance: 15%	Nitrogen Needs: MEDIUM	Temp. Range: 50-86°F

SENSY

Sulfur compound management and aromatic finesse

#15225 500 g

LALVIN SENSY™ respects varietal aromas and promotes aromatic esters while balancing mouthfeel and freshness. Ciders fermented with Sensy are described as having citrus and tropical fruit aromas, and subtle mineral notes.

SENSY has a short lag phase and produces very low to no SO_2 or H_2S even under low temperature and low turbidity.

Avoid adding >50 ppm SO_2 pre-fermentation.

This hybrid strain of *S. cerevisiae* was selected in collaboration with INRA, SupAgro Montpellier, ICV, and Lallemand Oenology as part of an innovative portfolio of yeast to control the production of negative sulfur compounds.

Alcohol Tolerance: 15%	Nitrogen Needs: LOW	Temp. Range: 54-64°F

VIN 13

Strong fermenter for fruity ciders

#15183 1 kg
#15228 10 kg

VIN 13 is an outstanding ester producer. It is highly recommended for ciders that are fermented with other fruit juices, especially juices that are tropical or citrus-based.

In neutral ciders, pineapple and banana flavors can develop, while in apples that contain terpenes VIN 13 can accentuate floral notes.

This yeast strain is aromatic and is favored for its ease of use and robustness, making this strain suitable for challenging conditions.

Temperature control is especially important with this strain.

Alcohol Tolerance: 17%	Nitrogen Needs: LOW	Temp. Range: 54-61°F

W15

Ferments cleanly at low temperatures

#15118 500 g
#15119 10 kg

LALVIN W15™ helps retain bright fruit characters while optimizing mouthfeel and balance.

Produces glycerol and succinic acid, especially when fermented between 15–20°C(59–68°F), adding complexity to the mid-palate.

Low heat generation during fermentation minimizes the potential for temperature spikes, yeast stress, and possible H_2S problems.

Isolated in 1991 at the Swiss Federal Research Station in Wädenswil, Switzerland.

Alcohol Tolerance: 16%	Nitrogen Needs: HIGH	Temp. Range: 50-81°F

PROTOCOL

CHANGE FLAVOR PROFILES WITH FERMENTATION DECISIONS

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.

Below are fermentation protocols to achieve the following goals: stimulate fruity and floral aromas, conduct a fermentation with a sensory neutral impact, or promote mouthfeel/structure.

Action	Reason for Action	Stimulate Fruity & Floral Aromas	Sensory Neutral	Promote Mouthfeel and Structure
Add **non-*Sacc* yeast** directly to juice	Bioprotection and antioxidant	25 g/hL INITIA™ (for antioxidant and antimicrobial benefits)		
Add **yeast derivative nutrient** directly to juice	Aroma protection and antioxidation	30 g/hL GLUTASTAR™	25-50 g/hL OPTI-WHITE™	25-50 g/hL OPTI-WHITE™
Clarify to a given solids goal and rack to fermentation vessel	Promote positive aromatics	60 – 100 NTU	80 - 100 NTU	80-120 NTU
Add **non-*Sacc* yeast** directly to fermentation vessel	Enhance sensory complexity	25 g/hL FLAVIA™	N/A	25 g/hL BIODIVA™
Select **yeast** compatible with sensory goal and environmental conditions	Yeasts strains differ in their sensory impacts and environmental tolerance. Choose one that meets both needs	CVW5™, ELIXIR™, VIN 13, CROSS EVOLUTION™, or R2™ at 25 g/hL	DV10™ or EC1118™ at 25 g/hL	BA11™, R-HST™, or W15™ at 25 g/hL
Rehydrate yeast in **rehydration nutrient**	Avoid yeast stress by providing vitamins, minerals, and sterols	30 g/hL GO-FERM PROTECT EVOLUTION™		
Add **fermentation nutrients** at inoculation	Adding amino acid-based nutrients at the beginning of fermentation promotes healthy fermentation kinetics	10-40 g/hL FERMAID O™		
Ferment at an appropriate temperature	Avoid yeast stress	60-70°F	50-80°F	60-75°F
		Ensure temperature is compatible with chosen yeast strain		
Add **fermentation nutrients** at 1/3 sugar depletion	Maintain healthy yeast population throughout fermentation	40 g/hL STIMULA CHARDONNAY™	25-50 g/hL FERMAID K™	25-50 g/hL FERMAID K™
Add **yeast derivative nutrient**	Enhance cider flavor profile	25-50 g/hL OPTI-WHITE™	30 g/hL NOBLESSE	30 g/hL NOBLESSE

ARTICLE

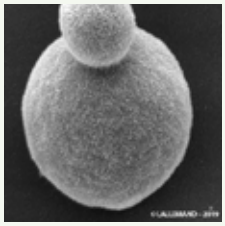
NON-*SACCHAROMYCES* YEASTS

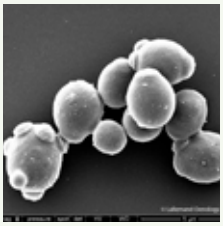
HARNESSING THE UNIQUE POWERS OF NON-*SACCHAROMYCES* YEASTS

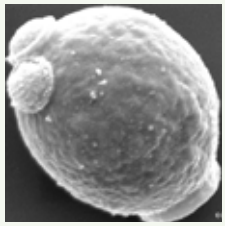
WHAT ARE NON-*SACCHAROMYCES* YEASTS?

The term non-*Saccharomyces* (or non-*Sacc*) is a colloquial term that is used to refer to the yeast associated with the pre- and early fermentation stages of cidermaking that are not of the genus *Saccharomyces*. These yeasts encompass approximately 20 genera and over 700 species. **This diverse group of yeast has been recognized for their contributions to cider aroma, flavor and mouthfeel.**

Our active dried non-*Sacc* yeasts include *Torulaspora delbrueckii*, *Metschnikowia pulcherrima*, and *Lachancea thermotolerans* and they are used in different ways than traditional *Saccharomyces* strains. **Non-*Sacc* yeast can enhance aromas and mouthfeel, modulate acid composition, and act as antimicrobial and antioxidant agents**. They are not used to complete alcoholic fermentation and should be used in conjunction with *Saccharomyces* yeasts.


Metschnikowia pulcherrima


Lachancea thermotolerans


M. pulcherrima


Torulaspora delbrueckii

NON-SACC SPECIES FOR CIDERMAKING

LEVEL² INITIA™ (*Metschnikowia pulcherrima*) can protect juice from microbial spoilage (bioprotectant)

Indigenous (spoilage) microflora require oxygen. LEVEL² INITIA™ is a specific strain of *M. pulcherrima* that very quickly scavenges oxygen, leaving the juice depleted. INITIA survives due to its ability to outcompete indigenous microflora for oxygen thereby acting as a bioprotectant to suppress volatile acidity-causing yeast and bacteria.

LEVEL² INITIA™ (*Metschnikowia pulcherrima*) can protect juice from oxidative damage (antioxidant)

Metal ions like copper are involved in the oxidation cascade. In addition to its oxygen scavenging abilities, LEVEL² INITIA™ also rapidly scavenges this damaging metal ion, thereby breaking the oxidation cascade. This means that color is brighter (less brown), and aromas are protected (increased aromatic complexity and freshness).

LEVEL² LAKTIA™ (*Lachancea thermotolerans*) can modulate acid composition

LEVEL² LAKTIA™ can produce between 2-9 g/L lactic acid as well as other minor metabolites from glucose. This production of lactic acid can have an impact on pH and titratable acidity. LAKTIA has exciting applications in cider to naturally increase acidity, which may be important when working with dessert apples or low-acid juices.

LEVEL² FLAVIA™ (*M. pulcherrima*) and LEVEL² BIODIVA™ (*Torulaspora delbrueckii*) enhance volume and aromatic complexity

LEVEL² FLAVIA™ and LEVEL² BIODIVA™ are strains of *M. pulcherrima* and *T. delbrueckii*, respectively. These organisms have interesting enzymatic abilities. FLAVIA can release bound varietal compounds like terpenes whereas BIODIVA produces esters. This means that ciders are more complex with enhanced tropical, citrus, fruity, and spicy aromas. These specific strains of non-*Sacc* can also impact mouthfeel due to the release of mannoproteins (FLAVIA) or mouthfeel components like arabinol (BIODIVA). BIODIVA and other *T. delbrueckii* strains can initiate fermentation, therefore, they should not be used as bioprotectants.

NON-*SACCHAROMYCES* YEAST

BIODIVA

15697 500g

Aromatically complex ciders with roundness and volume

LEVEL² BIODIVA™ is a pure culture of *Torulaspora delbrueckii* that can enhance the aroma profile and complexity of ciders. This non-*Saccharomyces* yeast is an ester producer and can produce compounds that lead to a fuller mouthfeel. BIODIVA is mildly fermentative and can tolerate approximately 6% alcohol.

BIODIVA is also osmotolerant, meaning that this yeast survives in high sugar environments making it an excellent choice for late-harvest juice and ice ciders. When BIODIVA is inoculated into high fermentable sugar juice, it consumes glucose, alleviating osmotic stress on *Saccharomyces*. This results in a cleaner fermentation with lower volatile acidity levels and potentially lower alcohol levels.

To optimize BIODIVA's performance, add at 25 g/hL and respect the following technical parameters: juice temperature of >16°C(61°F), turbidity >80 NTU, free SO_2 <15ppm, and YAN >150ppm, especially when used in high sugar situations. If YAN is <150ppm, rehydrate BIODIVA with GO-FERM PROTECT EVOLUTION™ and manage nutrition for alcoholic fermentation carefully.

Storage: Store at 20°C(68°F). Once opened use immediately.

Impact: Rounder, fruitier, more complex ciders due to over-production of mouthfeel components and esters	Add *Saccharomyces*: After 2-3°Brix drop

FLAVIA

15244 500g

Creates aromatically expressive ciders by releasing bound aromas

LEVEL² FLAVIA™ has the ability to release terpenes and polysaccharides resulting in aromatically complex ciders with good mouthfeel.

Terpenes are part of the aroma characteristics of apples and pears; however, they are often in a bound form, making them odorless. Some terpenes are bound to 2 sugar molecules; arabinose and glucose, and they only become odor-active once enzymatically released from both sugar molecules. Once released they can contribute fruity, floral, and spicy aromas.

FLAVIA, a pure culture of *Metschnikowia pulcherrima*, can target arabinose, however this non-*Saccharomyces* yeast has no fermentative abilities and should be used with a compatible strain of *S. cerevisiae* with B-glycosidase activity. The joint activity of FLAVIA and *Saccharomyces* can fully free the bound terpene from both sugar molecules elevating aromas.

In addition to FLAVIA's enzymatic activity, it can positively impact mouthfeel due to the fast release of polysaccharides.

This strain was selected in conjunction with the Universitad de Santiago de Chili (USACH).

To optimize FLAVIA's performance, add at 25 g/hL and respect the following technical parameters: juice temperature of 15-22°C(59-71°F), free SO_2 <10ppm, and YAN >150ppm. If YAN is <150ppm, rehydrate FLAVIA with GO-FERM PROTECT EVOLUTION™ and manage nutrition for alcoholic fermentation carefully.

Storage: Store for 24 months at 4-11°C(39-52°F). Once opened use immediately.

Impact: Heightened tropical, citrus and floral aromas due to release of terpenes	Add *Saccharomyces*: After 24 hours

INITIA

Protects aroma and color from oxidative damage

#15273 500g

LEVEL² INITIA™ rapidly consumes oxygen and copper ions, thereby protecting juice from oxidative browning. INITIA can be added to freshly pressed juice resulting in ciders with fresher aromatics and brighter color.

In addition to quality preservation, INITIA exerts a secondary bioprotective effect as it outcompetes indigenous aerobic yeast and acetic acid bacteria.

These organisms, if unchallenged, can negatively impact juice and final cider chemistry due to acetic acid and acetaldehyde production. This secondary bioprotective effect means that juice can be protected from microbial spoilage during the pre-fermentation stages of clarification, thawing, or during short-term juice storage and chemical additives like SO_2 can be minimized, and in some cases avoided.

INITIA is a pure culture of *Metschnikowia pulcherrima* that was selected at the Institut Français de la Vigne (IFV) in Beaune, France. This non-*Saccharomyces* yeast has very low fermentative abilities and is not tolerant of ethanol. Therefore, inoculation with a selected *Saccharomyces* strain and a balanced fermentation nutrition strategy is essential to complete alcoholic fermentation.

To optimize INITIA's performance, add at 25 g/hL and respect the following technical parameters: juice temperature of 4-18°C(39-64°F), free SO_2 <10ppm, total SO_2<40ppm, and YAN >150ppm. If YAN is <150ppm, rehydrate INITIA with GO-FERM PROTECT EVOLUTION™ and manage nutrition for alcoholic fermentation carefully.

Storage: Dated expiration. Store in a dry environment at 4°C(39°F). Once opened, use immediately.

Impact: Depletes oxygen from juice resulting in improved cider quality with better aromas and brighter colors	Add *Saccharomyces*: Once racked to fermentation tank

LAKTIA

Naturally acidifies ciders lacking acidity

15253 500g

LEVEL² LAKTIA™ is added at the beginning of fermentation where it produces lactic acid from sugar (glucose), impacting acid levels and bringing freshness and aromatic complexity to ciders. This non-*Saccharomyces* yeast is a pure culture of *Lachancea thermotolerans* which was isolated from the Rioja region of Spain. This is especially interesting if the juice is lacking acid as each g/L glucose metabolized results in 1g/L lactic acid, impacting both pH and titratable acidity (TA). The longer LAKTIA in is the juice prior to *Saccharomyces*, the higher the lactic acid concentration will be.

Although LAKTIA produces some alcohol, it does not have the ability to complete the alcoholic fermentation. It must be followed up after 24-72 hours with *S. cerevisiae*.

To optimize LAKTIA's performance, add at 25 g/hL and respect the following technical parameters: juice temperature of 14-28°C(57-82°F), free SO_2 <15ppm, Total SO_2<40 ppm, and YAN >150ppm.

To optimize lactic acid production: LAKTIA works most efficiently in juices free of SO_2. If SO_2 is present, the juice must be >20°C(68°F). Delay *Saccharomyces* inoculation up to 72 hours post-LAKTIA addition. If YAN is <150ppm, rehydrate LAKTIA with GO-FERM PROTECT EVOLUTION™ and manage nutrition for alcoholic fermentation carefully.

Storage: Store at 20°C(68°F). Once opened use immediately.

Impact: Adds freshness due to lactic acid production	Add *Saccharomyces*: After 24-72 hours

PROTOCOL

NON-*SACCHAROMYCES* REHYDRATION PROTOCOL

WORKING WITH NON-SACC YEASTS

While they require a bit of extra care, the non-*Saccharomyces* yeasts in our portfolio are powerful tools to enhance quality and allow the producer to achieve their desired cider style. Be sure to keep in mind the following when working with non-*Sacc* yeasts:

SECONDARY INOCULATION:

A secondary inoculation with *Saccharomyces* is necessary to ensure a complete alcoholic fermentation. This is because non-*Sacc* yeast have a very low tolerance to ethanol and CO_2. Their activity and viability drops once alcohol reaches approximately 5% v/v. YAN may need to be adjusted accordingly for the secondary *Saccharomyces* inoculation.

STRAIN-SPECIFIC INSTRUCTIONS:

Consult strain-specific instructions when using a non-*Saccharomyces* yeast for two reasons:

- Non-Sacc yeasts need to be rehydrated differently from *Saccharomyces* yeasts.
- The timing of your secondary *Saccharomyces* inoculation will depend on the non-*Saccharomyces* strain you have selected.

STARTING CONDITIONS:

Before beginning, ensure the starting conditions of your cider are compatible with the selected non-*Sacc* yeast strain:

	BIODIVA™	FLAVIA™	INITIA™	LAKTIA™
FSO_2 (ppm)	<15	<10	<15	<15
YAN (ppm)	>150	>150	>150	>150
Temperature	>16°C(>61°F)	15-22°C(59-71°F)	4-20°C(39-68°F)	14-28°C(57-82°F)

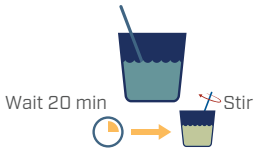
PROTOCOL

Instructions:

1. Suspend 25 g/hL non-Sacc yeast in 10x its weight of chlorine-free water at 30°C(86°F). Stir.
2. Wait 15 minutes and stir again.
3. Slowly add juice to the yeast slurry until the temperature of the yeast slurry drops by 10°C. Wait 15 min. Repeat this step until slurry is within 10°C of juice. NOTE: this step should not exceed 45 minutes total.
4. Inoculate
5. After inoculating with your chosen non-Sacc yeast strain, consult the chart below to determine how long to wait before completing a *Saccharomyces* inoculation.

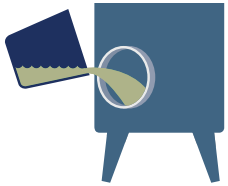
	BIODIVA™	FLAVIA™	INITIA™	LAKTIA™
When to add *Saccharomyces*:	After 2-3 °Brix drop	24 hours after FLAVIA	Once juice is racked to fermentation vessel	24-72 hours after LAKTIA

Step 1 Rehydrate non-Sacc in 10x its weight of chlorine-free water. Stir.



Step 2 Wait 15 min and stir again.

Step 3 Slowly add juice until temp drops by 10°C. Hold for 15 min. Repeat until slurry is within 10°C of juice.



Step 4 Inoculate.

PROTOCOL

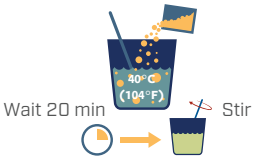
SACCHAROMYCES YEAST REHYDRATION

Proper yeast rehydration is one of the most important steps to ensure a strong and healthy fermentation. The normal inoculation rate for active dried yeast is 2 lb/1000 gal (25 g/hL). When added properly, this inoculation rate results in an initial yeast cell concentration of 3–4 million viable cells per mL of juice. Under favorable conditions, the initial yeast cell population will increase up to 100–150 million viable cells per mL of juice before growth stops and alcoholic fermentation begins. This biomass increase is critical for healthy fermentations. Higher inoculation rates are recommended on juices that are higher maturity (higher sugar). When using a yeast rehydration nutrient such as GO-FERM PROTECT EVOLUTION™, maintain a ratio of 1 part yeast to 1.25 parts rehydration nutrient. Careful rehydration, attemperation, inoculation and homogenization are all important to help prevent sluggish or stuck fermentations.

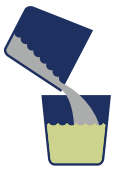
Note: This protocol is not appropriate for non-*Saccharomyces* yeast (see pg 20 for non-*Sacc* rehydration instructions).

1. Suspend 2.5 lb/1000 gal (30 g/hL) of GO-FERM PROTECT EVOLUTION in 20 times its weight of clean, chlorine free, 43°C(110°F) water. (For example: 2.5 lb rehydration nutrient x 20 = 50 ÷ 8.33 lb/gal water = 6 gal water.) The water temperature is important for mixing of the rehydration nutrient. Due to the unique nature of GO-FERM PROTECT EVOLUTION, it will not go into solution completely. This is due to the fatty acid and sterol content. *Please see pg 27 for information on yeast rehydration nutrients.* **Important: If not using a yeast rehydration nutrient, water temperature should begin at 40°C(104°F) and the volume of water should be 10 times the weight of the yeast amount. This lower temperature is important, so you do not to harm the yeast.**
2. Once the temperature of the yeast rehydration nutrient solution has dropped to 40°C(104°F), add 2 lb/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. Live yeast populations decline when allowed to stand for more than 30 minutes. **Note: Foaming is not an indicator of yeast viability.**
3. Slowly (over a period of 5 minutes) combine an equal amount of the juice to be fermented with the yeast suspension. This will help the yeast adjust to the high sugar conditions and the cooler temperature of the juice. This step is essential as it will help to avoid cold shock caused by a rapid temperature drop exceeding 10°C(18°F). This attemperation step may need repeating for very low temperature juice. Each attemperation step should last about 15–20 minutes. For every 10°C(18°F) temperature difference between the juice and the yeast slurry, an attemperation step must be performed. For example, for a juice temperature of 20°C(68°F) and yeast slurry temperature of 40°C(104°F), two attemperation steps are required.
4. For direct inoculation of yeast post rehydration, ensure you mix the yeast slurry into the full volume of the juice.
5. For large tanks with long filling times add the yeast slurry to the bottom of the fermentation vessel just as you begin filling with juice. This is especially important when inoculating with strains that are sensitive to the competitive factor (refer to scottlab.com). This allows the yeast a head start over indigenous organisms.

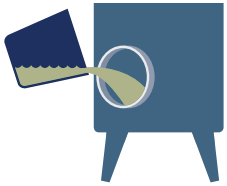
Step 1 Add GO-FERM PROTECT EVOLUTION to water.



Step 2 Cool, add yeast, stir, let stand for 20 minutes, stir.



Step 3 Attemperate. Repeat if necessary.



Step 4 Inoculate.

YEAST NUTRIENTS

Scott Labs' yeast nutrients are the gold standard.

Scott Labs and Lallemand Oenology have been providing customized yeast nutrients since the late 1970s. Our applied knowledge on yeast nutrition is second-to-none and our research has advanced the cider industry's knowledge of good fermentation practices. We were the first to develop a complete nutrient for fermentation (FERMAID), we were the first to patent the use of rehydration nutrients (GO-FERM), and we continue to push the understanding of yeast nutrient impact on cider quality.

Our nutrients go beyond preventing stuck fermentations. We discovered that specific nutrients can protect and stimulate aromas, protect color, and help manage negative sensory compounds. Our advanced and unrivaled lines of yeast nutrients and derivatives help take your cider to the next level.

WHAT NUTRIENTS DO YEAST NEED?

Nitrogen (in an assimilable form) controls cell number, fermentation rate, and the production of some aroma compounds. Yeast assimilable nitrogen (YAN) consists of most amino acids, ammonia, and some types of peptides. Apples vary in their YAN content and the composition typically consists of mostly amino acids and very little ammonia.

Survival factors (sterols and unsaturated fatty acids) are essential for healthy plasma membranes. When yeast have sufficient survival factors, sugar uptake can continue throughout fermentation and the toxic effects of ethanol can be minimized.

Vitamins and minerals. Interestingly, the higher the YAN the more vitamins and minerals yeast require. Vitamins and minerals are co-factors for growth and aroma metabolism and yeast cannot survive without them.

Additionally, there is a link between low vitamins and H_2S production. Calcium pantothenate is a critical co-factor for the incorporation of sulfur compounds into amino acids. Without it, the pathway leading to cysteine and methionine production is incomplete and H_2S is produced instead.

WHAT NUTRIENTS ARE PRESENT IN APPLES?

While apples contain nitrogen, vitamins and minerals, and survival factors, they do not contain them in levels that will support healthy fermentation. Most notably, **apples have very low yeast assimilable nitrogen (YAN)**[1]. YAN supplementation throughout fermentation is necessary for a healthy cider fermentation. **Additionally**, apple YAN will vary **between** cultivars and growing seasons [1] but can also vary **within** a cultivar and growing season.

Apple YAN is composed of amino acids. Apple amino acid composition heavily favors a few amino acids (asparagine and phenylalanine) over all others[2]. While this has not been heavily researched, it is hypothesized that this unbalanced amino acid profile may lead to issues in fermentation kinetics especially when YAN is not properly supplemented [1].

SUPPLEMENTING NUTRIENTS AND YAN FOR SUCCESS:

The amount of supplementation required for a healthy fermentation depends on several factors:

Initial juice chemistry. Prior to fermentation, sugar content and YAN should both be measured. Higher sugar and lower YAN fermentations will both require higher levels of YAN supplementation. Initial YAN levels may be affected by:

Processing and storage conditions. Apples can be stored after harvest in modified atmosphere storage for long periods of time. Alternatively, juice may be pressed immediately and frozen or concentrated. All of these decisions will affect YAN. Even if you are very consistent with your sourcing, you may see YAN variability.

Native microflora activity. Native microflora will consume YAN as well as vitamins and minerals, even in healthy fruit and juices. The longer the juice sits prior to inoculation, the lower the YAN will be.

Dissolved oxygen. Nitrogen is captured faster by yeast in juices with higher oxygen content, therefore more YAN will be necessary to sustain yeast over the course of fermentation. This may be a factor in stored/transported juice or thawed juices as the dissolved oxygen content may be higher in those.

Fermentation temperature. Higher fermentation temperatures stimulate fermentation rate and yeast growth, thereby requiring more nitrogen than cooler fermentations.

CITATION:
1. Stewart, A. C., Ma, S., Peck, G. M., McGuire, M. N., Boudreau, T. F., Gamp; O'Keefe, S. F. (2018). Yeast Assimilable Nitrogen and Cider Fermentation. Scott Laboratories Cider Handbook.
2. Ma, S., Neilson, A. P., Lahne, J., Peck, G. M., O'Keefe, S. F., Gamp; Stewart, A. C. (2018). Free amino acid composition of apple juices with potential for cider making as determined by UPLC-PDA. Journal of the Institute of Brewing, 124(4), 467–476. https://doi.org/10.1002/jib.519

QUICK GUIDE TO CHOOSING YEAST NUTRIENTS & DERIVATIVES

Cidermaking Stage	Cidermaking Goal	Recommended Products
Pre-Fermentation	Antioxidation	GLUTASTAR™ or OPTI-WHITE™
During Yeast Rehydration	Provide yeasts vitamins, minerals and sterols to promote healthy populations that can withstand fermentation conditions	GO-FERM PROTECT EVOLUTION™
At Inoculation	Nourish yeast with amino acids for steady fermentation kinetics	FERMAID O™
During Fermentation	Maintain steady fermentation rate and avoid off-odor production	STIMULA CHARDONNAY™ or FERMAID O™ and/or FERMAID K™
End of Fermentation	Enhance cider flavor profile	OPTI-WHITE™ or NOBLESSE™
	Manage sulfur off-odors	REDULESS™
	Scavenge oxygen to prevent oxidation	PURE-LEES™ LONGEVITY

DID YOU KNOW?

WHY WE RECOMMEND STAGED NUTRIENT ADDS

Our recommendation for optimal yeast nutrition includes adding nutrients at 2 or 3 time points. We recognize that production constraints may not be compatible with multiple nutrient additions. It is more important to sufficiently compensate for the juice's nutrient deficiency than it is to achieve optimal addition timing. Understanding our justification for the timing of each nutrient addition may help you develop the best nutrient regime for your process:

Rehydration: Nutrients should always be added during the yeast rehydration phase to supply the often-deficient vitamins and minerals, sterols, and unsaturated fatty acids (survival factors). This first add can be achieved using GO-FERM PROTECT EVOLUTION.

Inoculation: Nutrients should be sufficient in juice at inoculation so that yeast have enough nitrogen to grow and multiply. This is important as the number of cells will drive fermentation rate. If the juice has enough YAN to begin fermentation, then a nitrogen addition may not be necessary (See chart on pg 30). If the juice is deficient, FERMAID O may be added.

During Fermentation: Nutrients should be added during fermentation (at or around 1/3 sugar depletion) to replenish YAN levels. Yeast quickly utilize YAN present at inoculation and can encounter deficit conditions midway through fermentation. Adding nutrients like FERMAID O, FERMAID K, or STIMULA CHARDONNAY at 1/3 sugar depletion avoids yeast stress so that sugar uptake can continue, fermentation rate remains steady, and the yeast can produce desirable aroma compounds.

YEAST NUTRIENTS & DERIVATIVES

Scott Labs offers three types of yeast nutrients:

Rehydration Nutrients

Rehydration nutrients are added while rehydrating yeast. While they will contribute some nitrogen to a fermentation, rehydration nutrients should not be considered significant sources of YAN. Rather, they supply yeast with vitamins, minerals, and sterols. These compounds promote the development of healthy yeast that can withstand fermentation conditions. For example, sterols are incorporated into yeast cell membranes to improve their tolerance to increasing ethanol.

Fermentation Nutrients

Fermentation nutrients supply the yeast with nitrogen (YAN). We recommend adding these nutrients to the juice at inoculation and again partway through fermentation. Supplementing YAN at the beginning of fermentation ensures that a sufficient yeast population to sustain fermentation will develop. Supplementing YAN during fermentation avoids yeast stress which may result in off-odor development and stuck/sluggish fermentations. Our STIMULA line of fermentation nutrients can supply YAN while also stimulating yeast metabolic pathways that promote the production of desirable aroma compounds.

Yeast Derivative Nutrients

Yeast derivative nutrients are used for their ability protect positive sensory compounds and/or remove negative sensory compounds. While they will contribute some nitrogen to a fermentation, they should not be considered significant sources of YAN. Yeast derivative nutrients should be added either prior to inoculation or toward the end of fermentation.

These nutrients are produced from specific strains of yeast that have been inactivated and then autolyzed (partially or fully). They contribute compounds naturally found in or produced by yeast including:

- Glutathione and other peptides which have antioxidant effects
- Polysaccharides which can improve mouthfeel by reducing astringency and increasing volume
- Low levels of copper which can reduce sulfur off-odors

FERMAID K*

LALLEMAND

Complex yeast nutrient containing DAP
(Fermentation Nutrient)

#15073	2.5 kg
#15070	10 kg

FERMAID K™ is a complex yeast nutrient to assist with fermentation security, especially in low YAN situations. This reliable nutrient provides many essential key elements required by the yeast for growth and reproduction and is best used at 1/3 sugar depletion.

Usage: Suspend FERMAID K in water or juice and mix well before adding, especially during fermentation to avoid CO_2 release and overflowing of vessel.

Storage: Dated expiration. Store in a cool and dry environment at 18°C(65°F). Once opened, keep tightly sealed and dry.

Recommended Dosage	25-50 g/hL	2-4 lb/1000 gal

*Note: The ingredients in FERMAID K are listed by the TTB as acceptable in good commercial cidermaking practices in 27 CFR 24.250 together with 27 CFR 24.246. The ingredients in all other products shown on pgs 25-30 are listed by the TTB as acceptable in good commercial cidermaking practices in 27 CFR 24.246. For more information, please visit TTB.gov. FERMAID K contains thiamin. The TTB Maximum Legal Dose for thiamin hydrochloride = 0.60 mg/L (0.005 lb/1000 gal) of cider or juice. 21 CFR 184.1875.

Production Stage: 1/3 sugar depletion	Provides: Complex nutrient blend
Impact: Fermentation health and security	Measurable YAN at 25 g/hL dose: 25 ppm YAN equivalents at 25 g/hL dose: 25 ppm

FERMAID O

Organic yeast nutrient supplying amino acids; OMRI listed (Fermentation Nutrient)

#15067	2.5 kg
#15107	10 kg

FERMAID O™ is a blend of highly specific inactivated yeast fractions that are rich in assimilable amino acids (organic nitrogen). Its amino acid profile is balanced and highly consistent. Though FERMAID O does not supply a lot of Measurable YAN, it is a highly effective nutrient. It reliably lowers peak fermentation temperatures, improves fermentation kinetics and the yeast produces lower levels of negative sulfur compounds. FERMAID O use has been correlated with positive aromatic expression (esters) and mouthfeel. FERMAID O does not contain any DAP or supplemented micronutrients. For optimal results, FERMAID O should be used in conjunction with GO-FERM PROTECT EVOLUTION™ rehydration nutrient (pg 27).

Usage: Suspend FERMAID O in water or juice and mix well before adding, especially during fermentation to avoid CO_2 release and overflowing of vessel.

Storage: Dated expiration. Store in a cool and dry environment at 18°C(65°F). Once opened, keep tightly sealed and dry.

Recommended Dosage	10-40 g/hL	0.83-3.3 lb/1000 gal

Production Stage: At inoculation and/or 1/3 sugar depletion	Provides: Highly consistent source of amino acids
Impact: Fermentation security and enhanced aroma production	Measurable YAN at 40 g/hL dose: 16 ppm YAN equivalents at 40 g/hL dose: 64-96 ppm

GLUTASTAR

Protects and stabilizes aroma and color compounds against oxidation; OMRI listed (Yeast Derivative Nutrient)

#15265	1 kg
#15266	10 kg

GLUTASTAR™ is added to juice pre-fermentation to scavenge quinones that quickly lead to oxidative damage (browning) when left untreated. By scavenging quinones, aroma compounds and color are preserved.

GLUTASTAR is a highly soluble, unique, autolyzed yeast derivative nutrient that brings protective qualities of both specialized (nucleophilic) peptides and reactive glutathione. The effects of GLUTASTAR is long-lasting and its positive impact on varietal and fermentation-derived aromas and color contribute to a prolonged shelf-life. GLUTASTAR can be used in no- and low-SO_2 ciders as an antioxidant, however, it is not an antimicrobial substitute for SO_2.

Usage: Mix GLUTASTAR in 10 times its weight of water or juice. Add directly to juice post-pressing for optimal protection. This product is mostly soluble. Stir to maintain suspension before and during addition.

Storage: Dated expiration. Store in a cool and dry environment at 18°C(65°F). Once opened, keep tightly sealed and dry.

Recommended Dosage	30 g/hL	2.5 lb/1000 gal

Production Stage: Add directly to juice post-pressing	Provides: Peptides, polysaccharides and glutathione
Impact: Scavenges quinones to protect aromas and color	YAN contribution: Insignificant

DID YOU KNOW?

UNDERSTANDING YAN VS. YAN EQUIVALENTS:

Most academic recommendations for YAN supplementation have been based on measurable YAN, often supplemented in the form of inorganic nitrogen (usually DAP). Lallemand Oenology has demonstrated that organic forms of YAN are 4-6 times more efficient than inorganic YAN. This means that a 40 g/hL dose of FERMAID O has 16 ppm measurable YAN but a YAN equivalent of 64-96 ppm. Throughout our recommendations we have taken this efficiency into account.

GO-FERM PROTECT EVOLUTION

Yeast rehydration nutrient for yeast stimulation and protection; OMRI listed (Rehydration Nutrient)

#15103 2.5 kg
#15251 10 kg

GO-FERM PROTECT EVOLUTION™ is the latest generation of yeast rehydration nutrients to support healthy fermentations while increasing aroma uptake and production. This formulation has optimized the bioavailability of vitamins, minerals, sterols, and unsaturated fatty acids, all of which are derived from autolyzed wine yeast. The benefits are clearly seen at the end of alcoholic fermentation as yeast rehydrated in GO-FERM PROTECT EVOLUTION have enhanced viability, vitality and tolerance to stresses such as ethanol, acid, sugar, and temperature. The yeast also expresses more aromatic varietal aromas (e.g., terpenes) due to GO-FERM PROTECT EVOLUTION's high ergosterol content which enables yeast membrane transport systems to better assimilate the aromatic precursors. When used in fermentations where oxygen additions are difficult, GO-FERM PROTECT EVOLUTION's enhanced sterol and fatty acid content is a valid substitute for oxygen.

Usage: Mix GO-FERM PROTECT EVOLUTION in 20 times its weight of clean 43°C(110°F) water. Let the mixture cool to 40°C(104°F) then add the selected active dried yeast. Let stand for 20 minutes. Slowly (over five minutes) add equal amounts of juice to be fermented to the yeast slurry. Do not allow more than 10°C(18°F) difference between the juice and yeast slurry. Acclimatize yeast as necessary (see pg 21 for more details).

Note: Due to the unique nature of GO-FERM PROTECT EVOLUTION, they will not go into solution completely. This is due to the fatty acid and sterol content and is to be expected.

Storage: Dated expiration. Store in a cool and dry environment at 18°C(65°F). Once opened, keep tightly sealed and dry.

Recommended Dosage	30 g/hL	2.5 lb/1000 gal

Production Stage: During yeast rehydration	Provides: Natural vitamins, minerals, and survival factors in autolyzed yeast base
Impact: Supports healthy fermentation, minimizes yeast stress, optimizes aromas	YAN contribution: Insignificant

NOBLESSE

Contributes to balance, sweetness and softness on the finish; OMRI listed (Yeast Derivative Nutrient)

#15105 2.5 kg

NOBLESSE™ gives the perception of sweetness and promotes harmony between mouthfeel characteristics. Upon addition, NOBLESSE starts to release polysaccharides that can help mask sensations of acidity, astringency, and bitterness.

Ciders made using NOBLESSE appear to have more fruit and sweetness and a reduction in both drying and aggressive characters. NOBLESSE, a partially autolyzed yeast derivative nutrient, can be used at any time during fermentation and although immediate results are possible, full integration may take three to five months.

Usage: Mix NOBLESSE in 10 times its weight of water or juice. Add during a pump-over or tank mixing. This product is partially soluble. Stir to maintain suspension before and during addition.

Storage: Dated expiration. Store in a cool and dry environment at 18°C(65°F). Once opened, keep tightly sealed and dry.

Recommended Dosage	30 g/hL	2.5 lb/1000 gal

Production Stage: Anytime during fermentation processes	Provides: High and low molecular weight polysaccharides
Impact: Adds sweetness, harmonizes and integrates mouthfeel	YAN contribution: Insignificant

OPTI-WHITE

Promotes roundness and smoothness and protects aromatics; OMRI listed (Yeast Derivative Nutrient)

#15165	1 kg
#15136	2.5 kg
#15216	10 kg

OPTI-WHITE™ contains both antioxidant peptides and polysaccharides derived from yeast. The peptides protect aromatics, whereas the polysaccharides help stabilize aroma compounds and enhance roundness. When added to the juice at the onset of fermentation, OPTI-WHITE helps to prevent oxidative browning* while bringing smoothness and complexity. When OPTI-WHITE is added during the later stages of fermentation, it helps integrate the flavors. *Use 50 g/hL for maximum antioxidative properties or use GLUTASTAR™ (pg 26) for maximum anti-browning protection.

Usage: Mix OPTI-WHITE in 10 times its weight of juice or water. Add to the juice after settling or directly to the barrel or tank prior to the onset of fermentation. If adding during the later stages of alcoholic fermentation, add during a tank mixing for proper homogenization. This product is partially soluble. Stir to maintain suspension before and during addition.

Storage: Dated expiration. Store in a cool and dry environment at 18°C(65°F). Once opened, keep tightly sealed and dry.

Recommended Dosage 25–50 g/hL 2–4 lb/1000 gal

Production Stage: Any time before the completion of fermentation	Provides: Polysaccharides and antioxidant peptides
Impact: Balances mouthfeel and protects aromas	YAN contribution: Insignificant

PURE-LEES LONGEVITY

Gentle fining and oxygen scavenging, compatible with no/low SO_2 cidermaking (Yeast Derivative Nutrient)

#15249	1 kg

PURE-LEES™ LONGEVITY is used to scavenge dissolved oxygen and combat oxidation. Oxidation can be responsible for loss of fruit character, browning and decreased shelf-life. Using PURE-LEES LONGEVITY helps protect color and aromas. Although research determined it was more efficient than SO_2 at preserving color during 5-month aging trials, it is not an antimicrobial substitute for SO_2.

PURE-LEES LONGEVITY is the result of work conducted in collaboration with INRA in France.

Usage: Suspend PURE-LEES LONGEVITY in 10 times its weight of water, gently mix then add to cider. Mix thoroughly. Contact time depends on aging time (1–9 months).

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment below 25°C(77°F). Reseal opened packaging immediately.

Recommended Dosage 20–40 g/hL 1.7-3.4 lb/1000 gal

Production Stage: Any time before the completion of fermentation	Provides: Antioxidant peptides
Impact: Scavenges oxygen to protect aroma and colors	YAN contribution: Insignificant

REDULESS

Reduces sulfur off-aromas; OMRI listed
(Yeast Derivative Nutrient)

#15116	1 kg
#15115	2.5 kg

REDULESS™ is a unique yeast-based product used to reduce sulfur off-odors, such as H_2S and dimethyl sulfide. REDULESS is composed of yeast with cell walls rich in copper that can bind with sulfur off-odors. These negative sensory compounds are removed from cider once racked off REDULESS. REDULESS can also naturally enhance roundness and reduce phenol-related defects.

Usage: Mix REDULESS in 10 times its weight in water. Add immediately to the tank. Gently mix and rack off or filter after 72 hours. The potential copper contribution when used at 30 g/hL is 0.03 ppm. This product is partially soluble. Stir to maintain suspension before and during addition.

Storage: Store at room temperature, away from direct sunlight and strong odors. Once opened, keep tightly sealed and dry

Recommended Dosage: 10-30 g/hL 0.8-2.5 lb/1000 gal

Production Stage: Any time before the completion of fermentation	Provides: Yeast cell walls rich in copper residues
Impact: Reduces sulfur-off odors	YAN contribution: Insignificant

STIMULA CHARDONNAY

Stimulates fruity and floral aroma compounds
(Fermentation Nutrient)

#15245	1 kg
#15260	10 kg

STIMULA CHARDONNAY™ is used to optimize the yeast's production of fruity and floral aromas. When STIMULA CHARDONNAY is added at 1/3 sugar depletion it triggers specific yeast metabolic pathways resulting in increased ester production. Ciders made with STIMULA CHARDONNAY are also noted for their increased complexity and smooth mouth-feel. This 100% autolyzed yeast-based nutrient is rich in specific amino acids, small peptides, sterols, vitamins, and minerals allowing for maximum aromatic expression.

Usage: Mix STIMULA CHARDONNAY in 10 times its weight of clean, chlorine-free water or juice and add to the fermentation at 1/3 sugar depletion. It is essential that the timing of addition is respected. STIMULA CHARDONNAY is not fully soluble. Stir to maintain suspension before and during addition.

Storage: Dated expiration. Store in a dry environment at 18°C(65°F). Once opened, use immediately.

Recommended Dosage 40g/hL 3.3 lb/1000 gal

Production Stage: During fermentation at 1/3 sugar depletion	Provides: Organic nitrogen with natural vitamins and minerals
Impact: Increases fruity and floral aromas	Measurable YAN at 40 g/hL dose: 16 ppm YAN equivalents at 40 g/hL dose: 64-96 ppm

PROTOCOL

DEVELOP A YEAST NUTRITION PLAN

Use the following step-by-step guide to develop a complete yeast nutrition program.

DETERMINE HOW MUCH NITROGEN (YAN) TO ADD

1. **Measure SUGAR (BRIX) and YAN of the juice**.
2. **Choose a yeast strain**. Yeast strain product descriptions can be found on pgs 9-15.
3. **Determine the NITROGEN NEEDS of the chosen yeast strain**. Each strain is classed as a Low, Medium, or High N need strain and this information is listed in the product description.
4. **Determine YAN REQUIRED FOR FERMENTATION** by consulting the table on the right.
   - For example: If the juice is 12 °Brix and ALCHEMY I (a medium N need strain) is selected, the fermentation will need 108 ppm YAN.
5. **If the YAN REQUIRED is higher than the JUICE YAN, ADDITIONAL YAN is required**.
   - **ADDITIONAL YAN** = **YAN REQUIRED** – **JUICE YAN**
   - For example: If the YAN required for fermentation is 108 ppm and the juice has 40 ppm YAN, an additional 68 ppm YAN is required.

	YAN REQUIRED FOR FERMENTATION (ppm N)		
°BRIX	LOW N NEED	MEDIUM N NEED	HIGH N NEED
10	75	90	125
12	90	108	150
14	105	126	175
16	120	144	200
18	135	162	225
20	150	180	250

DETERMINE NUTRIENT TYPES, DOSAGES, AND TIMING OF ADDITION:

Based on the amount of **ADDITIONAL YAN** required (calculated above), use the chart below to determine which nutrients (and dosages) to add at each stage of fermentation.

Nutrients and Dosages by Stage of Fermentation				
ADDITIONAL YAN REQUIRED	Yeast Rehydration	Inoculation	During Fermentation (1/3 sugar depletion)	
				If making a fruity/floral cider
0-50 ppm	30 g/hL GO-FERM PROTECT EVOLUTION™	No Addition	30 g/hL FERMAID O	40 g/hL STIMULA CHARDONNAY
51-100 ppm		20 g/hL FERMAID O	20 g/hL FERMAID O + 12.5 g/hL FERMAID K	
101-150 ppm		40 g/hL FERMAID O	50 g/hL FERMAID K	

ARTICLE

YEAST NUTRITION: AMINO ACIDS ARE BETTER THAN AMMONIA (DAP)

THE IMPORTANCE OF AN ORGANIC SOURCE OF NITROGEN

WHAT FORMS OF NITROGEN CAN YEAST USE?

Nitrogen plays a critical role in yeast metabolism. Nitrogen-containing compounds that yeast can utilize are naturally found in apples. Often, the levels of these compounds are not high enough to sustain fermentation and their levels must be supplemented with nutrients.

Nitrogen that is available for yeast to utilize is called yeast assimilable nitrogen (YAN). YAN comes in two main forms, amino acids and ammonia. These are referred to as organic and inorganic nitrogen, respectively. This simply indicates whether the compound also contains carbon (organic contains carbon, inorganic does not contain carbon). When talking about inorganic and organic nitrogen, we prefer to directly address the nitrogen source:

Organic Nitrogen = Amino Acids and Peptides
In cidermaking, organic nitrogen is supplied as amino acids and some peptides. Common sources are nutrients derived from autolyzed yeast.

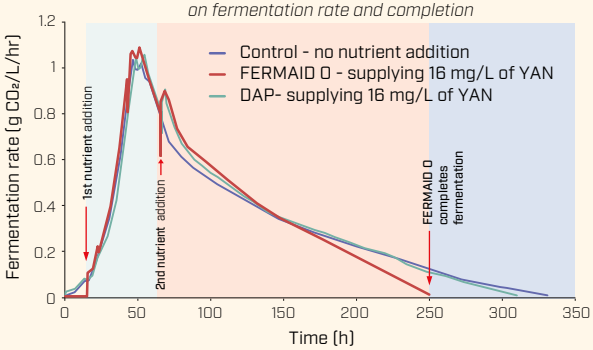
Inorganic Nitrogen = Ammonia (NH_3)
In cidermaking, inorganic nitrogen is supplied as ammonia (NH_3), most commonly as diammonium phosphate (DAP).

WHICH IS MORE EFFICIENT?

Historically, diammonium phosphate (DAP) has been the yeast nutrient of choice for fermented beverages, including cider. In fact, most academic recommendations for YAN supplementation are based on DAP addition. However, nitrogen supplied as ammonia (DAP) is taken up very quickly which can lead to uncontrolled cell growth and hot fermentations and does not necessarily give yeast the staying power to complete a fermentation.

Alternatively, when nitrogen is supplied in the form of amino acids, the fermentation profile is very different. Ferments do not get as hot, the yeast population is controlled, and the cells are healthier. Interestingly, both aroma and mouthfeel are also improved when DAP is avoided. While yeast may show an affinity for ammonia, a yeast diet balanced with amino acids can produce healthier fermentations, better aromatics (e.g., terpenes and esters) and lower levels of undesirable compounds (e.g., ethyl acetate and hydrogen sulfide).

Comparison of FERMAID O and DAP on fermentation rate and completion



16 mg/L YAN was added at two stages of fermentation (at the beginning and at 1/3 of the alcoholic fermentation) in two forms: inorganic nitrogen (DAP) and organic nitrogen (FERMAID O™). This graph indicates the greater efficacy of FERMAID O compared to DAP on a per milligram nitrogen basis. Using FERMAID O results in a quicker finish to alcoholic fermentation.

Data represented are from trials conducted by Lallemand Oenology and the Institut Coopératif du Vin (ICV) in collaboration with the National Agricultural Research Institute (INRA) Pech Rouge Research Station in the Languedoc region of France.

ARTICLE

WHY DOES THIS CIDER STINK?

PREVENTING SULFUR OFF-ODORS DURING FERMENTATION

Cider has a strong propensity to develop sulfur off-odors which are largely attributable to hydrogen sulfide (H_2S). There are several variables and potential sources of these off-odors. This guide has been created to determine critical control points for preventing sulfur off-odors before they develop.

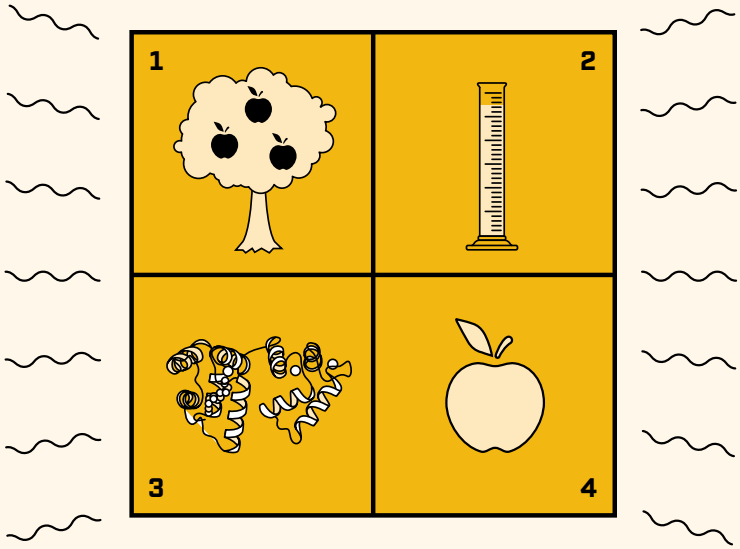
TERMS USED TO DESCRIBE SULFUR OFF-ODORS INCLUDE:

H_2S	Rotten Egg	Reduced	Burnt Rubber	Onion	Skunky	Garlic	Funk

HOW ARE THESE ODORS CREATED?

There are several potential sources of sulfur that end up creating off-odors including:

1. **Elemental sulfur from orchards or storage**
2. **Sulfur dioxide (sulfite) additions to prevent spoilage or oxidation in juice**
3. **Sulfur from sulfur-containing amino acids**
4. **Naturally occurring sulfates in apples**



These can all be utilized during yeast metabolism to produce sulfur-containing compounds required for cell growth and function (including amino acids like cysteine and methionine). Sulfites from SO_2 additions and elemental sulfur from orchards/storage can also bypass this process and be immediately reduced to hydrogen sulfide[1].

If yeast become stressed for nitrogen, there are two pathways that may generate H_2S. First, in the presence of low nitrogen, the pathway that incorporates nitrogen and sulfur into sulfur-containing amino acids (cysteine and methionine) is blocked. The excess S^{-2} is converted to hydrogen sulfide[2]. Second, in the presence of low nitrogen, yeast will degrade their own amino acids for nitrogen. When those amino acids also contain sulfur, H_2S is released as a byproduct[1]. Yeast strains vary in the potential amounts of H_2S they will produce in this process.

PREVENTING SULFUR OFF-ODORS

The key to preventing sulfur off-odors during fermentation is **compensating appropriately for your juice's nutritional shortcomings** and **maintaining a low-stress environment for yeast**:

JUICE

Understand and compensate for nutritional shortcomings

Even in freshly harvested "high YAN" juices, significant supplementation may be necessary. If not working with fresh juice, even more supplementation may be necessary. The method of acquiring apple juice for cider fermentation will have a strong influence over the nutrient content. This can be attributed to two main factors (discussed on pg 23):

- **Length of storage**: longer storage times (of juice and apples) allow native microflora to consume YAN, leaving juices deficient.
- **Degree of clarification**: juices that are too turbid are linked to H_2S production. Conversely, juices that are too clarified can cause yeast stress as yeast will struggle to stay in suspension. It is recommended to clarify to 50-80 NTU or 1-2% solids.

Fresh Juice may have sufficient YAN if freshly harvested and pressed, or may have low YAN if the apples have been stored prior to pressing. Either way, fresh juice will be very turbid and require some clarification.

Bulk Juice/Stored Juice may be YAN deficient depending on length of storage. These juices may have also been clarified or may have had a lengthy amount of time to settle, so they may struggle with over-clarification.

Concentrate typically has more YAN than the freshly pressed juice from which it was made[3]. However, the YAN in the reconstituted juice will heavily depend on the degree of dilution. Additionally, concentrate is intensely clarified during production since it receives multiple enzyme treatments, and over-clarification may be a concern.

As discussed on pg 23, yeast nutrition is more than YAN. The form of nitrogen added (amino acids vs. ammonia) is important. Yeast will also need vitamins, minerals, and sterols. See pgs 24 and 30 for information on proper nutrient timing and dosages.

FERMENTATION

Maintain a low-stress environment for yeast

Changes can be made during fermentation that can preemptively prevent H_2S production:

Yeast Selection and Handling: The best practice is to inoculate with a commercial yeast strain. Commercial strains are incredibly reliable when rehydrated appropriately, inoculated at the recommended rate, and their temperature tolerances are respected. These strains have been specifically isolated and tested to withstand fermentation conditions of specified alcohol levels and temperatures without becoming stressed. Furthermore, as discussed on pg 5, certain yeasts are verified to be low to no H_2S producers (BE FRUITS™, ICV OKAY™, ICV OPALE 2.0™, SENSY™).

We recommend avoiding indigenous fermentations. Indigenous yeasts are often less tolerant of fermentation conditions, may become stressed easily, may struggle to finish fermentation, and may produce a host of undesirable compounds like ethyl acetate. Re-pitching or yeast harvesting can be problematic as well since these yeasts have exhausted enzyme systems and/or contain microbial contaminants.

Other Environmental Stress: Yeast stress can also be induced during fermentation by **high oxygen**, **low pH**, and **extreme temperature**. Juices with high dissolved oxygen consume YAN more quickly and leave the juice depleted before the end of fermentation, causing yeast stress. pH during fermentation can drop during the first 18-36 hours, and a drop below 3.0 can induce yeast stress. Fermenting at the upper or lower extremes of a yeast's temperature range will also induce yeast stress.

CITATIONS
1. Zoecklein, B. (2008, February). Managing Sulfur-like Off Odors in Wine. Wine Business Monthly.
2. Iland, P., Bruer, D., Bruer, N., Caloghiris, S., Edwards, G., Ewart, A., Ford, C., Markides, A., Sitters, J., & Wilkes, E. (2021). Techniques and methods for chemical, physical and sensory analyses and tests of grapes and wine. Patrick Iland Wine Promotions Pty Ltd.
3. Rosend, J., Kaleda, A., Kuldjärv, R., Arju, G., & Nisamedtinov, I. (2020). The effect of apple juice concentration on cider fermentation and properties of the final product. Foods, 9(10), 1401. https://doi.org/10.3390/foods9101401

TANNINS

Scott Labs likes clever solutions for common problems.

Tannins are one of our favorite fixes for ciders that need balance and structure. Tannins are naturally occurring polyphenolic compounds that contribute to cider mouthfeel, structure, and aroma. If your fruit or juice lacks natural tannin, Scott Labs' tannins may become one of your favorite tools too!

Tannins are naturally occurring polyphenolic compounds that contribute to cider structure, mouthfeel and balance as well as protect from browning (oxidation). Scott Labs' tannins can be added to juice deficient in natural tannin, including juice from culinary apples, to provide these benefits.

Tannins have a broad range of applications: **antioxidation** (preserving aroma, protecting color); **building structure**; **building volume/roundness; enhancing aroma** and **adding freshness**. Tannins are versatile and, depending on the tannin, they can be added before ferementation, during fermentation, aging, or prior to bottling for last-minute adjustments.

Tannin can be extracted from a variety of sources. The tannins listed in this book were extracted from oak (both American and European, toasted and untoasted), exotic woods and/or gallnuts. **Tannins can form complexes with other compounds found in juice or cider and their behavior is highly dependent on the cider matrix**. The complexes that form will determine the tannin's impact.

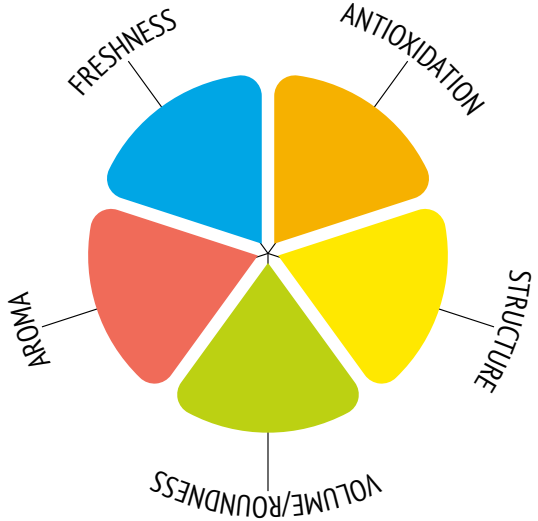
SENSORY IMPACT OF TANNINS

ENHANCES FRESHNESS

Tannins can increase the perception of freshness as a consequence of antioxidant and aroma-enhancing effects.

ENHANCES AROMA

Tannins can add aromas and/or enhance volatility of existing aromas.



ANTIOXIDATION

Some tannins can interact with quinones and iron, interrupting the oxidation chain to preserve aroma and protect color.

BUILDS STRUCTURE

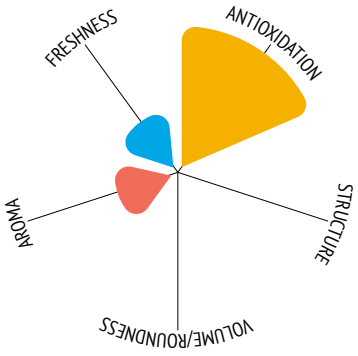
Certain tannins can modulate tannin intensity, bitterness and astringency.

BUILDS VOLUME/ROUNDNESS

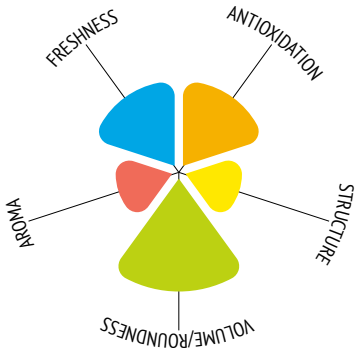
Some tannins can increase mouthfeel and increase the perception of sweetness due to their ability to interact with other molecules like polysaccharides and even other tannins.

QUICK GUIDE TO CHOOSING TANNINS

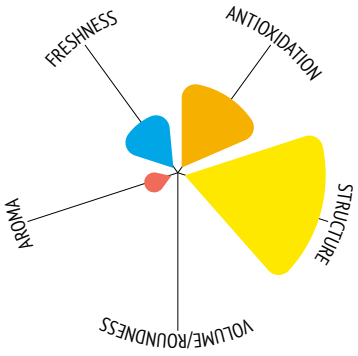
ESSENTIAL ANTIOXIDANT



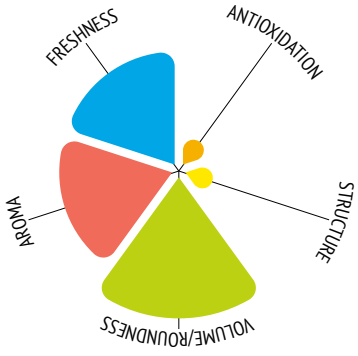
SCOTT'TAN FT BLANC SOFT



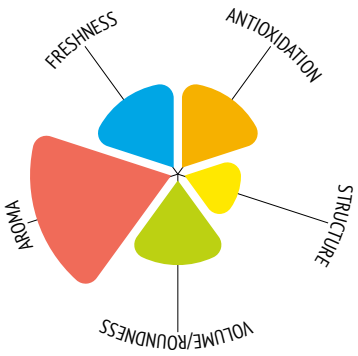
SCOTT'TAN FT BLANC



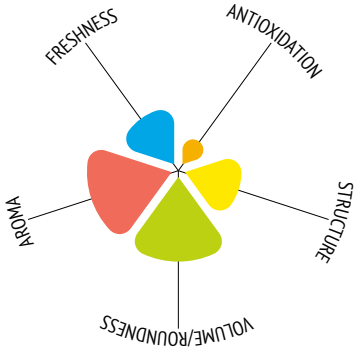
SCOTT'TAN RADIANCE



SCOTT'TAN FT BLANC CITRUS



SCOTT'TAN ROYAL



TANNINS

ESSENTIAL ANTIOXIDANT

Superior oxidation protection

#15984 1kg

ESSENTIAL ANTIOXIDANT is a highly effective gallnut tannin that protects juice and cider from oxidative damage with minimal impact on mouthfeel.

This new tannin from the Institut Œnologique de Champagne (IOC) is highly purified and composed of tannins derived from gallnuts, offering the highest rate of antioxidant protection of all the tannins within our portfolio. ESSENTIAL ANTIOXIDANT can be used on juice or finished ciders, and is particularly effective on ciders that are susceptible to browning to preserve color and aromas.

Usage: Dissolve ESSENTIAL ANTIOXIDANT in about ten times its weight of warm water 35–40°C(95–104°F) until fully dissolved. Add to cider gradually during a transfer or pump-over. Good mixing is important. If an addition is made post-fermentation, we recommend waiting 3–6 weeks after the tannin addition before racking, fining, filtering or bottling.

Storage: Dated expiration. Once opened, keep tightly sealed and dry.

Recommended Dosage

Juice 30–60 ppm	3-6 g/hL	0.25–0.5 lb/1000 gal
Oxygen sensitive juice 50–100 ppm	5–10 g/hL	0.42–0.83 lb/1000 gal
Cider 30–100 ppm	3–10 g/hL	0.25–0.83 lb/1000 gal

Production Stage: Pre-fermentation, Finishing	Minimum Contact Time: 3 weeks	Impact: Antioxidant protection

FT BLANC

Enhances tannin perception, increases mouthfeel, and protects against oxidation

#15954 1 kg
#15969 5 kg

SCOTT'TAN™ FT BLANC is a gallnut tannin that can be used to increase tannin levels in low tannin ciders.

Derived from Tara trees this tannin can help prevent oxidation during the pre-fermentation or aging stages.

When oxidation is inhibited cider color and aroma are preserved. In some cases, FT BLANC can minimize the impact of hydrogen sulfide.

Usage: Add FT BLANC to juice or cider during a tank mixing. Good homogenization is important. If an addition is made post-fermentation, we recommend waiting 3–6 weeks after the tannin addition before racking, fining, filtering or bottling.

Storage: Dated expiration. Unopened, the shelf-life is 5 years at 18°C(65°F). Once opened, keep tightly sealed and dry.

Recommended Dosage		
50–200 ppm	5–20 g/hL	0.42–1.6 lb/1000 gal

Production Stage: Pre-fermentation, Finishing	Minimum Contact Time: 3 weeks	Impact: Enhances structure and protects color and aromas

FT BLANC CITRUS

Enhances fruity and floral aromas

#15974	1 kg
#15975	5 kg

SCOTT'TAN™ FT BLANC CITRUS is a mixture of tannins from citrus wood and gallnuts.

The use of FT BLANC CITRUS during alcoholic fermentation enhances fruity and floral aromas, especially when used in combination with yeast strains that have beta-glycosidase activity (e.g., 58W3, ALCHEMY I, CROSS EVOLUTION, ELIXIR, ICV D47, ICV OPALE 2.0, NT 116, QA23, R2, R-HST, SENSY). Using FT BLANC CITRUS along with a specific yeast strain increases the aromatic profile resulting in ciders with more intense aromas of lemon, grapefruit, apple, and white flowers.

FT BLANC CITRUS can be used at any time during the cider-making process as it can protect the juice and cider from oxidation or assist with aromatic complexity.

Usage: Dissolve FT BLANC CITRUS in about 10 times its weight of warm water (35–40°C/95–104°F) then add it to the juice/cider and mix well. If using during alcoholic fermentation add 24–48 hours after yeast inoculation. Final additions should be made at least 3 weeks prior to bottling.

Storage: Dated expiration. Unopened, the shelf-life is 5 years at 18°C(65°F). Once opened, keep tightly sealed and dry.

Recommended Dosage		
20–150 ppm	2–15 g/hL	0.17–1.2 lb/1000 gal

Production Stage: Pre-fermentation, Finishing	Minimum Contact Time: 3 weeks	Impact: Aromatic Enhancement

FT BLANC SOFT

Enhances mouthfeel, adds mid-palate complexity, and protects against oxidation

#15955	1 kg
#15980	5 kg

SCOTT'TAN™ FT BLANC SOFT is a blend of gallic tannins derived from gallnuts and Tara.

FT BLANC SOFT improves softness and enhances mouthfeel. Ciders made using FT BLANC SOFT have enhanced texture, fuller mid-palate and a perception of sweetness. Relatively small dosages can contribute to freshness. FT BLANC SOFT can be used at any time during the cider-making process.

Usage: Add FT BLANC SOFT to juice or cider during a tank mixing. Good homogenization is important. If an addition is made post-fermentation, we recommend waiting 3–6 weeks after the tannin addition before racking, fining, filtering or bottling.

Storage: Dated expiration. Unopened, the shelf-life is 5 years at 18°C(65°F). Once opened, keep tightly sealed and dry.

Recommended Dosage		
20–150 ppm	2–15 g/hL	0.17–1.2 lb/1000 gal

Production Stage: Pre-fermentation, Finishing	Minimum Contact Time: 3 weeks	Impact: Antioxidant and Mouthfeel

RADIANCE

#15978 250 g

Enhances freshness and reveals fruit aromas; Can be added pre-bottling

SCOTT'TAN™ RADIANCE is extracted from lightly toasted French oak which helps to unmask and refine aromas and bring an aromatic freshness to ciders. RADIANCE also promotes balance and mouthfeel.

RADIANCE integrates rapidly and is great for "last-minute" additions. It can be added up to 48 hours before membrane (final) filtration. Always conduct filterability trials prior to addition to avoid filtration challenges.

Usage: Dissolve RADIANCE in about ten times its weight of warm water 35–40°C(95–104°F) until fully dissolved. Add to cider gradually during a transfer or pump-over. Good mixing is important.

Storage: Dated expiration. Unopened the shelf-life is 4 years at 18°C(65°F). Once opened, keep tightly sealed and dry.

Recommended Dosage		
10–100 ppm	1–10 g/hL	0.08–0.83 lb/1000 gal

Production Stage: Pre-bottling	Minimum Contact Time: 48 hours	Impact: Mouthfeel, Aromas

ROYAL

#15979 250 g

Gently impacts structure and aromatic complexity, can mask off odors; Can be added pre-bottling

SCOTT'TAN™ ROYAL, extracted from American oak, gently enhances structure, balance, and adds length to the palate. ROYAL can help mask off-aromas and flavors of *Brettanomyces*.

ROYAL integrates rapidly and is great for "last-minute" additions. It can be added up to 48 hours before membrane (final) filtration. Always conduct filterability trials prior to addition to avoid filtration challenges.

Usage: Dissolve ROYAL in about 10 times its weight of warm water 35–40°C(95–104°F) until fully dissolved. Add to cider gradually during a transfer or pump-over. Good mixing is important.

Storage: Dated expiration. Unopened the shelf-life is 4 years at 18°C(65°F). Once opened, keep tightly sealed and dry.

Recommended Dosage		
10–100 ppm	1–10 g/hL	0.08–0.83 lb/1000 gal

Production Stage: Pre-bottling	Minimum Contact Time: 48 hours	Impact: Structure, Balance, Masks Off-Odors

CLARIFICATION

FINING & STABILITY

Call us crazy, but we are genuinely excited about fining and stability! We have curated a portfolio of products that we love from suppliers we trust. We are committed to providing the best product and process knowledge for all fining and stability challenges. If your cider has mystery hazes, troubles with oxidation, nightmare filtrations, or you simply want to improve your current practices, we're here to help.

ENZYMES

Scott Labs knows enzymes. Our enzymes have been synonymous with quality and ease-of-use for over 25 years. The benefits of enzymes are often overlooked and undervalued, but not by us! We appreciate their specialized and nuanced activities and know that they help make processing easier at all stages of cidermaking. We are committed to sharing the benefits of enzymes with producers of any size, so we offer a variety of package sizes and formats. No batch is too large or too small to use our enzymes - we have you covered.

ARTICLE

CIDER CLARIFICATION 101

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. However, during settling it is important not to over-clarify or yeast will struggle to stay in suspension, potentially leading to a sluggish or stuck fermentation. 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. Attempting to clarify with only post-fermentation treatments may not be as effective.

CLARIFICATION BEST PRACTICES

Below we detail best practices for clarifying cider throughout the cidermaking process:

Pressing: Treating milled apples with enzymes improves clarity of the juice. Additionally, enzyme treatment increases the volume of free run juice and can increase the volume of juice extracted at lower pressures. A minimum of 2 hours contact time with enzymes is recommended.

Juice: Clarification of juice can be achieved in multiple ways. First, determine if juice needs to be clarified: Ideally, juices should be clarified to 80-120 NTU or 1-2% solids. If juice does need to be clarified this can be achieved via the addition of enzymes and fining agents.

Step 1: Add Enzymes

Fruit juice cloudiness post-pressing is mainly caused by pectin. Negatively charged pectin molecules form a protective layer around positively charged fruit particles, keeping them suspended. Enzymes, specifically pectinases, break down pectin, allowing fruit particles to settle and compact in the lees.

Step 2: Add Fining Agents

Fining agents such as bentonites and chitosans help speed up settling. They facilitate flocculation of fruit particles after the pectin holding them in solution has been broken down (via enzyme treatment). Once flocculation has occurred, sedimentation can commence. Bentonite-based fining agents may inactivate enzymes, so it is important to follow proper timing when working with enzymes and bentonite.

Step 3: Perform Settling or Flotation (or Centrifugation)

Physical processes like settling, flotation and centrifugation should be used as the last step of juice clarification. This process collects and compacts the fruit particle/fining agent floccules and allows clean juice to be removed. Settling and centrifugation rely on gravity, whereas flotation relies on gas injection.

Post-Fermentation: Finished ciders are complex colloidal solutions. The two main factors that complicate post-fermentation clarification are:

- **Temperature:** Ciders may have been cold-crashed to stop fermentation. At this temperature, enzymes are inactive and settling may be inhibited.
- **Alcohol:** Alcohol has a stabilizing effect on some colloidal compounds, making clarification less efficient.

If juice has not been properly clarified prior to fermentation, it may be difficult to clarify completely post-fermentation and avoid filtration issues. However, there are some treatments that may help. Post-fermentation clarification can be achieved with enzymes, chitosan, gelatin, isinglass, bentonite, or silica gel. These products can also address other fining and stability concerns. Consult the chart on pgs 42-43 for assistance in choosing post-fermentation clarification products.

FINING AND STABILITY

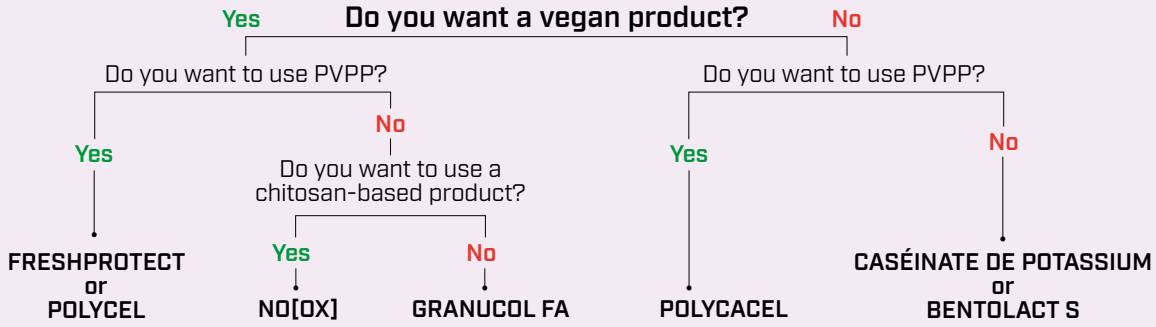
Fining removes unwanted elements from juice and cider; however, **fining is more than clarification**. There are many other purposes fining serves in terms of **treating and preventing off-odors, off-flavors, and visual flaws**. Though fining agents work by different mechanisms, they all react with unwanted substances that are then removed by racking, filtration, centrifugation, or other means.

Stability is complementary to fining and, in fact, fining often leads to stability. Stability is a broad term that encompasses colloidal stability, color and aroma stability, and microbial stability. When used in the phrase "fining and stability" it refers to all except microbial stability (see pgs 58-62). Proper fining, stabilization, and filtration ultimately leads to a package-stable cider.

QUICK GUIDE TO CHOOSING FINING AND STABILITY AGENTS

	NACALIT PORE-TEC	QI'UP XC	CRISTALLINE PLUS	COLLE PERLE	INOCOLLE	GELOCOLLE	FLASHGUM R LIQUIDE	ULTIMA SOFT
Formulation	Bentonite	Chitosan	Isinglass	Gelatin	Gelatin	Silica Gel	Gum arabic	Mannoprotein-gum arabic
Primary Use	**Clarification**	**Clarification**	**Clarification** (for brilliance, after standard clarification)	**Removal of astringency and bitterness**	**Unmask positive aromatics**	**Prevention of overfining,** used in conjunction with animal-derived fining agents	**Confers colloidal stability**	**Confers colloidal stability**
Secondary Uses	Compaction of lees			Clarification	Clarification	Compaction of lees during settling	Enhance perception of sweetness	Enhance perception of sweetness and mouthfeel; Minimize bitterness and astringency
Stage of Production	Juice, Post-fermentation	Juice, Flotation, post-fermentation	Post-fermentation	Post-fermentation	Juice, Post-fermentation	Flotation, Post-fermentation	Immediately prior to bottling	Immediately prior to bottling
	Clarification						*Colloidal Stability*	

HOW TO CHOOSE A PRODUCT FOR TREATING AND PREVENTING OXIDATION



	BENTOLACT S	CASÉINATE DE POTASSIUM	FRESHPRO-TECT	POLYCACEL	POLYCEL	NO[OX]	GRANUCOL FA	GRANUCOL GE
	Bentonite-Casein blend	Casein	Bentonite-PVPP blend	PVPP-Casein blend	PVPP	Chitosan	Carbon	Carbon
	Treat and prevent oxidation issues	**Treat and prevent oxidation issues**	**Treat and prevent oxidation issues**	**Treat and prevent oxidation issues**	**Removes color and browning induced by oxidation**	**Treat and prevent oxidation issues**	**Decolorization**	**Deodorization**
	Reduce sulfur off odors, Counteract moldy aromas	Counteract moldy aromas, Diminish bitterness	Counteract moldy aromas, Diminish bitterness	Counteract moldy aromas, Diminish bitterness	Diminish bitterness	Counteract moldy aromas, Diminish bitterness	Treat and prevent oxidation issues	
	Juice, Fermentation, Post-fermentation	Juice, Post-fermentation	In press, Juice, Post-fermentation	Juice, Post-fermentation	Fermentation, Post-fermentation	In press, Juice, Post-fermentation	In press, Juice, Post-fermentation	In press, Juice, Post-fermentation

*Other products for preventing and treating oxidation include INITIA™ and GLUTASTAR™ (can be used prior to fermentation) and PURE-LEES LONGEVITY (can be used toward the end of fermentation).

BENTOLACT S IOC

#15788 5 kg

Bentonite- casein blend for the preventative treatment of oxidation and removal of off-odors

BENTOLACT S is a proprietary blend of soluble casein and bentonite. It is most commonly used to prevent and treat oxidation. When used early in the cidermaking process it is effective in cleaning up moldy fruit aromas, removing bitter characters or assisting with clarification. It can also help remove volatile sulfur off-odors.

Usage: Suspend BENTOLACT S in approximately 10 times its weight in cold water and mix vigorously to remove lumps. Mix well and allow the mixture to stand for 3 hours. Add during a pump-over or a good mixing. BENTOLACT S additions may take up to 7 days to settle.

Once hydrated, BENTOLACT S should not be stored for more than 24 hours.

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment below 25°C(77°F). Reseal opened packaging immediately.

Recommended Dosage *Bench trials recommended*		
Juice		
200–1000 ppm	20–100 g/hL	1.7–8.4 lb/1000 gal
Cider		
1000–2000 ppm	100–200 g/hL	8.4–16.8 lb/1000 gal

Production Stage: Juice, Cider	Contact Time: 1-2 weeks	Impact: Cleans up off odors and flavors, Prevent and treat oxidation

CASÉINATE DE POTASSIUM IOC

#15808 5 kg

Casein to help prevent oxidation and remove oxidized components

CASÉINATE DE POTASSIUM can be used in both juice and cider for the treatment of oxidized phenolics and bitter compounds. It helps freshen cider and reveals muted aromas. Although the potassium helps with solubility, once added a thorough mixing is essential.

Usage: Suspend CASÉINATE DE POTASSIUM in approximately 10 times its weight of cold water. Mix well and allow the solution to stand for 4 hours. Stir to remove lumps. For juice, add before settling or at the start of alcoholic fermentation. For cider, mix vigorously after adding since CASÉINATE DE POTASSIUM can float.

Once hydrated, CASÉINATE DE POTASSIUM should be used within 48 hours.

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment below 25°C(77°F). Reseal opened packaging immediately.

Recommended Dosage *Bench trials recommended*		
Juice		
500–1000 ppm	50–100 g/hL	4.2–8.4 lb/1000 gal
Cider		
200–1000 ppm	20–100 g/hL	1.7–8.4 lb/1000 gal

Production Stage: Juice, Cider	Contact Time: 1-2 weeks	Impact: Treats oxidation

COLLE PERLE

Gelatin for clarification and treatment of astringent ciders

#15798	1 L
#15799	5 L
#15800	20 L

COLLE PERLE is a hydrolyzed gelatin solution that can be used for clarification or softening of bitter and astringent tannins. COLLE PERLE flocculates and settles well, especially when used in conjunction with the silica gel, GELOCOLLE. It is particularly useful for young cider.

Usage: Add and mix vigorously into the cider to ensure thorough distribution. Racking should be done after 1 week. Filtration is possible and most productive 48–72 hours after fining with COLLE PERLE. For ciders intended for aging, a second racking 1 week after the first racking will produce the best results. It is not recommended to leave COLLE PERLE in cider for more than 30 days.

COLLE PERLE can be used in conjunction with GELOCOLLE to improve settling and/or prevent overfining (see pg 47 for directions).

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment below 25°C(77°F). Once open use immediately.

Recommended Dosage *Bench trials recommended*		
800–1500 ppm	80–150 mL/hL	3.0–5.7 L/1000 gal

Production Stage: Cider	Contact Time: 1 week	Impact: Clarification, removal of bitter and astringent compounds

CRISTALLINE PLUS

Isinglass to assist with clarification and brightening

#15770	100 g
#15771	1 kg

CRISTALLINE PLUS is a blend of isinglass stabilized with citric acid and potassium metabisulfite. It has a strong positive charge and can improve clarity and filterability even in very difficult to filter cider. It is favored by cidermakers due to its gentle fining effect and brightening of aromas. CRISTALLINE PLUS is not sensitive to cold temperatures but may be slow to complete settling.

Usage: Dissolve CRISTALLINE PLUS in 150–200 times its weight of tepid water (15–20°C(59–68°F)). Allow to swell for 3 hours. Add additional water if solution is too viscous. Add homogenized solution to cider, taking care to mix well. Rack once lees are well settled. CRISTALLINE PLUS can be used in conjunction with GELOCOLLE to improve settling (see pg 47 for directions).

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment below 25°C(77°F). Reseal opened packaging immediately.

Recommended Dosage *Bench trials recommended*		
15–30 ppm	1.5–3 g/hL	0.12–0.25 lb/1000 gal

Production Stage: Cider	Contact Time: 2-4 weeks	Impact: Clarification, brightening and aroma revealing

FLASHGUM R LIQUIDE

Gum arabic for colloidal protection

#15772	1 L
#15773	5 L
#15769	20 L

FLASHGUM R LIQUIDE is a gum arabic derived from *Acacia seyal* which acts as a colloidal protector when added pre-bottling. As a colloidal protector, FLASHGUM R LIQUIDE can help to stabilize color as well as reduce the risk of colloidal deposits forming in the bottle, especially in unfiltered ciders. It is often noted that ciders treated with FLASHGUM R LIQUIDE have reduced sensations of astringency and bitterness and increased perceptions of sweetness, volume, and fullness. If the cider will not be filtered, this fully soluble product can be added immediately prior to bottling.

Usage: FLASHGUM R LIQUIDE should be the last commercial product added to the cider. It is best to do inline additions 24–72 hours prior to the final pre-membrane and membrane filtrations. Filterability trials prior to membrane filtration are recommended. If using on cider that is not going to be filtered, add FLASHGUM R LIQUIDE just prior to bottling.

Storage: Dated expiration. Store in a dry, odor-free environment at or below 25°C(77°F).

Recommended Dosage *Bench trials recommended*		
400–1200 ppm	40–120 mL/hL	1.5–4.5 L/1000 gal

Production Stage: 24-72 hours Pre-bottling	Contact Time: Indefinite	Impact: Colloidal protection, sweetness

FRESHPROTECT

Bentonite-PVPP blend for the treatment of oxygen-sensitive juice and cider

#15791	5 kg

FRESHPROTECT is a proprietary blend of polyvinylpolypyrrolidone (PVPP) and bentonite. Cellulose and gum arabic are added as processing aids. Freshprotect can be used to remove oxidized characters, bitterness, and herbaceousness in both juice and cider. It is especially useful in the treatment of hard-press juice where it reduces aggressiveness and reveals fruit. FRESHPROTECT must be removed from cider via filtration per TTB regulations due to the PVPP portion.

Usage: Suspend FRESHPROTECT in approximately 10 times its weight of cool water. Mix well and allow to sit for 1 hour. Add the mixture into the tank slowly; making sure the solution is thoroughly mixed.

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment below 25°C(77°F). Reseal opened packaging immediately.

Recommended Dosage *Bench trials recommended*		
200–1000 ppm	20–100 g/hL	1.7–8.3 lb/1000 gal

Production Stage: Juice, Cider	Contact Time: 1-2 weeks	Impact: Removes oxidized characters, improves mouthfeel

GELOCOLLE

#15783 5 L

Silica gel for improved settling, lees compaction and prevents overfining

GELOCOLLE is a negatively charged solution of suspended silica that can be used alone or in conjunction with INOCOLLE, COLLE PERLE, CRISTALLINE PLUS, or other protein-based fining agents. GELOCOLLE initiates the flocculation of fining agents, resulting in faster settling, and more compact lees. GELOCOLLE also reduces the risk of leaving residual protein-based fining agents behind (overfining). This is especially important in low tannin ciders. GELOCOLLE can be used alone in hard-to-filter ciders since it chelates proteins and other compounds, facilitating filtration throughput.

Usage: GELOCOLLE can be used alone or in concert with other fining agents. To aid in settling GELOCOLLE should be added directly to cider 1 hour before the addition of protein-based fining agents (gelatin, isinglass, etc.). To prevent overfining GELOCOLLE should be added directly into cider 1 hour after the addition of protein-based fining agents (gelatin, isinglass, etc.). Post-addition GELOCOLLE should be mixed thoroughly.

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment 10-20°C(50-68°F). Reseal opened packaging immediately.

Do not refrigerate or freeze! GELOCOLLE solidifies at temperatures less than 0°C(32°F). This process is irreversible.

Recommended Dosage *Bench trials recommended*		
200–1000 ppm	20–100 mL/hL	0.75–3.8 L/1000 gal

Production Stage: Cider	Contact Time: 1-2 weeks	Impact: Speeds settling, compacts lees, aids filtration

GRANUCOL FA

#15331 1 kg
#15334 10kg

Carbon with decolorizing properties

GRANUCOL® FA is a decolorizing carbon for the elimination of off-colors due to browning in juice and cider. These activated carbon pellets are prepared for ease of use.

Usage: Add GRANUCOL FA directly to juice or cider. The pellets immediately dissolve after addition. Stir vigorously for several minutes to ensure even distribution. The activated carbon deposit should be racked as soon as possible.

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment below 25°C(77°F). Reseal opened packaging immediately.

Recommended Dosage *Bench trials recommended*		
Juice 100–1000 ppm	10–100 g/hL	0.83–8.3 lb/1000 gal
Cider 100–300 ppm	10–30 g/hL	0.83–2.5 lb/1000 gal

Production Stage: Juice, Cider	Contact Time: 24 hours	Impact: Removes color

GRANUCOL GE

Carbon with deodorizing properties

#15332	1 kg
#15333	10kg

GRANUCOL® GE is a deodorizing carbon for the absorption of off-tastes and off-aromas. It is especially useful in removing moldy aromas. These activated carbon pellets are prepared for ease of use.

Usages: Add GRANUCOL GE directly to juice or cider. The pellets immediately dissolve after addition. Stir vigorously for several minutes to ensure even distribution. The activated carbon deposit should be racked as soon as possible.

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment below 25°C(77°F). Reseal opened packaging immediately.

Recommended Dosage *Bench trials recommended*

Juice		
100–1000 ppm	10–100 g/hL	0.83–8.3 lb/1000 gal
Cider		
100–300 ppm	10–30 g/hL	0.83–2.5 lb/1000 gal

Production Stage: Juice, Cider	Contact Time: 24 hours	Impact: Removes off-odors and flavors

INOCOLLE

Gelatin for clarification and aroma revelation

#15795	1 L
#15796	5 L

INOCOLLE is a multi-purpose, partially hydrolyzed gelatin solution that can be used to clarify juice or cider, remove unstable colloids, and reveal muted aromas. It is particularly useful for juice fining and flotation.

Usage: Juice

Dilute INOCOLLE 1:1 in water. Introduce into juice gradually while mixing vigorously to ensure even treatment. Racking should be done after 1 week.

Usage: Cider

Dilute INOCOLLE 1:1 in water. Introduce into cider gradually while mixing to ensure even treatment. Filtration is possible and most productive 48-72 hours after treating with INOCOLLE. If INOCOLLE will not be removed via filtration, rack after 1 week and conduct a second racking 1 week after the first. It is not recommended to leave INOCOLLE in cider for more than 30 days.

INOCOLLE can be used in conjunction with GELOCOLLE to improve settling or prevent overfining (see GELOCOLLE description for directions).

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment below 25°C(77°F). Reseal opened packaging immediately.

Recommended Dosage *Bench trials recommended*

300-1000 ppm	30–100mL/hL	1.1-3.8 L/1000 gal

Production Stage: Juice, Cider	Contact Time: 1 week	Impact: Clarification and aroma revelation

NACALIT PORE-TEC

Sodium-calcium bentonite for clarification

#15322 5 kg
#15324 20kg

NACALIT® PORE-TEC is a granulated sodium-calcium bentonite that is specifically formulated for instances where superior flocculation, adsorption, and clarification are required.

Usage: Add NACALIT PORE-TEC slowly to approximately 5-10 times its weight of water under constant stirring (water temperature is not important). Allow to swell for a minimum of 4–12 hours. Dispose of supernatant and add remaining bentonite slurry to the juice or cider while thoroughly mixing.

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment below 25°C(77°F). Reseal opened packaging immediately.

Recommended Dosage *Bench trials recommended*		
50–1500 ppm	50–150 g/hL	4.2–12.6 lb/1000 gal

Production Stage: Juice, Cider	Contact Time: 1-7 days	Impact: Clarification

NO[OX]

Chitosan-bentonite blend to remove oxidized characters and increase freshness

#16421 5 kg

NO[OX] is a non-animal, non-allergenic fining agent that can be used in juice or cider to remove undesirable aromas and oxidized compounds resulting in ciders with brighter color and increased aromatic freshness. NO[OX] is an innovative and highly specialized chitosan-bentonite based fining agent. NO[OX] can be used at any time during the cidermaking process. When added to juice, NO[OX] can reduce moldy or herbaceous aromas. When used post-fermentation it can remove oxidized characters including color, aromas, and flavors and reduce herbaceous and bitter notes resulting in significant quality improvements. By blending in bentonite, lees are compacted, and cider loss is minimized.

Usage: Slowly add NO[OX] in 10 times its weight of clean, chlorine-free water, mixing constantly until suspension is homogeneous. There must be no lumps in the suspension. Depending on amount of NO[OX] to rehydrate this can take up to one hour. NO[OX] is insoluble, so it is essential that the solution is mixed during addition. Rack once lees are well settled.

Storage: Dated expiration. Store away from light and in a dry, odor-free environment below 25°C(77°F). Once opened, use immediately.

Recommended Dosage *Bench trials recommended*		
Juice 300–800 ppm	30–80 g/hL	2.5–6.7 lb/1000 gal
Cider 200–600 ppm	20–60 g/hL	1.67–5.0 lb/1000 gal

Production Stage: Any: pre-fermentation, during fermentation or post-fermentation	Contact Time: Juice 16 hours minimum. Cider 1-2 weeks	Impact: Removes oxidized characters, freshens aromas, reduces herbaceousness and bitterness

POLYCACEL IOC

PVPP-Casein blend for the treatment of oxidized juice or cider, or for the preventative treatment of browning

#15785	1 kg
#15786	5 kg

POLYCACEL is a blend of polyvinylpolypyrrolidone (PVPP) and casein, along with micropulverized cellulose. It is useful for reducing bitterness, removing phenolic compounds associated with browning, and revealing hidden aromas. POLYCACEL must be removed from cider via filtration per TTB regulations due to the PVPP portion.

Usage: Suspend POLYCACEL in approximately 20 times its weight in cool water. Mix well and allow to sit for 2 hours. Add the mixture into the tank slowly; making sure the addition is thoroughly blended into the juice or cider being treated. This is important as the casein portion can float.

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment below 25°C(77°F). Reseal opened packaging immediately.

Recommended Dosage *Bench trials recommended*

Juice 300–700 ppm	30–70 g/hL	2.5–5.8 lb/1000 gal
Cider 150–300 ppm	15–30 g/hL	1.25–2.5 lb/1000 gal

Production Stage: Juice, Cider	Contact Time: 10-21 days	Impact: Treatment of oxidation, unmasking of aromas

POLYCEL IOC

PVPP for the treatment of browning, removal of bitter compounds

#15784	1 kg

POLYCEL is a blend of polyvinylpolypyrrolidone (PVPP) and cellulose formulated to help prevent and/or treat compounds that cause browning. It can also be used to treat bitterness and herbaceousness. POLYCEL must be removed from cider via filtration per TTB regulations due to the PVPP portion.

Usage: Suspend POLYCEL in approximately 20 times its weight of cool water. Mix well and allow to sit for 1 hour. Add mixture to the tank slowly, making sure the addition is thoroughly blended into the juice or cider being treated. Depending upon the cider, POLYCEL may take up to a week to settle out.

Storage: Dated expiration. Store in a dry, odor-free and well-ventilated environment below 25°C(77°F). Reseal opened packaging immediately.

Recommended Dosage *Bench trials recommended*

Juice 400–800 ppm	40–80 g/hL	3.3–6.7 lb/1000 gal
Cider (Preventative) 150–300 ppm	15–30 g/hL	1.25–2.5 lb/1000 gal
Cider (Curative) 300–500 ppm	30–50 g/hL	2.5–4.2 lb/1000 gal

Production Stage: Juice, Cider	Contact Time: 1-2 weeks	Impact: Oxidation control, removal of bitter compounds

QI'UP XC

#16430 1 kg

Chitosan for superior clarification

QI'UP XC is a non-animal, non-allergenic fining agent which results in superior clarification. QI'UP XC is a specialized preparation of chitosan, activated with tartaric acid, resulting in a high surface charge which allows for the rapid aggregation of solid particles resulting in advanced settling, even under difficult conditions. This innovative flocking agent was initially used for flotation but does equally well during traditional juice or cider settling.

When used during flotation the large flocced particles are carried to the top of the flotation vessel on micro-bubbles of nitrogen gas or air, resulting in a clean juice. For successful flotation, the juice must not have started fermenting and it should be pectin-free (use 3-4mL/hL SCOTTZYME® PEC 5L), and temperature >13°C(55°F). To aid in lees/cap compaction, QI'UP XC should be used in conjunction with 10-30g/hL of NACALIT® PORE-TEC.

Usage: Add QI'UP XC in 10 times its weight of clean, chlorine-free water, mixing constantly until suspension is homogeneous. Stir to maintain suspension during addition.

Storage: Dated expiration. Store away from light and in a dry, odor-free environment below 25°C(77°F). Once opened, use immediately.

Recommended Dosage *Bench trials recommended*		
30–100 ppm	3–10 g/hL	0.25–0.83 lb/1000 gal

Production Stage: Juice, Cider	Contact Time: Until target solids level reached.	Impact: Superior clarification

ULTIMA SOFT

#17012 1 kg

Mannoprotein-gum arabic blend to promote colloidal stability with perceived softness and volume

ULTIMA SOFT is a unique blend of mannoproteins and gum arabic. In finished ciders, ULTIMA SOFT can offer a degree of stability, soften aggressive sensations, enhance body, add length, and maintain fruity characters.

Usage: Add ULTIMA SOFT by mixing with 10 times its weight of water. ULTIMA SOFT should be the last commercial product added to the cider. Ideally it should be added to the cider using a dosing pump. If the cider will be filtered, it is recommended that the addition be done 24–72 hours before the membrane filtration and that filterability trials be conducted prior to filtration.

Storage: Dated expiration. Store in a dry, well-ventilated environment with temperatures less than 25°C(77°F).

Recommended Dosage *Bench trials recommended*		
150–300 ppm	15–30 g/hL	1.2–2.4 lb/1000 gal

Note: This product contains ingredient(s) currently listed by the TTB as acceptable in good commercial practices in 27 CFR 24.250. For more information please visit TTB.gov.

Production Stage: 24-72 hours pre-bottling	Contact Time: Indefinitely	Impact: Stability and softness

ARTICLE

THE MANY ROLES OF CHITOSAN IN CIDERMAKING

Chitosan is an exciting **non-allergenic and non-animal based tool** for both traditional and vegan cidermaking. It can **replace animal and allergen-based products for juice and cider clarification and microbial stabilization,** including gelatin, casein, and lysozyme. Chitin is the second most abundant polysaccharide on earth after cellulose, and chitosan is naturally produced by many living organisms through the deacetylation of chitin.

Depending on the preparation, chitosan can vary in degree of deacetylation, thus impacting the molecules' ionic charge, molecular weight, and solubility. By changing one or more of these properties, the functionality of the chitosan molecule changes. This means that chitosan is not limited to a single application:

Antimicrobial* Agent

NO BRETT INSIDE™ and BACTILESS™ are 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.

These formulations for antimicrobial activity cause intense electrostatic interactions with negatively charged components on yeast and bacteria cell walls. This causes cell membrane damage leading to an osmotic and energy imbalance, loss of growth capacity, and eventually cell death. These chitosan formulations rely on optimization of charge, molecular weight, and solubility.

Antioxidation* Agent

NO[OX] is an effective chitosan-based antioxidant and can be used instead of SO_2 to prevent oxidation and browning which ultimately impacts color and aromas.

This formulation for antioxidative activity blocks the formation of free radicals via direct scavenging or via indirect means through metal ion (iron and copper) chelation. This means that the oxidation cascade is blocked, and browning is minimized. Chitosan is also thought to inhibit browning due to absorption of oxidized phenolic compounds or by coagulation of suspended solids to which polyphenol oxidases are bound. Chitosan formulations that inhibit browning have a high degree of deacetylation and high molecular weight.

Clarification Agent

QI-UP XC is a chitosan-based clarification agent that can be used instead of animal-based agents like gelatin and isinglass. QI-UP XC is blended with tartaric acid to allow it to carry an even higher charge, further increasing clarification efficiency.

This formulation for clarification has strong positive charges to promote flocculation and destabilization of colloids which increases clarification rates. It also has a high degree of deacetylation which creates a strong charge.

**Although chitosan products have antimicrobial and antioxidation roles and can help lower SO_2 use, the individual products are not replacements for SO_2. NOTE: Per the TTB regulations chitosan used in cider must be derived from the fungus* Aspergillus niger.

ENZYMES

Enzymes are present in all plants and animals, including apples and microorganisms, and are responsible for catalyzing a variety of reactions that would otherwise occur slowly in apples, juice, and cider. In ciders, the main function of enzymes is to break down pectin and other structural polysaccharides. Pectin is a complex and large molecule that, if left in its native form, can cause clarification and filtration challenges.

For cidermaking purposes, enzymes purified from fungi, including *Aspergillus niger* and *Trichoderma harzianum,* are added to increase yield before fermentation and make clarification and filtration easier. At almost every stage of cidermaking, proper enzyme use can improve quality and processing. Fungal-derived enzymes work well under most juice and cider conditions. However, there are certain factors that can have a major impact on their efficiency:

FACTORS IMPACTING ENZYME ACTIVITY

Temperature	Extent of Contact: Time and Mixing	Dosage	Interactions with Other Products
Ideal temperature for enzyme activity is 50-86°F (10-30°C). LOW TEMP: At temperatures <50 °F/10°C enzymes will still work, but slowly. HIGH TEMP: At temperatures >140°F/60°C the enzyme can be denatured and destroyed. Be mindful of temperature when using enzymes during juice thawing or cold crashing.	**Time: 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. **Mixing: The more often a vessel is mixed, the greater the ability of the enzyme to come in contact with its substrate (pectin).**	**The dosage required varies depending on contact time, level of pectin, stage of production, and presence of inhibitory substances.**	**Some products will immediately halt enzyme activity including:** • **High SO_2 additions** • **Bentonite additions** • **Tannin additions** Time these additions carefully and never mix enzymes directly with any of these additives. To completely stop all enzyme activity, add 5-10g/hL Bentonite (NACALIT® PORE-TEC).

QUICK GUIDE TO CHOOSING ENZYMES

Cidermaking Stage	Cidermaking Goal	Recommended enzyme
Milled Fruit/In-Press	Improve juice extraction and increase yield	SCOTTZYME® HC in conjunction with SCOTTZYME® PEC5L
Juice	Decrease pectin for improved clarity, faster settling, decreased solids, and compacted lees	SCOTTZYME® HC in conjunction with SCOTTZYME® PEC5L
		RAPIDASE® CLEAR EXTREME
Post-Fermentation, Pre-Filtration	Improve clarity, increase filtration efficiency and minimize loss	SCOTTZYME® KS
		SCOTTZYME® SPECTRUM

RAPIDASE CLEAR EXTREME

Superior juice clarification under difficult conditions

#16257 100g

RAPIDASE® CLEAR EXTREME is a granular enzyme that can be used after milling or pressing to reduce juice viscosity, improve clarity, help compact lees, and speed up clarification even in difficult conditions (e.g., low temperature, low pH) while preserving aromatic freshness. CLEAR EXTREME will remain active at 6–50°C(43–122°F), however, enzyme dose should be increased for use in low temperature juice.

Usage: Dissolve RAPIDASE CLEAR EXTREME in 10 times its weight of water, stir gently, allow to sit for a few minutes, then add to the juice right after pressing.

Storage: Dated expiration. Store refrigerated at 4–8°C(39–45°F). Once rehydrated, use within a few hours.

Recommended Dosage		
Juice	1-4 g/hL	38-152 g/1000 gal
Cider	Not recommended	

Production Stage: Juice Settling	Activity: Pectinase	Impact: Clarification under extreme conditions

SCOTTZYME HC

Increased yield, enhanced processing, and solids management

#16171 1 kg (890 mL)
#16161 25 kg (22.25 L)

SCOTTZYME® HC is a liquid pectinase and cellulase blend developed to increase yield, reduce solids and improve filtration. It is a strong enzyme useful for pome (apple or pear) or stone (pitted) fruits. HC is best used in conjunction with SCOTTZYME® PEC 5L.

Usage: Dilute SCOTTZYME HC to approximately a 10% solution in cool water. Pour the solution over the milled fruit or add during a tank mixing before alcoholic fermentation. If adding to cider, gently mix a 10% solution into the tank for even dispersion.

Storage: Store at 4°C(39°F) for 1–2 years. Keep tightly sealed and refrigerated once opened.

Recommended Dosage *Bench trials recommended for cider*		
Milled Fruit	60–100 mL/ton	
Juice	5.3–7.9 mL/hL	200–300 mL/1000 gal
Cider	6.6–9.2 mL/hL	250–350 mL/1000 gal

Production Stage: Fruit, Juice, or Cider	Activity: Pectinase and cellulase	Impact: Clarification and filtration

SCOTTZYME KS

Improved settling and filtration

#16174 1 kg (890 mL)
#16164 25 kg (22.25 L)

SCOTTZYME® KS is a liquid blend of enzymes creating a special formulation for difficult-to-settle or hard-to-filter juice or cider. KS can be used at any point in the cidermaking process after pressing, though the earlier KS is used, the more effective it will be. Customers have reported very favorable results when used to solve "nightmare" filtrations before bottling.

Usage: Dilute SCOTTZYME KS to approximately a 10% solution in cool water. Add to the juice after pressing or to the cider after alcoholic fermentation during a tank mixing.

Storage: Store at 4°C(39°F) for 1–2 years. Keep tightly sealed and refrigerated once opened.

Recommended Dosage *Bench trials recommended for cider*		
Milled Fruit	Not recommended	
Juice	2.6–4.0 mL/hL	100–150 mL/1000 gal
Cider	5.3–7.9 mL/hL	200–300 mL/1000 gal

Production Stage: Juice or cider	Activity: Pectinase, cellulase and protease	Impact: Clarification and filtration

SCOTTZYME SPECTRUM

Enhanced settling and filtration for difficult lots

#16177 1 kg (890 mL)
#16167 25 kg (22.25 L)

SCOTTZYME® SPECTRUM is a powerful liquid enzyme created for use in ciders that are very difficult to clarify and/or filter. It has higher enzyme activities for the most difficult tasks. SPECTRUM should be used on finished cider only, either to assist with settling or to help with filtration issues before bottling.

Usage: Dilute SCOTTZYME SPECTRUM to approximately a 10% solution in cool water. Add to the cider after alcoholic fermentation during a tank mixing.

Storage: Store at 4°C(39°F) for 1–2 years. Keep tightly sealed and refrigerated once opened.

Recommended Dosage *Bench trials recommended*		
Fruit	Not recommended	
Juice	Not recommended	
Cider	4 mL/hL	150 mL/1000 gal

Warning: Never use SCOTTZYME SPECTRUM before pressing or on the juice. It is our most aggressive enzyme and may result in over clarification of juice.

Production Stage: Cider	Activity: Pectinase, cellulase and protease	Impact: Clarification and filterability in very difficult lots

SCOTTZYME PEC5L

Improved pressing and clarification

#16170 1 kg (890 mL)
#16160 25 kg (22.25 L)

SCOTTZYME® PEC5L is a highly concentrated blend of liquid pectinases.

It is used on berries, pome, and stone fruit for easier pressing and increased yields or in juice for improved settling, clarification, and filtration. When adding to fruit, it is beneficial to use in conjunction with SCOTTZYME® HC.

Usage: Dilute SCOTTZYME PEC5L to approximately a 10% solution in cool water. Pour over the milled fruit before pressing or add to the juice before the start of alcoholic fermentation.

Storage: Store at 4°C(39°F) for 1–2 years. Keep tightly sealed and refrigerated once opened.

Recommended Dosage *Bench trials recommended for cider*		
Milled Fruit	10–20 mL/ton	
Juice	1.0–1.3 mL/hL	40–50 mL/1000 gal
Cider	1.3–1.6 mL/hL	50–60 mL/1000 gal

Production Stage: Fruit, Juice, and Cider	Activity: Pectinase	Impact: Clarification

MICROBIAL CONTROL

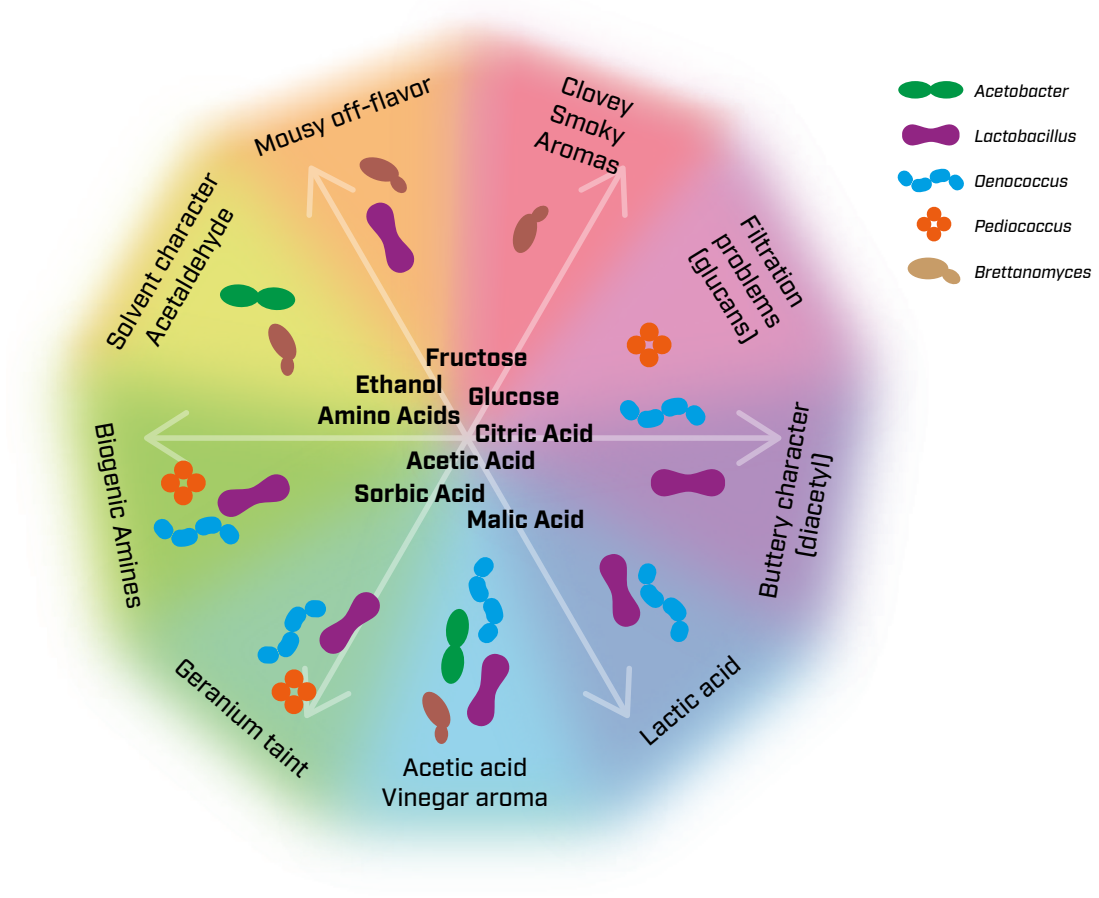
Scott Labs loves microbial diversity but not when it interferes with the taste and quality of cider. Microbial spoilage can occur at all stages of cidermaking and we're here to help you protect your cider from apple to bottle. If your cider is stinky, smells like vinegar, or is re-fermenting without your permission, we're here to help. With decades of experience, we can provide both product and process solutions that best fit your needs and challenges.

Yeast and bacteria can cause spoilage at various stages of the cidermaking process; however, their presence alone does not necessarily mean spoilage will occur. It depends additionally on environmental conditions and precursor/metabolite availability.

SPOILAGE IS COMPLICATED!

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 a variety of 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 many other compounds in juice and cider (e.g., amino acids, malic acid) that support organism growth potentially resulting in spoilage.



QUICK GUIDE TO CHOOSING MICROBIAL CONTROL AGENTS

Cidermaking Stage	Cidermaking Goal	Recommended product
Incoming fruit/in press	Protect from indigenous yeast and bacteria	INODOSE GRANULES
Juice	Protect from indigenous yeast and bacteria	INITIA (See pg 19), INODOSE GRANULES, DELVOZYME
Fermentation	Protect from indigenous yeast and bacteria	INOCULATE WITH YEAST (see pgs 6-15)
	Protect from lactic acid bacteria during sluggish/stuck fermentation	INODOSE GRANULES, DELVOZYME
	Inhibit MLF	BACTILESS, INODOSE GRANULES, INODOSE TABLETS, DELVOZYME
Post-fermentation	Control lactic acid bacteria	BACTILESS, INODOSE GRANULES, INODOSE TABLETS, DELVOZYME
	Control acetic acid bacteria	BACTILESS, INODOSE GRANULES, INODOSE TABLETS
	Control *Brettanomyces*	INODOSE GRANULES, INODOSE TABLETS, NO BRETT INSIDE
Pre-Bottling	Control spoilage organisms	INODOSE GRANULES, INODOSE TABLETS, VELCORIN

MICROBIAL CONTROL AGENTS WORK IN ONE OF THREE WAYS:

Removal	Inhibition	Destruction
Microorganisms are physically removed from the cider. Removal strategies include filtration, centrifugation and some types of fining when 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:** • Use of biocontrol agents like selected yeast that outcompete spoilage organisms • Acidification to lower pH • Use of sulfur dioxide or DELVOZYME at non-lethal concentrations	Microorganisms are killed and will not survive to replicate. Destruction strategies include NO BRETT INSIDE™, BACTILESS™, and DELVOZYME.

INODOSE GRANULES

Effervescent sulfur dioxide granules

#15780	100 g
#15781	400 g

INODOSE GRANULES are small, effervescent granules made of potassium metabisulfite and potassium bicarbonate. As they dissolve the granules release a precise dose of total SO_2 (free SO_2 will increase based on cider conditions). Inodose granules are packaged in pre-measured 100 g and 400 g packs. INODOSE GRANULES are perfect for SO_2 additions to incoming juice or cider. The potassium bicarbonate in these granules assists with mixing and has little to no effect on pH.

INODOSE TABLETS

Effervescent sulfur dioxide tablets

#15775	2 g (48/box)
#15776	5 g (42/box)

INODOSE TABLETS are a blend of potassium metabisulfite and potassium bicarbonate. They are packaged to release 2 g and 5 g of SO_2. As they dissolve into juice or cider, the tablets release a precise dose of total SO_2 (free SO_2 will increase based on cider conditions).

The effervescent action of the bicarbonate provides mixing in barrels or small tanks while reducing time and labor needed for stirring. These easy-to-use tablets help prevent overdosing problems associated with traditional forms of SO_2. Sealed strip packages keep unused tablets fresh for optimal efficacy. The potassium bicarbonate fraction in these tablets has little to no effect on pH.

Usage: Various applications include:

- Add during transport of juice to inhibit indigenous yeast and bacteria.
- Add in tanks or barrels before or after fermentation.
- To make SO_2 additions to cider during aging.

Storage for Granules and Tablets: Store in a dry, well-ventilated environment at temperatures below 25°C(77°F). Once the pack has been opened it should be used immediately.

INODOSE Granules and INODOSE Tablets Conversion Chart (ppm of Total SO_2)

SO_2 Dose	1 Liter	1 Gallon	60 Gallons	100 Gallons	1000 Gallons
2 g	2,000	529	9	5	0.5
5 g	5,000	1,321	22	13	1.3
100 g	100,000	26,420	440	264	26.4
400 g	400,000	105,680	1,761	1,057	106

Note: The SO_2 products contribute a precise dose of pure SO_2, measured as total SO_2. The measured increase in free SO_2 depends on conditions and cider should be analyzed post-addition to determine the change in free SO_2. These products are blends of potassium metabisulfite and potassium bicarbonate and weigh more than 2 g, 5 g, etc.

BACTILESS

#15232 500 g

Chitin-glucan and chitosan blend for acetic acid and lactic acid bacteria control

BACTILESS™ is a non-allergenic source of chitin-glucan and chitosan derived from a non-GMO strain of *Aspergillus niger*. BACTILESS helps protect cider from acetic acid and lactic acid spoilage bacteria. BACTILESS can be used to drastically reduce bacteria populations and to help prevent bacterial growth in ciders. It offers a non-animal based alternative to lysozyme treatment and/or significant amounts of SO_2. The effectiveness of BACTILESS can be enhanced with SO_2, but it does not replace the use of SO_2 since it does not have antioxidant or antifungal properties. BACTILESS can help inhibit malolactic fermentation when it is not desired. In ciders where malolactic fermentation is desired, BACTILESS should not be used until after MLF is complete.

Usage: Suspend BACTILESS in 5–10 times its weight of cool water or cider (BACTILESS is insoluble, so it will not go into solution). BACTILESS should be mixed to obtain a homogeneous addition. Leave BACTILESS in contact with the cider for 10 days and then conduct a clean racking. If malolactic fermentation is desired, BACTILESS should not be added until after MLF is complete.

To assess BACTILESS effectiveness wait 20–30 days post-racking before microbial analysis by traditional plating, microscopic observations or RT-PCR.

Storage: Dated expiration. Store in a dry environment below 25°C(77°F).

Recommended Dosage		
200–500 ppm	20–50 g/hL	1.67–4.16 lb/ 1000 gal

Note: This product contains ingredient(s) currently listed by the TTB as acceptable in good commercial practices in 27 CFR 24.250. For more information, please visit TTB.gov.

Impact of Bactiless™ on six different organisms 30 days after treatment

	Control	BACTILESS at 20 g/hL
Acetic acid bacteria (cells/mL)	2,033,333	54,800
Lactobacillus brevis (cells/mL)	35,733	1,030
Lactobacillus plantarum (cells/mL)	99,333	4,867
Lactobacillus kunkeei (cells/mL)	313	73
Oenococcus oeni (cells/mL)	1,733,333	46,667
Pediococcus species (cells/mL)	100,033	2,700

Trials conducted by ETS Laboratories, St. Helena, California. Trial results are the average of three replicates.

NO BRETT INSIDE

#16410 100 g

Chitosan for Brettanomyces spp. control

NO BRETT INSIDE™ is a non-allergenic source of chitosan derived from a non-GMO strain of *Aspergillus niger* that specifically targets *Brettanomyces* cells reducing the potential for *Brettanomyces* spoilage. Ciders infected with *Brettanomyces* can lose their aromatic freshness or in extreme cases can present phenolic-related defects and funky, farm animal, or barnyard-like aromas.

NO BRETT INSIDE targets *Brettanomyces* in two ways: 1) cells adsorb onto the surface of NO BRETT INSIDE, increasing the particle size causing the *Brettanomyces* spp. to settle, and 2) a biological action occurs which ultimately results in cell death. This double action of NO BRETT INSIDE helps control contaminating populations to preserve cider quality. However, NO BRETT INSIDE cannot decrease any sensory contribution already produced by *Brettanomyces*. In ciders where malolactic fermentation is desired NO BRETT INSIDE should not be used until MLF is complete.

Usage: Suspend NO BRETT INSIDE in 5 times its weight of cool water (NO BRETT INSIDE is insoluble, so it will not go into solution). NO BRETT INSIDE can be added during a pump-over or tank/barrel mixings to ensure a homogeneous addition. Leave the NO BRETT INSIDE in contact with the cider for 10 days and then conduct a clean racking. If malolactic fermentation is desired, NO BRETT INSIDE should not be added until after MLF is complete.

To assess NO BRETT INSIDE effectiveness, wait 20–30 days post-racking before microbial analysis by traditional plating, microscopic observations or RT-PCR.

Storage: Dated expiration. Store in a dry, odor-free environment below 25°C(77°F).

Recommended Dosage		
40–80 ppm	4–8 g/hL	0.33–0.67 lb/1000 gal

Note: This product contains ingredient(s) currently listed by the TTB as acceptable in good commercial practices in 27 CFR 24.250. For more information please visit TTB.gov.

VISUALIZATION OF NO BRETT INSIDE™ EFFECT ON *BRETTANOMYCES*

Before

Scanning Electron Micrograph x 20,000 magnification Brettanomyces *cells prior to being treated with NO BRETT INSIDE.*

After

Scanning Electron Micrograph x 20,000 magnification Brettanomyces *cells treated with 4 g/hL of NO BRETT INSIDE. Image shows Brettanomyces cells attached to the surface of the chitosan.*

Images courtesy of Biljana Petrova and Dr. Charles G. Edwards, Washington State University, Pullman, WA.

DELVOZYME LYSOZYME

OENOBRANDS

#16404 5 kg

Lysozyme for lactic acid bacteria control

Lysozyme, a protein extracted from egg whites, can be used at any stage of the cidermaking process to control or inhibit lactic acid bacteria (LAB) including *Oenococcus oeni*, *Pediococcus* spp., and *Lactobacillus spp.* Lysozyme degrades the cell walls of gram-positive bacteria (LAB) but not gram-negative bacteria (*Acetobacter* spp.) or yeast. Lysozyme is highly effective. However, its effectiveness depends on the type of bacteria and the number of cells present. Lysozyme should be deactivated with 5-10g/hL bentonite. If left in solution there is a potential for protein hazes to form.

Usage: Rehydrate lysozyme in 5–10 times its weight of warm water. Stir gently for one minute and avoid foaming. Allow to soak for 45 minutes. Repeat until the solution is a clear, colorless liquid. To ensure accurate results, wait one week before culturing for microbes. If lysozyme-treated samples are assessed too quickly after treatment, results may show a false-positive for bacterial growth. It is important to note that lysozyme requires a minimum seven day contact time to allow the enzyme to work.

Storage: Store in dry form for 2 years at 5-15°C(41-59°F). Once rehydrated, Lysozyme should be used immediately.

Recommended Dosage				
Lysozyme Applications	Lysozyme Dose			Timing of Addition
Inhibit LAB Spoilage of Juice This is especially important in high pH conditions.	200 ppm	20 g/hL	0.75 g/gal	Add prior to fermentation
Protection During Stuck or Sluggish Fermentations Reduce the risk of VA production by lactic acid bacteria and limit use of SO_2 to encourage yeast growth.	250–400 ppm	25–40 g/hL	0.94–1.50 g/gal	Add at first signs of a stuck fermentation
Post-Fermentation Bacterial Stabilization Protect cider and inhibit MLF during aging.	250–500 ppm	25–50 g/hL	0.94–1.90 g/gal	Add immediately after fermentation

VELCORIN LANXESS

VELCORIN LANXESS

#18006 6kg

An alternative to pasteurization to prevent re-fermentation in package

APPLICATIONS:

- To help prevent refermentation in finished ciders
- To reduce or eliminate sorbic acid
- To decrease the amount of sulfur dioxide used in ciders
- Expanded packaging options.

VELCORIN® is the trade name for dimethyldicarbonate (DMDC), a microbial control agent produced by LANXESS®. VELCORIN has been used in the U.S. since 1988.

Its approvals include use in wine, low-alcohol wine, non-alcoholic wine, cider, juice, juice sparklers, sports drinks, and ready-to-drink teas. VELCORIN is very effective at low dosages against a broad range of yeast, bacteria and molds. Unlike other chemical preservatives, VELCORIN is non-persistent and does not affect cider taste, aroma or color. VELCORIN can remain active for several hours thereby helping to eliminate contamination from other sources such as bottles, closures and filling equipment.

HOW VELCORIN IS USED

VELCORIN must be dosed into cider using an approved VELCORIN dosing machine. Due to the unique physical properties of VELCORIN, LANXESS Corp. requires the use of approved dosing machines to ensure safe handling. DMDC is hydrophobic and solidifies at 17°C(63°F) and the dosing machines are engineered to prevent solidification and aid in solubility. Dosers also include specific safety features and a special metering system. If you do not own a dosing machine, there are several mobile VELCORIN suppliers (see FAQ).

VELCORIN EFFICACY TESTING AT ETS LABORATORIES

Scott Labs has partnered with ETS Laboratories to offer options for lab testing on products using VELCORIN. For more information see **etslabs.com.**

- **VELCORIN Challenge Test**: Lab procedure used to determine if the population of microbes present in a product can be inactivated with the appropriate dose of VELCORIN.
- **VELCORIN Microbiological Validation Test:** Bottle sterility testing can test beverage samples that have already been dosed with VELCORIN during packaging for effectiveness.
- **VELCORIN/Methanol Validation Test:** Methanol is byproduct of VELCORIN addition, analysis of methanol can provide information about the success or dosage level of an addition.

Sample setup for dosing VELCORIN prior to packaging. This setup can be changed depending on your production and needs.

VELCORIN - FREQUENTLY ASKED QUESTIONS

Q. How does VELCORIN work?

A. VELCORIN controls microorganisms by entering the cell and inactivating some of the key enzymes required for cell function. Specifically, DMDC is thought to react with the histidyl residues of proteins, including those involved in the active site of many enzymes. Susceptible enzymes are consequently rendered functionless due to blockage of the active site and/or conformational changes in structure. Excess DMDC then completely hydrolyzes in the presence of water.

Q. What factors determine VELCORIN effectiveness?

A. The effectiveness of VELCORIN depends on microbial type, microbial load and other factors. At low doses, VELCORIN (DMDC) is very effective against yeast. At greater doses, DMDC is effective against bacteria and certain fungi. Pretreatment of cider must reduce the microbial load to less than 500 microorganisms/mL. VELCORIN is not a replacement for good sanitation practices.

Q. How do I know that VELCORIN will work against my specific cider/perry microorganism?

A. While VELCORIN is effective against a wide array of microorganisms, the only way to know whether it will be effective in your cider environment is to run a VELCORIN Challenge test.

Q. Do I have to list VELCORIN (DMDC) as an ingredient on the label?

A. No, the FDA lists dimethyldicarbonate (DMDC) as a direct secondary food additive and therefore no labeling is required (21 CFR 101.100).

Q. How much VELCORIN can I use in my cider/perry?

A. The TTB allows up to 200 ppm total of DMDC to be used in cider and/or perry (27 CFR 24.246).

Q. How do I determine if VELCORIN was dosed correctly?

A. The most common analytical method for determining whether the desired ppm amount of VELCORIN product was added is by methanol analysis. Methanol is a naturally occurring by-product of fermentation and baseline methanol concentrations vary in cider. Therefore, samples for methanol analysis must be taken before and after VELCORIN product dosing to determine whether the desired level of VELCORIN product was achieved.

Q. What type of packaging is compatible with VELCORIN?

A. VELCORIN technology can be used with all known packaging options, including plastics (such as PET, PVC or HDPE), aluminum cans and bottles, glass, bag-in-a-box, stainless steel kegs and others.

Q. How long does VELCORIN remain active?

A. VELCORIN (DMDC) activity is based on its hydrolysis rate. Hydrolysis occurs when DMDC reacts with water to form methanol and carbon dioxide. The rate of this reaction is dependent on the temperature of the cider. At 10°C(50°F) it takes approximately four hours for DMDC to completely break down. At 20°C(68°F) breakdown occurs in about two hours.

Q. How can I use VELCORIN if I don't have a dosing machine?

A. Scott Labs sells the VELCORIN DT MOTION dosing machine from LANXESS, which can be purchased via one of our technical sales experts. Mobile VELCORIN service providers also provide on-site dosing. See scottlab.com for more information.

Q. Is VELCORIN-treated cider and/or perry approved in countries other than the US?

A. VELCORIN approval is product and country specific. Please note that it is the exporter's responsibility to ensure the compliance of products. For a current list of countries that allow VELCORIN-treated cider and/or perry, please contact us.

CLEANING

BENEFITS OF AIRD® PRODUCTS ∞AIRD

- Specially formulated products for the wine industry
- Significant water savings — no citric rinse is required
- Non-dusting product
- Innovative BUILT FORMULA for more effective cleaning
- Effective at low doses over wide temperature ranges
- Does not require hazardous shipping
- No chlorine, other halogens, phosphates, silicates or fillers
- Safer and lower environmental impact than bulk chemical cleaners

WATER SAVINGS WITH AIRD PRODUCTS

AiRD Process **vs** **Classical Method**

Due to its unique formulation, AiRD products can result in up to **50% water savings**.*

AiRD Process	Water Used*
Rinse	100 gallons
AiRD Product	200 gallons
Short Rinse	100 gallons
TOTAL	**400 gallons**

Classical Method	Water Used*
Rinse	100 gallons
Caustic	200 gallons
Long Rinse	200 gallons
Citric	200 gallons
Rinse	100 gallons
TOTAL	**800 gallons**

The chart shows a common cleaning procedure for a 2,000 gallon tank cleaning.
*Not including potential reuse of AiRD solutions. Actual water savings may be greater.

DESTAINEX-LF (LOW FOAMING) ∞AIRD

Oxidizing cleaner for multi-purpose use

#18504 5 kg

DESTAINEX-LF is a proprietary sodium percarbonate based cleaning agent with microbial neutralizing abilities. This highly effective formulation can be used at low levels to remove stains, mold, mildew, and biofilms from stainless steel, galvanized metals, concrete, polyethylene (low and high density), polypropylene, plastics, flexible hoses, glass, and powder-coated surfaces. DESTAINEX-LF can be used in both automated (CIP) and manual systems. The sodium percarbonate in DESTAINEX-LF is complemented with proprietary surfactants and chelation agents, water conditioning materials, and rinse aids for a bright, clean and spot free neutral surface.

Storage: Store in a dry, odor-free environment between 10–20°C(50–68°F) away from sunlight.

Recommended Dosage		
0.5–1.5% w/v	5–15 g/L	0.7–2.0 oz/gal

OAK RESTORER ∞AIRD

Oak cleaner and refresher

#18508 5 kg

OAK RESTORER products are proprietary cleaners formulated for use on oak surfaces. These buffered carbonate blends also contain bicarbonates and surfactants to effectively remove soil thereby extending the working life of barrels, puncheons, redwood tanks, and staves.

OAK RESTORER is a single process cleaning agent requiring only a water rinse. No subsequent neutralization is required. OAK RESTORERS leave your wooden surfaces refreshed, odorless, and pH neutral.

Storage: Store in a dry, odor-free environment between 10–20°C(50–68°F) away from sunlight.

Recommended Dosage		
0.5–2.0% w/v	5–20 g/L	0.7–2.7 oz/gal

FILTRATION

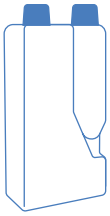
Filtration remains the most assured way to protect cider quality but we don't see filtration as an isolated process. Our team of experts understand that every production activity can have an impact on filtration, sometimes making it easier, and other times making it significantly more difficult. While filtration is a reliable solo act in achieving stability goals, it is most effective as a "dance partner" to other ingredients, processes, and processing aids. Whether you're filtering a single barrel or your entire cellar, we have you covered with filtration equipment, media, and expertise.

Cider filtration starts well before actual filtration. A variety of upstream choices will have a significant effect on ease of filtration.

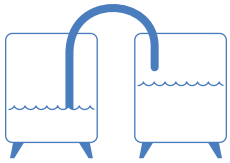
PRE-FILTRATION STEPS FOR SUCCESS

Filtration is often disrupted by colloids including polysaccharides, proteins, mannoproteins, pectin, hemicellulose, etc. Colloids tend to bind to other charged particles and molecules forming webs that can prematurely clog filter media. In addition to the following preparatory steps, the best way to gauge filtration success is to run a filterability test. Colloids are unpredictable and may present filtration issues even if appropriate preparatory steps are taken.

Did you use a good filterability enzyme like SCOTTZYME SPECTRUM? It can keep colloids like pectin and polysaccharides from coming out of solution and causing you to clog up media prematurely and strip out these long chained colloids which may include color and flavor.



Did you rack off the lees cleanly before filtration? The cleaner the cider, the more efficient filtration will be.



Did you measure the turbidity of the cider? Filtering with a porosity that is too tight too soon can give you poor throughput and strip the good stuff like color and flavor. Step down your filtration based on the grade selection.

Did you back-sweeten or make other additions right before filtration? Additions right before filtration can cause you to get less than stellar throughput.

DID YOU KNOW?

TO FILTER OR NOT TO FILTER?

THE CLOUDY CIDER DILEMMA

The degree to which finished cider is clarified is a stylistic choice but it significantly impacts how microbial stability is achieved. The goal of filtration is two-fold: it achieves both clarity and microbial stability. Cloudy ciders are generally not filtered, however, they should be stabilized so that refermentation or microbial spoilage does not detract from the quality and negatively impact sensory characteristics. VELCORIN is an excellent choice to stabilize ciders that will not undergo sterile filtration (see pg 62).

ARTICLE

METHODS OF CIDER FILTRATION

TYPES OF FILTER MEDIA:

Filtration media can generally be categorized into two types: depth media and membrane (surface) media.

Depth Media

Depth media has a high dirt or solids holding-capacity and retained solids are trapped in the media itself. Depth media comes in a range of porosities, but the pore size rating is nominal (represents an average pore size). **Depth media is most appropriate for initial filtrations for clarity and decreased solids in preparation for sterile filtration.**

Membrane (surface) Media

Membrane media does not trap solids, has a very low solids holding-capacity, and can be easily fouled by solids. However, its pore size rating is absolute (can be relied upon to exclude any solids larger than its pore size), making it ideal for removing unwanted microorganisms. In other words, **membrane media is the best choice for sterile filtration.**

COMMON TYPES OF FILTRATION FOR CIDER:

Sheet Filtration/Plate & Frame (depth media)

Sheet filters are depth filters made from cellulose, diatomaceous earth (DE) and other materials to achieve various properties depending on their intended use. These sheets are commonly positioned between plates in a frame, with the number, size, and type of sheets configured for the desired throughput and product clarity. Sheet filtration is typically used for yeast and solids removal prior to color and aroma removal and sterile filtration. This type of filtration is highly flexible and is useful for smaller production batch sizes but is labor intensive and has relatively high losses of product and media. Although still relevant, filtration technology has progressed such that other types of filtration that use the same principle are more efficient (lenticular filtration).

Lenticular Filtration (depth media)

Lenticular filters are essentially sheet filters (see previous filtration type) that are pre-configured in a stacked-disc module and housed in a closed system. In comparison to plate and frame filtration, lenticular filtration is user-friendly, re-usable, has lower product loss, has a smaller footprint, can be heat sanitized, and comes in a wide range of porosities and materials making the system highly flexible.

Pressure Leaf Filtration (depth media)

Pressure leaf filters are a type of depth filtration wherein DE or other depth media (perlite) cakes are formed on filter leaves. Unfiltered product enters the filter and passes through the cake which retains the solids. While this equipment is common in many breweries, this type of filtration has fallen out of favor in recent years due to environmental issues with spent cake material and the complexity of building the cake. It is also labor intensive and difficult to get consistent outcomes.

Cartridge Filtration (depth and membrane media)

Cartridges are tubular, modular filters that are inserted into a housing. Cartridge media comes in a variety of depth and membrane types and porosities. Cartridge membrane filters are commonly used for sterile filtration due to an absolute pore size rating and ability to be integrity tested. This high precision filtration method is a popular choice due to its ease of integration into production lines and ability to withstand higher system pressures making it suitable for in-line packaging operations.

Crossflow Filtration (specific membrane media)

Crossflow filters separate yeast and solids by passing a liquid tangentially across a membrane surface, rather than into the membrane. Retained solids are removed by tangential motion which prevents fouling of the membrane and increases throughput. Crossflow filtration is an excellent choice for continuous filtration of large volumes of liquids containing relatively high solids content. It is most suitable for large operations desiring automation and the ability to filter product in one pass, producing a brightly polished product this is ready for final stabilization at packaging.

FILTRATION EQUIPMENT AND MEDIA

CARTRIDGE FILTRATION

SCOTTCART Cartridge Filter Housings

Depth filter cartridge

Scott Laboratories sanitary cartridge filter housings are made of electropolished 316L stainless steel, which ensures strength, corrosion resistance, improved cleanability and excellent chemical compatibility. Features include:

- Available in 30"
- Available in sizes to accommodate 1–12 filter cartridges at a time
- Compatible with 10", 20", or 30" code 7 cartridges due to the T-style adapter.
- "T-style" flow pattern
- Drain and vent ports allow for complete and easy drainage of the vessel
- Gauges and fittings included

SCOTTCART PreMembrane PP

Depth filter cartridge (maximum production efficiency)

The SCOTTCART PreMembrane PP cartridges were optimized for the wide range of prefiltration, especially for the rentention of particles from beverages and water. SCOTTCART PreMembrane PP filter cartridges combine multiple layers of progressively finer pleated polypropylene depth filter material.

The SCOTTCART PreMembrane PP cartridges come in 0.65, 1.2, 3, 5, 10, 20, 30 and 50 micron porosities.

SCOTTCART PreMembrane GF

Pre-fiter cartridge

These 30", 0.5u, code 7 and code 8, glass fiber cartridges can be used for clarification, stabilization and bio burden reduction.

They are optimized for the protection of downstream membrane filter systems and clarification. Due to their high adsorptive power by glass micro fiber, they are the ideal solution for removal of charged colloids from difficult to filter beverages like cider.

SCOTTCART Membrane PES

Final filter cartridge (maximum security)

The SCOTTCART Membrane PES filter cartridges are pleated membrane filter cartrdiges with a single layer asymmetrical polyethersulfone membrane inside. The Membrane PES has been especially designed for the filtration of cider, wine, and sparkling wine, prior to bottling.

The SCOTTCART Membrane PES comes in 0.45 and 0.65 micron porosities with the highest retention ratings and total throughputs.

CROSSFLOW FILTRATION

VLS TMF Filter

A versatile and scalable crossflow setup for medium to large producers

Originally developed for wine clarification, the VLS TMF offers compactness, ease of operation and high quality filtration. The concept behind the Crossflow system is "Set and Forget" and this is exactly what the TMF delivers. Automated cycles for filtration and cleaning allow the unit to virtually run without the need for an operator. The savings on filtrations are not limited to labor as media costs are also minimized compared to pad or D.E filtrations.

The VLS TMF also allows for future growth with a modular design which allows for additional filter elements to be added at a later date.

Units in standard production include 3, 6, 9, 12, 24, 36, 48 and 60 element designs, with each filter element having the equivalent of 10 m^2 of filtration surface.

VLS UNICO Filter

The all-in-one filtering solution for small and medium producers

The UNICO filter is designed for small/medium manufacturers needing to filter both cider and lees with a "single" solution, obtaining a filtered product of excellent quality with a turbidity below 1NTU. The VLS UNICO delivers a single pass solution utilizing organic membranes to filter settled product and sintered stainless steel membrane material to filter lees from the bottom of the same tank. A finished product from the filtration of both settled cider and lees is brilliant, bright, and filtered to 0.2µm.

VLS LEES-STOP Filter

A specialized crossflow for lees filtration and recapture

This crossflow filter, specifically designed for the treatment of tank bottom lees, is equipped with stainless steel membranes that can handle fining agents (bentonite & carbon) with ease. The unit is constructed of sintered stainless steel which provides characteristics to handle high temperature cleaning (steam) along with high pressure and chemicals. Tank bottom lees are filtered through a series of 2 to 8 membranes each of which have 7.5m^2 of surface area and porosity of 0.2µm. The process of the filter can be handled completely automatically, without the need of an operator.

LENTICULAR FILTRATION

Scott Labs Lenticular Housings

Scott Laboratories lenticular filter housings filter without product loss due to an enclosed design. The filter requires less space than a standard plate filter due to its vertical design, and is simple to set up and break down. Housings can be loaded with as few as one module, and modules can be backflushed and resused multiple times if using Pall SupraDisc II modules. Features include:

- Material in 316L stainless steel, sanitary construction with electro polish
- Equipped with sanitary pressure gauges, two butterfly valves and fittings
- Vent valve and drain included with the housing
- A 12" 3-high lenticular housing can hold the equivalent of almost 36 40x40 filter sheets
- Available in 12" and 16" sizes from 1 to 4 module stacks.

SEITZ® K Series SUPRADISC II Lenticular Modules

With 13 different grades of permeability, the K series modules represent Pall's standard depth filter series. These sheets consist of a cellulose matrix with very fine kieselguhr (diatomaceous earth or DE) mixtures and perlite, as filtration-active substances. The K series modules are used for a wide range of very fine to coarse filtration in many food and beverage applications, including prefiltration of juice concentrate, polishing filtration, and prefiltration of juice prior to the final membrane filtration.

SEITZ® ZD Series SUPRADISC II Lenticular Modules

The SUPRADISC II ZD filter media is made of 100% pure cellulose fiber matrix material, without any use of diatomaceous earth (DE) or Perlite.

The SUPRADISC Zero-DE (ZD) Series brings a 100% cellulose depth filter sheet matrix to Pall's excellent SUPRADISC II design. Featuring a patented Inside/Outside Separator Technology that differentiates from classic stacked-disc lenticulars in their filtration and handling characteristics.

SUPRADISC II ZD filter modules are available in 4 grades which are suitable for microbial reduction, fine filtration and clarifying filtration passes.

SEITZ® K Series Depth Filter Sheets

SEITZ K Series depth filter sheets were developed to meet the entire range of removal requirements in the food and beverage industry. From the selection and quality control of raw materials to application of the latest production technologies, the K Series filter sheets meet the highest quality standards. K Series filter sheets are available in multiple grades suitable for microbial reduction and applications requiring fine, clarifying and coarse filtration. This includes haze removal and filtration after stabilization, as well as prefiltration of juice prior to the final membrane filtration.

SEITZ® ZD Series Depth Filter Sheets

These sheets are made of 100% pure cellulose fiber matrix material, without any use of diatomaceous earth (DE) or Perlite. ZD filter sheets have been designed to give excellent filtration performance while respecting cider quality at the highest level.

The SEITZ ZD flat filter sheets consist of fibrillated pure cellulose fibers and are produced without the use of any inorganic material such as DE or Perlite. SEITZ ZD filter sheets are available in multiple grades suitable for microbial reduction as well as fine and clarifying filtration.

VLS Plate & Frame Setup

Scott Labs offers plate and frame filter setups by special order only.

ARTICLE

SELECTING DEPTH FILTER MEDIA GRADE USING TURBIDITY

Choosing the right filter grade media to start your initial filtration can sometimes be a head scratcher. Start too coarse and you may be wasting your time and filter media. Start too tight and you may deal with frustrating premature fouling. The best way to ensure a successful filtration is to run a filterability test, though measuring turbidity can help estimate the appropriate filter media grade for your product.

Turbidity and filterability are not the same.

Turbidity quantifies how easy it is for light to pass through a liquid and is a measure of how "cloudy" it is. Turbidity is measured in NTU (nephelometric turbidity units), and a nephelometer or turbidity meter is needed for measurement.

Many components can contribute to the turbidity of a liquid such as yeast, bacteria and amorphous or crystalline material that is a result of fermentation or additives like bentonite and other fining agents. **Filterability** is a measure of how easy it is for your product to pass through your selected filter media grade.

Turbidity and filterability do not strongly correlate.

Many compounds (colloids) are too small to contribute to turbidity readings but do impact filtration and can clog media; however, if a cider has been properly pre-treated for colloidal instabilities, turbidity can be used to help approximate appropriate filter media grade.

The following turbidity chart is a useful way to gauge what may be an appropriate starting grade. It is also recommended to measure turbidity after each filtration pass to gauge whether the filtration was effective (no bypass, etc.) and to determine if subsequent filtration is required and at what grade.

TURBIDITY AND FILTER MEDIA GRADE CHART

SEITZGRADE	TURBIDITY	GRADE	AVERAGE PARTICLE HOLDING SIZE	BIOLOGY	STEP DOWN TO LIMIT
PERMADUR S	< 200 NTU	Coarse	15 µm	Lees	K700
K900	< 100 NTU	Coarse	9-10 µm	Yeast	K300
K800	< 80 NTU	Coarse	7-8 µm	Yeast	K250/ZD 25
K700	< 60 NTU	Medium	5-7 µm	Yeast	K200
K300	12-35 NTU	Medium	3-4 µm	Yeast	KS80/ZD 08
K250 or ZD25	10-20 NTU	Bright Polish	2.5 µm	Yeast	KS50
K200	1-15 NTU	Bright Polish	2 µm	Yeast	EK/ZDEK
K150	1-10 NTU	Fine	1.5 µm	Yeast	EK/ZDEK
K100 or ZD10	1-7 NTU	Fine	1 µm	Yeast	EK1
KS80 or ZD08	1-5 NTU	Microorganism Reducing	0.8 µm	Yeast	EK1
KS50	1-4 NTU	Microorganism Reducing	0.5 µm	Yeast/bacteria	EKS/Membrane PES 0.45 µm
EK or ZDEK	1-3 NTU	Microorganism Reducing	0.45 µm	Yeast/bacteria	EKS/Membrane PES 0.45 µm
EK1	< 1 NTU	Microorganism Reducing	0.35 µm	Yeast/bacteria	Membrane PES 0.45 µm
EKS	< 1 NTU	Microorganism Reducing	0.25 µm	Yeast/bacteria	Membrane PES 0.45 µm

**Please note that this chart is based on cellulose-based depth filter media like filter sheets and lenticular modules. Cartridge pre filters do not belong in the same category as their dirt holding capacity for the same surface area is significantly lower. We only recommend prefilter cartridges for batches of under 100 gallons when used as the main depth filter.*

GENERAL TOOLS & CONVERSIONS

VOLUME CONVERSIONS mL = milliliter, fl oz = fluid ounce, gal = gallon, L = liter, hL = hectoliter
1 mL = 0.035 fl oz
1 fl oz = 30 mL
1 L = 1000 mL
1 L = 0.2642 gal
1 gal = 3785 mL
1 gal = 3.785 L
1 hL = 100 L
1 hL = 26.4 gal

MASS CONVERSIONS mg = milligram, g = gram, kg = kilogram, lb = pound
1 kg = 1000 g
1 kg = 2.205 lb
1 g = 1000 mg
1 lb = 453.6 g
1 lb = 0.4536 kg
1 metric ton = 1000 kg
1 metric ton = 2205 lb
1 US ton = 2000 lb
1 US ton = 907 kg

INTERNET CONVERSION PROGRAMS

onlineconversion.com	wineadds.com	winebusiness.com/tools

TEMPERATURE CONVERSIONS

F° = Degree Fahrenheit C° → F° = (C° x 9/5) + 32	F°	0	32	40	50	60	70	80	90	100	110	120
C° = Degree Celsius F° → C° = (F° - 32) x (5/9)	C°	-18	0	4	10	16	21	27	32	38	44	49

OTHER CONVERSIONS

1 lb/1000 gal = 454 g/1000 gal = 0.454 kg/1000 gal = 120 mg/L = 27.2 g/barrel* = 0.120 g/L
1 kg/hL = 1000 g/hL = 10,000 mg/L = 2.271 kg/barrel* = 10 g/L
1 ppm = 1 mg/L
*barrel = 60 gal = 227.1 L
1°Brix = 1% sugar (wt/vol)

**Standard barrel size is 60 gallons. 59 and 70 gallon barrels are also common and sometimes the three are not visually distinct in size.*

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