



CELEBRATING A DECADE OF THE SCOTT LABORATORIES CIDER HANDBOOK

Welcome to the 2024 edition of the Scott Laboratories Cidermaking Handbook! This year marks a milestone as we celebrate ten years of publishing a handbook especially for cider producers. After many years of attending CiderCon and working with the cidermaking communities throughout the US, we feel more than ever that this community is a vibrant, enthusiastic, and close-knit one, and we are honored to be a part of it.

As always, we take immense pride in delivering exceptional products, 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.

We look forward to connecting with you, whether it's in person, over the phone, or by drinking your cider! We are privileged to join you on your journey of crafting extraordinary ciders and are here to help unlock the full potential of your creations.

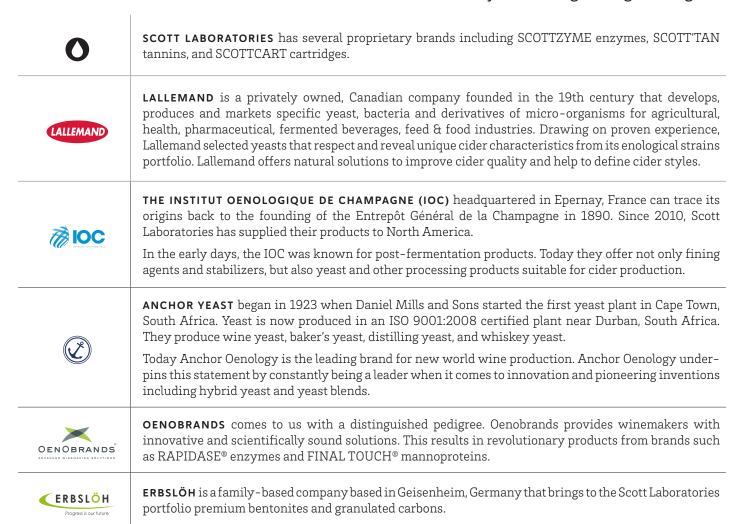
We are deeply grateful for your continued trust and support, and we raise our glasses to the next ten years and beyond. Here's to a fruitful (and flavorful) future!

Cheers,

The Scott Labs Team

SUPPLIERS

At Scott Laboratories, our mission is to advance the long-term success of the specialty beverage industry by providing best-in-class products and services. The suppliers we work with share our mission and reflect our values of education, honesty, and doing the right thing.



Vendor Notice: The information in this booklet is, to the best of our knowledge, true and accurate. The data and information, however, are not to be considered as a guarantee, expressed or implied, or as a condition of sale of our products. Furthermore, it is understood by both buyer and vendor that cider is a natural product. Circumstances such as fruit qualities and cellar conditions are infinitely variable. It is the responsibility of the buyer to adapt the use of our products to such circumstances. There is no substitute for good cidermaking practices or ongoing vigilance.

Please Note: Trade of alcoholic beverages between the United States, Canada and other nations and/or trade blocs (such as the European Community) may involve

restrictions. In particular these may involve proscription or limitation on the allowable levels of certain ingredients in fermentation aids, fining agents or stabilization products. To the best of our knowledge, all products described in this handbook when used as directed herein are legal for use in cider made in, and sold in, the United States. Conditions of trade with other nations and trade blocs are subject to ongoing change beyond the control of Scott Laboratories, Inc. It is the responsibility of users of our products to be informed of current restrictions of other countries or trade blocs to which they export to and to use only products and product levels which conform to those restrictions.

CONTENTS

2024/2025 New Products for Cider5
The Cidermaking Process and Where We Can Help $6-9$
YEAST10-29
Quick Guide to Choosing A Yeast Strain12-13
ARTICLE Optimize Cider Aroma
Through Yeast Selection
Saccharomyces Yeast Product Descriptions 15-21
PROTOCOL Yeast Rehydration with GO-FERM STEROL FLASH™
PROTOCOL Yeast Rehydration with GO-FERM™ & GO-FERM PROTECT EVOLUTION™ 23
DID YOU KNOW? Why You Should Inoculate at 25 g/L . 24
What's So Cool About Non-Saccharomyces Yeast? 25
Quick Guide to Choosing Non-Saccharomyces Yeast 26
Non-Saccharomyces Yeast Product Descriptions 27-28
PROTOCOL Non-Saccharomyces Yeast Rehydration29
YEAST NUTRIENTS
Quick Guide to Choosing Yeast Nutrients
and Derivatives
DID YOU KNOW? Why We Recommend
Staged Nutrient Adds
Yeast Nutrients and Derivatives
Product Descriptions
DID YOU KNOW? Understanding YAN vs. YAN Equivalents
ARTICLE The Importance of
Yeast Rehydration Nutrients
PROTOCOL Develop a Yeast Nutrition Plan
ARTICLE Oxidative Damage: Process & Prevention . 40-41
TANNINS
Tannin Product Descriptions
ARTICLE Unlocking the Full Potential of Culinary Apples: Elevate your Cider with Tannins

ENZYMES AND FINING50	0-59
ARTICLE Cider Clarification 101	51
Enzymes5	2-55
Quick Guide to Choosing Enzymes	52
Enzyme Product Descriptions	3-55
DID YOU KNOW? Not All Pectinases are the Same.	55
Fining and Stability5	6-70
Fining & Stability Agents In Juice and Cider	. 56
PROTOCOL Best Practices For Settling With Fining Agents	57
Quick Guide to Choosing Fining & Stability Agents 5	8-59
Fining and Stability Product Descriptions	0-69
ARTICLE Replacing Allergenic and Animal-Based Fining Agents	70
MICROBIAL CONTROL AND CLEANING	
ARTICLE Overcoming Common Cider Sensory Deviations	
Quick Guide to Choosing Microbial Control Agents	
Microbial Control Product Descriptions	
VELCORIN®	
ARTICLE Preventing Microbial Issues Without SO ₂ . 8	
FILTRATION SUPPLIES8	6-92
Pre-filtration Steps for Success	87
DID YOU KNOW? To Filter or Not to Filter?	
The Cloudy Cider Dilemma	
ARTICLE Methods for Cider Filtration	
Filtration Product Descriptions	
ARTICLE Selecting Filter Media Grade via Turbidity	92
HOW TO ORDER	93
NDEX	94

2024/2025 NEW PRODUCTS FOR CIDER

Yeast

1895C



The Sleeping Beauty Yeast for clean crisp ciders

In June 2008, on the beautiful shores of Lake Zurich, Swiss winemakers got together to taste wines made from the almost extinct white cultivar Räuschling. The oldest of these wines dated back to the 1895 vintage! During the tasting, a prominent microbiologist, Professor Gafner, from the Agroscope-Changins Wädenswil research station was present. His curious nature led him to examine the sediment in some of the oldest bottles. Imagine the excitement when he discovered that the sediment present in a bottle from 1895 was actually *Saccharomyces* yeast in its dormant form! Thus, the sleeping beauty yeast was born or rather awakened.

Yeast

SM102



Yeast for sweet and semi-sweet ciders

FERMIVIN SM102™ is a pure strain of *Saccharomyces* cerevisiae that produces delicate and floral ciders while respecting apple characteristics. SM102 is easily stopped by chilling to <55°F (13°C) or by alcohol levels beyond 12%, making it ideal for sweet and semi-sweet cider production.

Tannin

FT ROUGE BERRY



Tannin for rosé-style cider production

SCOTT"TAN FT ROUGE BERRY™ is a blend of condensed tannins from red berry plants that is well-suited to making rosé-style ciders. FT ROUGE BERRY can enhance watermelon, strawberry, and red apple aromas and can also help stabilize color.

Nutrient



Revolutionary rehydration nutrient for use with cool water

GO-FERM STEROL FLASH™ is a revolutionary new rehydration nutrient that allows yeast to be rehydrated with cool water, bypassing the need for acclimatization and significantly shortening the yeast rehydration process. GO-FERM STEROL FLASH is also optimized with respect to the quantity and quality of micronutrients and sterols it provides, contributing to maximal yeast vitality, sustained fermentative power, and aroma production.

Tannin

RICHE EXTRA



Tannin for imparting smoothness and rich oak characters

SCOTT'TAN RICHE EXTRA $^{\text{TM}}$ is a tannin derived from 100% toasted American oak that is well-suited for barrel-aged style ciders. RICHE EXTRA elevates aromatic complexity, heightens the perception of vanilla and coconut, and contributes to mid-palate structure and a smooth finish.

Enzymes & Fining

FINAL TOUCH MANNOPROTEINS



Mannoproteins for colloidal stability and "last minute" adjustments

FINAL TOUCH POP™, FINAL TOUCH TONIC™, and FINAL TOUCH GUSTO™ are a line of specialized liquid mannoproteins that improve the quality and stability of ciders. They can be added prior to final filtration to enhance colloidal stability, preserve freshness and aromas, and improve mouthfeel.

THE CIDERMAKING PROCESS...

1

Harvesting:

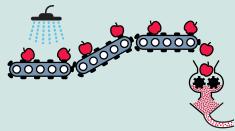
This initial step involves carefully picking and collecting apples from the orchard. The timing of the harvest is crucial, as the quality of the apples directly affects the final cider's flavor and aroma.



2

Milling:

Once harvested, the apples are milled, where they are crushed into a pulp. The milling process helps break down the apples into smaller pieces, allowing for easier juice extraction.



During milling certain **microbial control** products can be useful to control spoilage organisms.

3

Pressing:

The milled apple pulp is transferred to a press, where the juice is extracted. Pressure is applied to the pulp to squeeze out the juice, which is collected for further processing.

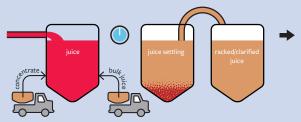


During pressing, **enzymes** can help increase juice yields and improve settling in the next few steps.

4

Juice Settling & Racking:

Whether using freshly-pressed juice, bulk juice, or juice concentrate, settling is an important step to remove solids or other undesirable compounds. These particles fall to the bottom of the vessel and the clear juice is carefully racked off the sediment and transferred to a new vessel.

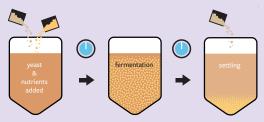


During juice settling, **fining agents** bind solids and other undesirable compounds, **enzymes** break down juice compounds (like pectin) that inhibit settling, **microbial control** products help control spoilage organisms, and certain **nutrients** and **tannins** help prevent oxidation.

5

Fermentation:

The clear apple juice is now ready for fermentation. Yeast begin the biological conversion of sugars into alcohol and aroma compounds. This process can take anywhere from a few days to several weeks.



Beyond the obvious (Saccharomyces yeast and fermentation nutrients), at this stage non-Sacc yeast can also enhance aroma and complexity, and yeast derivative nutrients added at the end of fermentation can help prevent oxidation.

...AND WHERE WE CAN HELP

6

Post-Fermentation:

After fermentation, cider is at risk for oxidation and microbial spoilage. This is because yeast are no longer producing carbon dioxide (which pushes oxygen out of solution), and are no longer outcompeting spoilage organisms. These concerns should be addressed immediately post-fermentation.



Microbial control products, **tannins**, and **fining agents** can help prevent these issues.

7

Fining, Stabilization, & Finishing:

In this stage, there are several different processes that can help prepare the cider to be shelf-stable and free of visual and sensory deviations. This includes further fining and clarification, removal of off-odors and flavors, and addition of products for colloidal and/or microbial stability.



Much like during juice settling (step 4), **fining agents** and **enzymes** can help remove solids and other undesirable compounds. **Tannins** and **mannoproteins** can be added as last minute adjustments to enhance stability, flavor, aroma, and texture.

8

Filtration & Packaging:

Cider is often sterile filtered on the packaging line to remove yeast and bacteria. This helps prevent refermentation in package and minimizes the risk of developing other sensory and visual flaws. Getting through a sterile membrane filter often requires some pre-filtration steps which can be achieved via multiple filtration methods.



In addition to filtration, other **microbial control** products (including Velcorin®) can be used to prevent refermentation and spoilage in the package.



See next page for more specific product recommendations



THE CIDERMAKING PROCESS...

STAGE OF PRODUCTION	GOAL	ACTION		
MILLING/	Control spoilage organisms	Add antimicrobial agent		
PRESSING	Increase yield	Add enzymes		
	Control spoilage organisms	Add antimicrobial agent		
SETTLE/RACK JUICE	Protect aromas and color	Add antioxidant		
,5.52	Reduce solid content for cleaner fermentation	Add enzymes		
	Accelerate juice settling, compact lees, and remove undesirable compounds	Add fining agents		
	Enhance aroma complexity	Add non-Saccharomyces yeast		
	Protect yeast and enhance fermentation kinetics	Add rehydration nutrient		
FERMENTATION	Reliably and efficiently complete alcoholic fermentation without fermentation problems or production of off-aromas and flavors	Add yeast Use a strain that will be compatible with juice chemistry and cider style. See individual strain descriptions for temperature recommendations		
		Add fermentation nutrient at onset of fermentation		
		Add fermentation nutrient at 1/3 fermentation		
	Protect aromas and color	Add antioxidant		
	Protect aromas and color	Add antioxidant		
POST- FERMENTATION	Enhance cider style	Add tannins		
	Control spoilage organisms	Add antimicrobial agent		
	Reduce solid content via clarification for improved aromas, yield, and filtration throughput	Add enzymes		
	Reduce Solid Content via clarification for improved aromas, yield, and illitiation tilloughput	Add fining agent		
FINING, STABILIZING, &	Remove negative sensory compounds that mask aromas and negatively impact mouthfeel	Add product to remove off-odors, including sulfur off-odors		
FINISHING	Treat oxidation and oxidative damage	Addicionand		
	Remove undesirable color	Add fining agent		
	Enhance cider style	Add tannins		
	Enhance cider style	Add tannins		
PRE-PACKAGING	Confer colloidal stability	Add stability agents		

...AND WHERE WE CAN HELP

BOOST YOUR FRUIT	CLEAN AND CRISP	SUPERCHARGE MOUTHFEEL AND STRUCTURE	NO/LOW SULFUR DIOXIDE							
	Sulfur Dioxide, LYSOZYME, BACTILESS, INITI	A	LYSOZYME, BACTILESS, INITIA							
	SCOTTZYME HC + SCOTTZYME PEC5L									
	LYSOZYME, BACTILESS, INITIA									
FT BLANC CITRUS, GLUTASTAR, Sulfur Dioxide										
Cold Juices <43-50°F: RAPIDASE	CLEAR EXTREME, Difficult to Settle Juic	es: SCOTTZYME KS, General Purpose: SC	OTTZYME HC + SCOTTZYME PEC5L							
	NACALIT PORE-TEC, QI'U	JP XC, INOCOLLE, NO[OX]								
FLAVIA, BIODIVA	LAKTIA	BIODIVA	FLAVIA, BIODIVA, LAKTIA							
	GO-FERM PROTECT EVOLUTION	ON or GO-FERM STEROL FLASH								
58W3, 71B, ALCHEMY I, CVW5, ICV D47, ELIXIR, NT116, RHONE 4600, VIN 13	1895C, DV10, QA23, W15	BAII, CROSS EVOLUTION, ICV D21, R-HST	ICV OKAY, ICV OPALE 2.0, IOC BE FRUITS, or any other non-H ₂ S strain LOW H ₂ S and SO ₂							
	For a full list of yeast strains suitable	for each style see chart on page 12-13								
	FERM	IAID O								
STIMULA CHARDONNAY	FERMAID O or FERMAID K	STIMULA CHARDON	NNAY or FERMAID O							
	OPTI-WHITE	or NOBLESSE								
ESSENTIAL	ANTIOXIDANT, PURE-LEES LONGEVITY, Su	lfur Dioxide	ESSENTIAL ANTIOXIDANT, PURE-LEES LONGEVITY							
FT BLANC CITRUS	FT BLANC, FT BLANC CITRUS	FT BLANC, FT BLANC SOFT	Choose based on style							
Sulfur	Dioxide, LYSOZYME, BACTILESS, NO BRETT	INSIDE	LYSOZYME, BACTILESS, NO BRETT INSIDE							
	SCOTTZYME KS, SCO	OTTZYME SPECTRUM								
	NACALIT PORE-TEC, QI'U	JP XC, CRISTALLINE PLUS								
	FT BLANC, BENTOLACT	S, INOCOLLE, REDULESS								
BE	NTOLACT S, CASÉINATE DE POTASSIUM, FR	RESHPROTECT, POLYCACEL, POLYCEL, NO[C	DX]							
	GRANUCOL	FA, POLYCEL								
	FT BLANC SOFT, FT BLANC CITRUS, RICHE EXTRA									
	RADIANO	CE, ROYAL								
FINAL TOUCH GUSTO, FINAL TOUCH TONIC	FINAL TOUCH TONIC, FINAL TOUCH POP	FINAL TOUCH GUSTO, FLASHGUM R LIQUIDE, ULTIMA SOFT	Choose based on style							



Celebrating Over 90 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 can do so much more! At Scott Labs, our mission is to provide robust and reliable yeast strains that optimize quality, aromas, and flavors.

SELECTING YEAST FOR SUCCESS

Every cider fermentation is different. 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.

Yeast should be selected in two steps:

STEP 1. Identify	which ve	ast strains are	compatible with	fermentation	conditions
31EF I. IUCIIUIV	WILL VE	asi silallis ale	COIIIDAUDIE WIUI	iei illelitation	COHUIUIII

POTENTIAL ALCOHOL	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 <i>Saccharomyces</i> yeasts can only ferment glucose and fructose.
TEMPERATURE	Yeast strains vary in their temperature tolerances. Yeast will become stressed if fermenting at the upper or lower end of the recommended range. If temperature can't be controlled, choose a yeast with a large temperature range. When working with high potential alcohol fermentations, lower fermentation temperatures are recommended.

STEP 2: Compare the sensory impact of compatible yeast strains

AROMA, FLAVOR, & MOUTHFEEL 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 14). Certain strains also produce polysaccharides and other compounds increasing mouthfeel. Select yeast with traits best suited for your intended cider style.
AVOIDING HYDROGEN SULFIDE (H ₂ S) & 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 no (or very little) H ₂ S, even under stressful conditions. Look for the Low H,S and SO ₁ in the yeast descriptions to identify these strains.

SELECTING A YEAST STRAIN

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

See pgs 6	5-9 for	suggestions	to	achieve
different	cider st	tyles.		

See pgs 12-13 for our yeast choosing chart which compares yeasts' fermentation characteristics and sensory parameters.

See pgs 15-28 for detailed descriptions of each yeast.

QUICK GUIDE TO CHOOSING A YEAST STRAIN

							Saccha	romyces	5					
Recommended ŏ	58W3	71B	1895C NEW	ALCHEMY I	BA11	CROSS EVOLUTION	CVW5	DV10	EC1118	ELIXIR	EXOTICS MOSAIC	ICV D21	ICV D47	ICV OKAY
Page	15	15	15	15	16	16	16	16	17	17	17	17	18	18
S. cerevisiae cerevisiae	ŏ	ŏ	ŏ		ŏ							ŏ	ŏ	
S. cerevisiae bayanus							ŏ	ŏ	ŏ					
Yeast hybrid						ŏ				ŏ	ŏ			ŏ
Yeast blend				ŏ										
Non-Saccha- romyces yeast														
Sensory Impact - Clean & Crisp			ŏ					ŏ	ŏ					
Sensory Impact - Fruity Esters	ŏ	ŏ		ŏ	ŏ	ŏ	ŏ			ŏ	ŏ	ŏ	ŏ	ŏ
Sensory Impact - Floral Esters	ŏ			ŏ	ŏ	ŏ				ŏ			ŏ	
Sensory Impact - Mouthfeel	ŏ				ŏ	ŏ				ŏ	ŏ	ŏ	ŏ	
Low to No H2S Production														ŏ
Alcohol Toler- ance (% v/v)	14	14	15	15.5	16	15	15	17	18	15	15.5	16	15	16
Temperature Tolerance (°F)	54-77	59-85	60-89	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	moderate	fast	moderate	moderate	fast	fast	fast	wols	moderate	moderate	moderate	moderate

QUICK GUIDE TO CHOOSING A YEAST STRAIN

Saccharomyces										No	n-Sacci	haromy	ces		
ICV OPALE 2.0	IOC BE FRUITS	K1 (V1116)	NT 116	QA23	R2	RHÔNE 4600	R-HST	SENSY	SM102 NEW	VIN 13	W15	BIODIVA	FLAVIA	INITIA	LAKTIA
18	19	19	19	20	20	20	20	21	21	21	21	27	27	28	28
		ŏ				ŏ	ŏ		ŏ		ŏ				
				ŏ	ŏ										
ŏ	ŏ		ŏ					ŏ		ŏ					
												ŏ	ŏ	ŏ	ŏ
ŏ	ŏ	ŏ	ŏ	ŏ	ŏ	ŏ		ŏ	ŏ	ŏ		ŏ	ŏ		
		ŏ		ŏ	ŏ				ŏ	ŏ			ŏ		
ŏ			ŏ			ŏ	ŏ	ŏ			ŏ	ŏ			
ŏ	ŏ							ŏ							
14	14	18	16	16	16	15	15	15	12	17	16	6	3	3	7
59-86	54-75	50-95	54-83	59-90	50-86	56-72	50-86	54-64	61-72	54-61	50-81	>61	59-71	39-64	57-82
moderate	moderate	fast	fast	fast	moderate	moderate	moderate	moderate	moderate	fast	moderate	mildly fermentative	non-fermentative	non-fermentative	mildly fermentative

SACCHAROMYCES YEAST

ARTICLE

OPTIMIZE CIDER AROMA THROUGH YEAST SELECTION

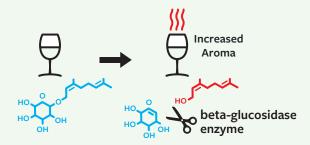
Cider aroma compounds originate either from apples or are produced by yeast during alcoholic fermentation. Yeast selection has a strong influence over the expression of both of these categories of aroma compounds.

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.

Esters are released from apples in an odor-active form, while terpenes are released into juice as odorless. However, some yeast have enzymes that can convert terpenes into their odoractive form. Yeast strains differ in how much of these enzymes (beta-glucosidase) they produce, and therefore how effective they are at converting these compounds. Some non-Saccharomyces yeasts also have this enzymatic ability.

Enzymatic Release of Terpenes from Sugars

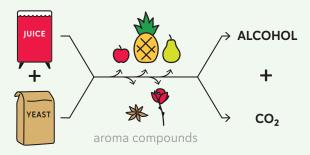


AROMAS DERIVED FROM YEAST

Not only are esters present in apples, esters are also produced by yeast during fermentation enhancing floral and fruity aromas.

There are two main classes of esters produced by yeast: acetate esters and ethylesters. The amount and type of esters produced and their relative ratios will vary depending on the genetic background of the yeast, the precursors present, and the fermentation conditions.

Ester Production by Yeast



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 pgs 6-9 for suggestions to achieve different cider styles.

See pgs 12-13 for our yeast choosing chart which compares yeasts' fermentation characteristics and sensory parameters.

See pgs 15-28 for detailed descriptions of each yeast.

58W3



Spicy, fruity, and well-balanced ciders

Alcohol Tolerance: 14%

Nitrogen Needs: Medium

Temp. Range: 54-77°F

500 g #15630 10 kg #15631 VITILEVURE $58W3^{\text{TM}}$ produces high levels of beta-glucosidase enzymes which increases classic apple and spicy aromas.

- Ciders are well balanced with well-integrated acidity
- Moderate fermentation rate, relatively cold tolerant, and low hydrogen sulfide $(H_{\circ}S)$ and foam production
- Saccharomyces cerevisiae cerevisiae strain
- Isolated by the National Research Institute for Agriculture, Food and the Environment (INRAe) in Alsace, France

71B



Enhances fruity characters and degrades malic acid

Alcohol Tolerance: 14%

Nitrogen Needs: Low

Temp. Range: 59-85°F

500 g #15059 10 kg #15078 LALVIN 71B[®] is known for producing fruity and floral ciders with long-lived aromas due to the synthesis of stable esters and higher alcohols.

- Produces stable fruity and floral (rose) aromas
- Softens mouthfeel by metabolizing malic acid and absorbing tannins onto the yeast cell wall
- Saccharomyces cerevisiae cerevisiae strain
- Isolated and selected by National Research Institute for Agriculture, Food and the Environment (INRAe) in Narbonne, France

NEW <

1895C



The sleeping beauty yeast for clean crisp ciders

Alcohol Tolerance: 15%

Nitrogen Needs: Low Temp. Range: 60-89°F

500 g #15655

1895C was isolated from a bottle of Räuschling (white) wine made in 1895.

- This strain is suitable for most cider types where clean, pure aromatics are desired
- Steady fermenter with a short lag phase
- · Low volume of lees due to smaller cell size
- Low foaming strain with very low production of volatile acidity and ${\rm H_2S}$
- Saccharomyces cerevisiae cerevisiae strain

ALCHEMY I



Intensely fruity and floral ciders

Alcohol Tolerance: 15.5%

Nitrogen Needs: Medium

Temp. Range: 56-61°F

1kg #15174

ALCHEMY I is a complementary blend of yeast strains that produce high levels of esters, resulting in intensely fruity and floral ciders.

- · High aroma production which can be useful in relatively neutral apples
- Fast fermenter with low foam production
- Temperature control is advised and barrel fermentations should be avoided
- Blend of Saccharomyces cerevisiae wine yeast strains
- Developed in collaboration with the Australian Wine Research Institute (AWRI), Australia

BA11



Strong fermenter for aromatic complexity and mouthfeel

Alcohol Tolerance: 16%

Nitrogen Needs: High

Temp. Range: 59-77°F

500g #15117

LALVIN BA11™ promotes clean aromatic characteristics with subtle notes of spice, orange blossom, pineapple, and apricot, making it suitable for relatively neutral varietals or culinary apples.

- Will release polysaccharides quickly with lees stirring, increasing mouthfeel softness and roundness
- Short lag phase and moderate fermentation vigor, low potential for H₂S production
- Saccharomyces cerevisiae cerevisiae strain
- Selected in 1997 near the Estação Vitivinicola de Barraida, Portugal

CROSS EVOLUTION



Strong fermenter for round, rich, aromatic ciders

Alcohol Tolerance: 15%

Nitrogen Needs: Low

Temp. Range: 58-68°F

500 g #15640 10 kg #15641 CROSS EVOLUTION $^{\circledR}$ increases fresh fruit and floral aromas, resulting in aromatic ciders.

- Increases mouthfeel for well-balanced ciders.
- Strong fermenter even under challenging conditions of high alcohol and low YAN
- · Saccharomyces cerevisiae cerevisiae hybrid
- From the Institute for Wine Biotechnology at the University of Stellenbosch, South Africa

CVW5



Fresh and fruity ciders under difficult fermentation conditions

Alcohol Tolerance: 15%

Nitrogen Needs: Low

Temp. Range: 57-82°F

500g #15237 10 kg #15210 CVW5 is a high producer of fruity aromas (esters) and a low producer of volatile acidity (VA) and sulfur dioxide (SO₂).

- Strong fermenter even under difficult conditions, including low turbidity, low temperatures, and low YAN
- Has the lowest nitrogen demand of all Lallemand Oenology yeast strains making it well suited for fermenting highly clarified juice, concentrates, or other YAN-deficient juices
- Saccharomyces cerevisiae bayanus strain
- Selected from the Lallemand Oenology yeast strain collection and is a close relative of LALVIN EC1118 $^{\circ}$ (pg 17)
- Must be stored at 39-52°F (4-11°C)

DV10



Strong fermenter for crisp, clean ciders

Alcohol Tolerance: 17%

Nitrogen Needs: Low

Temp. Range: 50-95°F

500 g #15062 10 kg #15106 LALVIN DV10 $^{\text{m}}$ 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).

- Recognized for its low foam, low VA, and very low H₂S and SO₂ production
- Saccharomyces cerevisiae bayanus strain
- French isolate from an area renowned for making sparkling wine

EC1118 (PRISE DE MOUSSE)



Sensory neutral fermenter

Alcohol Tolerance: 18%

Nitrogen Needs: Low

Temp. Range: 50-86°F

500 g #15053 10 kg #15076 LALVIN EC1118® is the original robust, low-foaming yeast strain that ferments cleanly and efficiently at low temperatures.

- Good flocculation characteristics resulting in compact lees
- Under deficient nutrient conditions, EC1118 can produce high amounts of ${\rm SO_2}$ (up to 50 ppm)
- Saccharomyces cerevisiae bayanus strain
- Selected by the Institut Oenologique de Champagne (IOC) in Epernay, France

ELIXIR



Increased floral and fruity aromas for aromatically intense ciders

Alcohol Tolerance: 15%

Nitrogen Needs: Medium

Temp. Range: 57-77°F

500g #15214

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

- Ciders show fruity and floral varietal aromas due to the release of bound terpenes and the production of stable esters
- Equally suitable for freshly pressed cider apples, or highly clarified juices
- Low SO₂, H₂S, and VA producer
- · Saccharomyces cerevisiae hybrid
- From the yeast hybridization program at the Institute for Wine Biotechnology at the University of Stellenbosch, South Africa

EXOTICS MOSAIC



Aromatically intense ciders suitable for aging

Alcohol Tolerance: 15.5%

Nitrogen Needs: Medium

Temp. Range: 64-83°F

250 g #15213 5 kg #15220 EXOTICS MOSAIC produces ciders with exotic aromas and flavors, and a well-balanced mouthfeel

- Ciders fermented with EXOTICS MOSAIC can take time to mature. Therefore, this yeast is an excellent choice for ciders destined for aging
- Do not inoculate into cold juice as this strain is not cold tolerant
- Can partially degrade malic acid
- Low VA and SO₂ production
- $\it Saccharomyces\ cerevisiae\ and\ S.\ paradoxus\ hybrid$
- Developed at the Institute for Wine Biotechnology at the University of Stellenbosch, South Africa
- Must be stored at 41-59°F (5-15°C)

ICV D21



Freshness and mouthfeel for mature apples

Alcohol Tolerance: 16%

Nitrogen Needs: Medium

Temp. Range: 61-86°F

500 g #15143 10 kg #15163 LALVIN ICV D21 $^{\$}$ can be used with ripe apples, developing stable fresh fruit aromas, higher perception of acidity, and a well-balanced mouthfeel.

- Equally suited for use in barrels or tanks
- Fast onset of fermentation, but can produce VA if stressed
- Saccharomyces cerevisiae cerevisiae strain
- Isolated from Languedoc by the Institut Coopératif du Vins (ICV), France

ICV D47



Aromatic and well-balanced barrel- or tank-fermented ciders

Alcohol Tolerance: 15%

Nitrogen Needs: Low

Temp. Range: 60-82°F

500 g #15642 10 kg #15643 LALVIN ICV D47[®] is a high polysaccharide and ester producing strain that can produce full-bodied, complex ciders with fruity and floral notes.

- Suitable for lees aging, where spicy notes can develop
- Stir and increase temperature to 63–68°F (17–20°C) at end of fermentation for a cleaner finish
- Suitable for both tank- and barrel-fermented ciders
- Saccharomyces cerevisiae cerevisiae strain
- Isolated from Suze-la-Rousse in the Côtes du Rhône region of France

LOW H

H₂S and SO₂

ICV OKAY



Strong fermenter and fruity ester producer

Alcohol Tolerance: 16%

Nitrogen Needs: Low

Temp. Range: 54-86°F

500 g #15221 10 kg #15222 LALVIN ICV OKAY $^{\otimes}$ is recommended for fresh and aromatic ciders with good fruit intensity.

- Especially suitable for ciders that struggle with H₂S and sulfur off-odors
- Very short lag phase, steady fermentation kinetics, and good fermentation security
- · Low production of acetaldehyde
- · Saccharomyces cerevisiae cerevisiae hybrid
- Selected in collaboration with the National Research Institute for Agriculture, Food and the Environment (INRAe), SupAgro Montpellier, the Institut Coopératif du Vin (ICV), and Lallemand Oenology

LOW

H₃S and SO₃

ICV OPALE 2.0



Fruity and floral aromatic ciders

Alcohol Tolerance: 14%

Nitrogen Needs: Low

Temp. Range: 59-86°F

500 g #15065

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

- Ciders are round with a full mid-palate and balanced finish which can mask astringency
- Good for rosé-style ciders and ciders that struggle with H₂S and sulfur off-odors
- Fast onset of fermentation followed by a steady fermentation rate
- · Low production of acetaldehyde
- Saccharomyces cerevisiae cerevisiae hybrid
- Selected in collaboration with the National Research Institute for Agriculture, Food and the Environment (INRAe), SupAgro Montpellier, the Institut Coopératif du Vin (ICV), and Lallemand Oenology

LOW H₃S and SO₃

IOC BE FRUITS

78 IOC

Fruity ester production for cold-fermented ciders

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

500g #15241

IOC BE FRUITS™ produces fruity esters while respecting apple characters.

- Especially suitable for ciders that struggle with H₂S and sulfur off-odors
- Optimal conditions for fruity ester production are achieved when juice is clarified (80 NTU ± 20) and fermentation temperatures are between 54-59°F $(12-15^{\circ}C)$
- Fast onset of fermentation followed by a relatively fast fermentation rate
- Low production of acetaldehyde
- Saccharomyces cerevisiae cerevisiae strain
- · Selected by the National Research Institute for Agriculture, Food and the Environment (INRAe), France

K1 (V1116)



LALVIN K1 (V1116)™ is one of the highest ester-producing strains in our portfolio.

- Strong fermenter for high ester production under challenging conditions
 - Alcohol Tolerance: 18% Nitrogen Needs: Low
 - Temp. Range: 50-95°F

500g #15063 10 kg #15077

- - Strong floral ester producer, well suited to juice lacking aromatic complexity such as those from culinary apples or concentrate
 - · Performs well under difficult conditions such as extreme temperatures, high alcohol (18% v/v), and low turbidity
 - · Saccharomyces cerevisiae cerevisiae strain
 - · Selected by the Institut Coopératif du Vin (ICV), France

NT 116



All-purpose strain for many cider styles

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

1 kg #15185 10 kg #15226 NT 116 is well suited to many cider styles due to its release of varietal aromas, glycerol, and mannoproteins, giving aromatic complexity and roundness.

- In juices from cider apples, NT116 can reduce astringency and bitterness
- In neutral juices like those from pears, culinary apples, or concentrate, NT116 can build complexity and aromatic intensity
- · Very strong fermenter temperature control is advised when using this low foaming but vigorous strain
- · Saccharomyces cerevisiae hybrid
- Product of the yeast hybridization program of Infruitec-Nietvoorbij, the wine and vine institute of the Agricultural Research Council in Stellenbosch, South Africa

QA23



Strong fermenter for fruity expression in highly clarified juice

Alcohol Tolerance: 16%

Nitrogen Needs: Low

Temp. Range: 59-90°F

500 g #15652 10 kg #15653 LALVIN QA23® produces large amounts of the enzyme beta-glucosidase, which releases bound fruity and floral terpenes.

- In aromatic apples (cider apples), it increases floral and spicy notes and in non-aromatic apples (culinary apples), QA23 enhances fruity aromas
- Low nutrient and oxygen requirements and can ferment juice with low turbidity at low temperatures
- Saccharomyces cerevisiae bayanus strain
- Selected in Portugal by the Universidade de Trás-os-Montes e Alto Douro (UTAD) in cooperation with the Viticultural Commission of the Vinho Verde region

R2



Expression of varietal aromas at cold temperatures

Alcohol Tolerance: 16%
Nitrogen Needs: Medium

Temp. Range: 50-86°F

500g #15071

LALVIN R2[™] can enhance varietal characters due to beta-glucosidase activity producing intensely aromatic ciders with heightened fruity and floral aromas.

- Excellent cold temperature properties and has been known to ferment in conditions as low as 41°F (5°C)
- Tends to produce VA without proper nutrition or when stressed
- Saccharomyces cerevisiae bayanus strain
- Isolated in the Sauternes region of Bordeaux, France

RHÔNE 4600



Aromatic and elegant ciders

Alcohol Tolerance: 15%

Nitrogen Needs: Low

Temp. Range: 56-72°F

500g #15171

LALVIN RHÔNE 4600® produces cider with complex aromas and good volume.

- Elevates fresh fruit aromas (apple and pear), increases roundness, and diminishes bitterness, making this strain ideal for easy-drinking ciders
- May produce VA and SO_2 under stressful conditions
- Saccharomyces cerevisiae cerevisiae strain
- Isolated in the Côtes du Rhône region of France in collaboration with Inter-Rhône's technical department

R-HST



Crisp, fresh ciders with well-balanced mouthfeel

Alcohol Tolerance: 15%

Nitrogen Needs: Medium

Temp. Range: 50-86°F

500g #15130

LALVIN R-HST $^{\!\scriptscriptstyle\mathsf{TM}}$ 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
- Short lag phase which allows R-HST to dominate over spoilage yeast in juice
- Tolerates temperatures as low as 50°F (10°C), although temperature should be increased toward the end of fermentation for a clean finish
- Saccharomyces cerevisiae cerevisiae strain
- Selected from Riesling trials conducted in the Heiligenstein region, Austria

LOW H₂S and SO₂

SENSY



Aromatic finesse and varietal aroma expression under difficult conditions

Alcohol Tolerance: 15%

Nitrogen Needs: Low

Temp. Range: 54-64°F

500g #15225

LALVIN SENSY™ respects varietal aromas and promotes aromatic esters while balancing mouthfeel and freshness.

- Enhances citrus and tropical fruit aromas and contributes subtle mineral notes
- SENSY has a very short lag phase
- Total SO₂ prior to inoculation should not exceed 50 ppm
- Low production of acetaldehyde
- Saccharomyces cerevisiae hybrid
- Selected in collaboration with the National Research Institute for Agriculture, Food and the Environment (INRAe), SupAgro Montpellier, Institut Coopératif du Vin (ICV), and Lallemand Oenology

NEW

SM102



Sweet and semi-sweet ciders

Alcohol Tolerance: 12%

Nitrogen Needs: Medium

Temp. Range: 61-72°F

500g #17140

FERMIVIN SM102™ produces delicate and floral ciders while respecting apple characteristics.

- Easily stopped by alcohol levels above 12% or with chilling to <55°F (13°C), making it ideal for sweet and semi-sweet cider production
- Saccharomyces cerevisiae cerevisiae strain
- Isolated from the Cognac region, France

VIN 13





1 kg #15183 10 kg #15228 VIN 13 is an outstanding ester producer and is recommended for ciders that are fermented with other fruit juices, especially juices that are tropical- or citrus-based.

- In neutral juices, pineapple and banana flavors can develop, while in apples that contain terpenes, VIN 13 can accentuate floral notes
- Favored for its ease of use and robustness, making this strain suitable for challenging conditions
- Temperature control is especially important with this strain
- Saccharomyces cerevisiae hybrid
- Product of the yeast hybridization program at the Institute for Wine Biotechnology, University of Stellenbosch, South Africa

W15



Clean fermenter at low temperatures

Alcohol Tolerance: 16%

Nitrogen Needs: High

Temp. Range: 50-81°F

500 g #15118 10 kg #15119 LALVIN W15™ helps retain bright fruit characters and optimizes mid-palate and balance.

- Low heat generation during fermentation helps minimize the potential for temperature spikes and possible $\rm H_2S$ production
- Saccharomyces cerevisiae cerevisiae strain
- Isolated from a Müller-Thurgau fermentation in 1991 at the Swiss Federal Research Station in Wädenswil, Switzerland

PROTOCOL

YEAST REHYDRATION WITH GO-FERM STEROL FLASH™

GO-FERM STEROL FLASHTM was specifically developed to eliminate the need for warm water rehydration and acclimatization steps. This protocol is only for use with GO-FERM STEROL FLASH. If using a different GO-FERM rehydration nutrient, please see the protocol on the next page.

PREPARE REHYDRATION NUTRIENT:

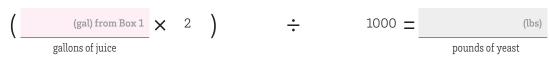
1. Suspend 30 g/hL (2.5 lb/1000 gal) of GO-FERM STEROL FLASH in 10 times its weight of clean, chlorine-free, water (>15°C/59°F).





REHYDRATE YEAST:

2. Add 25 g/hL (2 lb/1000 gal) of active dried yeast.



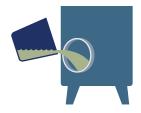


3. Stir gently to break up any clumps and let suspension stand for 15 minutes. Foaming is not an indicator of yeast viability. Do not let yeast stand in rehydration water longer than 30 minutes without inoculating or yeast viability will decline.

INOCULATE:

4. Add yeast slurry from step 3 directly into juice and mix.

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 allows the yeast a head start over indigenous organisms.



PROTOCOL

YEAST REHYDRATION WITH GO-FERM® & GO-FERM PROTECT EVOLUTION™

Note: This protocol is not appropriate for non-Saccharomyces yeast. To rehydrate non-Saccharomyces yeast, please review the non-Saccharomyces rehydration protocol.

PREPARE REHYDRATION NUTRIENT

Pro Tip: do this step in a vessel that can accommodate up to 4 times the volume of the rehydrated yeast.

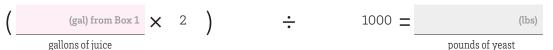
1. Suspend 30 g/hL (2.5 lb/1000 gal) of GO-FERM® or GO-FERM PROTECT EVOLUTION™ in 20 times its weight of clean, chlorine-free, 110°F (43°C) water. Please note that these rehydration nutrients do not fully dissolve into solution, some clumping is normal.



If not using a rehydration nutrient, add yeast to a water volume that is 10x the weight of the yeast at 104°F (40°C). This lower temperature is important, so you do not harm the yeast.

REHYDRATE YEAST

- 2. Allow temperature of yeast rehydration nutrient solution from step 1 to drop to $104^{\circ}F$ ($40^{\circ}C$).
- 3. Add 25 g/hL (2 lb/1000 gal) of active dried yeast.





4. Stir gently to break up any clumps and let suspension stand for 20 minutes, then stir gently again. Foaming is not an indicator of yeast viability. Do not let yeast stand in rehydration water longer than 30 minutes without adding juice or yeast viability will decline.

ACCLIMATIZE

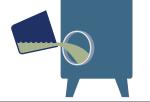
- 5. Slowly, over 5 minutes, add some juice to the yeast slurry to drop the temperature by $18^{\circ}F$ ($10^{\circ}C$). Let stand 15-20 minutes.
- 6. Repeat step 5 until the temperature difference between the yeast slurry and the juice is within $18^{\circ}F$ ($10^{\circ}C$). For example, if juice temperature is $68^{\circ}F$ ($20^{\circ}C$) and the yeast slurry temperature is $104^{\circ}F$ ($40^{\circ}C$), step 5 will need to be repeated twice.



INOCULATE

7. Add yeast slurry from step 6 directly into juice and mix.

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 allows the yeast a head start over indigenous organisms.



DID YOU KNOW? WHY YOU SHOULD INOCULATE YEAST AT 25 G/HL								
Benefit	Reason							
Faster onset of fermentation (shorter lag phase)	Higher Initial Cell Count: Inoculating yeast at 25 g/hL leads to a greater number of cells that quickly adapt to juice conditions and enter active growth phase sooner							
Proceed at a regular pace	Enhanced Kinetics: Fermentation can be linked to sugar utilization per cell. More cells lead to smoother and more consistent fermentation kinetics							
Shorter fermentation length	Adequate Cell Population: With enough cells available when yeast growth ends (~30-50% sugar depletion), fermentation concludes sooner							
Lower final volatile acidity (VA)	Rapid Dominance over Indigenous Microorganisms: Faster implantation inhibits VA-producing indigenous microorganisms, reducing final VA levels							
Lower final residual sugar (RS)	Continued Metabolism: Abundant metabolically active cells will persist at low sugar levels, further consuming sugar to minimize RS							
Healthier cell population	Reduced Off-Aromas from Stressed Yeast: Healthy cells produce fewer undesired aroma compounds, leading to a more favorable aromatic profile							
Fewer negative sensory compounds	Minimized Off-Aromas: Lower levels of undesirable compounds like higher alcohols, aldehydes, and soapy/waxy aromas (short chain fatty acids)							
Make to a series of the order of the order of the order								

Note: In some situations a lower inoculation rate can be successful, however, those situations must be evaluated with the juice chemistry, microbial load, and desired aromatic profile taken into consideration.

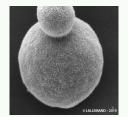
NON-SACCHAROMYCES YEAST

Yeast used in cidermaking can be split into two categories; yeast that belong to the *Saccharomyces* genus and those that don't. Non-*Saccharomyces* (non-Sacc), although poor fermenters, have metabolic capabilities that make them useful cidermaking tools. Depending on strain, non-*Saccharomyces* yeast can increase aroma, increase acidity, enhance mouthfeel, or offer antimicrobial and antioxidant protection.

Although non-Sacc yeast have not historically been selected and dried for cidermaking applications, in the last decade, there has been an explosion of research on applications for non-Sacc yeasts. These yeast are as varied in their applications and demonstrate as much diversity as their *Saccharomyces* cousins.

WHAT'S SO COOL ABOUT NON-SACC YEAST?

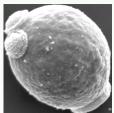
Both *Saccharomyces* and non-*Saccharomyces* yeast are able to impact cider aroma, flavor, and texture, but non-*Saccharomyces* yeast are not reliable fermenters. However, some non-Sacc yeast from the genera *Metschnikowia*, *Lachancea*, and *Torulaspora* can act in a variety of other ways which make them exciting tools for cidermaking:







Lachancea thermotolerans



M. pulcherrima



Torulaspora delbrueckii

ANTIMICROBIAL

 $LEVEL^2$ INITIATM very quickly scavenges oxygen, allowing it to outcompete and suppress native spoilage organisms. By using INITIA in juice, pre-fermentation VA production is limited.

ANTIOXIDATION

In addition to its oxygen scavenging abilities, LEVEL² INITIA™ also rapidly scavenges copper ions. Copper ions are an integral part of certain browning reactions and by eliminating copper, these reactions are blocked. This means that juice color is brighter (less brown) and aromas are protected (increased aromatic complexity and freshness).

ACIDIFICATION

LEVEL 2 LAKTIA $^{\text{m}}$ can produce between 2-9 g/L lactic acid from glucose, which can lower pH and increase titratable acidity. LAKTIA is especially well-suited for ciders made from concentrate, but it can be used in any juice that lacks freshness or complexity.

AROMA AND MOUTHFEEL ENHANCEMENT

LEVEL 2 FLAVIA $^{\text{\tiny{TM}}}$ can release bound varietal compounds (terpenes) and LEVEL 2 BIODIVA $^{\text{\tiny{TM}}}$ produces esters, leading to ciders with more intense aromatic expression. These specific strains of non-Sacc can also increase mouthfeel roundness due to the release of mannoproteins (FLAVIA) and other mouthfeel components like arabinol (BIODIVA).

QUICK GUIDE TO CHOOSING NON-SACCHAROMYCES YEAST

	BIODIVA™	FLAVIA™	INITIA™	LAKTIA™
Organism	Torulaspora delbrueckii	Metschnikowia pulcherrima	Metschnikowia pulcherrima	Lachancea thermotolerans
Cidermaking application	Enhances mouthfeel, fruity aromas and complexity of ciders due to the production of polysaccharides and esters. Alleviates osmotic (high sugar) stress on Saccharomyces which makes it suitable for late harvest, ice-cider, and high sugar juices where VA can be a challenge	Produces enzymes that cleave aroma compounds (terpenes) which optimizes tropical, citrus, and floral notes in certain ciders	Outcompetes VA-producing native microflora for oxygen thereby acting as a bioprotectant against oxidative damage and microbial spoilage	Converts glucose to lactic acid which will acidify the juice adding freshness and complexity
When to add Non-Saccharomyces	To the tank prior to alcoholic fermentation	To the tank prior to alcoholic fermentation	To freshly pressed juice to protect during transportation, thawing, or cold settling	To the tank prior to alcoholic fermentation
When to add Saccharomyces	After 1.5-4 °Brix drop	24 hours after FLAVIA	Once juice is racked to fermentation vessel	24-72 hours after LAKTIA
Suggested compatible Saccharomyces strains	Any strain that meets your cidermaking goal	Strains with beta-glucosidase activity (Denoted as strains that enhance varietal characters)	Any strain that meets your cidermaking goal	Any strain that meets your cidermaking goal

DID YOU KNOW?

THERE ARE SPECIAL CONSIDERATIONS WHEN USING NON-SACC YEAST

Timing of inoculation: Some non-Sacc yeast should be added to the recently harvested apples, some to freshly pressed juice, and some directly to the fermentation vessel. Be sure to follow the recommendations for each strain.

 $\textbf{Rehydration temperature:} \ \text{Non-Sacc yeast are rehydrated at a lower temperature than } \textit{Saccharomyces (see pg 29)}.$

Optimal conditions for use: Each non-Sacc yeast strain operates best under certain temperature and free SO_2 conditions. See product descriptions on pgs 27-28 for more information.

Tolerance to alcohol: Non-Sacc yeast cannot complete alcoholic fermentation because they are inhibited by alcohol. When using a non-Saccharomyces strain, subsequent inoculation with a Saccharomyces strain is required.

You may not need to use 25 g/hL: For some non-Sacc strains, dosage can be adapted based on certain cidermaking conditions, such that you might not need 25 g/hL!

NON-SACCHAROMYCES YEAST

BIODIVA



Aromatically complex ciders with roundness and volume

When to add BIODIVA:

Directly to fermentation vessel

When to add *Saccharomyces*:
After 1.5-4 °Brix drop

Optimal Conditions: Free SO₂: <15 ppm Temp: >61°F (>16°C)

500g #15697

LEVEL² BIODIVA™ produces esters that enhance fruitiness and produces compounds that increase mouthfeel volume and roundness.

- Ciders show fruity (tropical, white fruits), floral, and pastry notes
- Mildly fermentative and can produce up to approximately 6% alcohol
- Consumes glucose, alleviating osmotic stress on *Saccharomyces* in high sugar concentrations. This results in a cleaner fermentation with lower volatile acidity levels
- Osmotolerant, meaning that this yeast survives in high sugar environments and is an excellent choice for ice ciders
- · Torulaspora delbrueckii strain

Usage: See pg 29 for rehydration instructions.

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

Recommended Dosage	250 ppm	25 g/hL	2 lbs/1000 gal
--------------------	---------	---------	----------------

FLAVIA



Creates aromatically expressive ciders by releasing bound aromas

When to add FLAVIA:

Directly to fermentation vessel

When to add *Saccharomyces*: 24 hours after adding FLAVIA

Optimal Conditions: Free SO₂: <15 ppm Temp: 59-71°F (15-22°C)

500g #15244

 $LEVEL^2$ FLAVIATM can release terpenes and polysaccharides resulting in aromatically complex ciders with good mouthfeel.

- · Ciders have heightened tropical fruit, citrus, floral, and spicy aromas
- Positively impacts mouthfeel due to the fast release of mannoproteins
- Non-fermentative but can tolerate approximately 3% alcohol
- Optimal results are when FLAVIA is used with a *Saccharomyces* strain that also enhance varietal aromas
- Metschnikowia pulcherrima strain
- Selected in conjunction with the Universidad de Santiago de Chili (USACH)

Usage: See pg 29 for rehydration instructions.

Storage: Dated expiration. Store at 39-52°F (4-11°C). Once opened use immediately.

DID YOU KNOW?

TERPENES IN APPLES ARE ODORLESS

Terpenes are part of the aroma characteristics of apples and pears; however, they are often in a bound form. When these compounds are bound, they are odorless. Some terpenes are bound to a single sugar molecule; glucose, while other terpenes are bound to two sugar molecules; arabinose and glucose.

Terpenes can only become odor active when released from both sugar molecules. Once released they contribute **fruity**, **floral and spicy aromas**. Some *Saccharomyces* yeast have enzymes that can cleave glucose from terpenes, but they cannot cleave arabinose from terpenes. FLAVIA, however, can cleave arabinose.

When FLAVIA is used in conjunction with a compatible strain of *Saccharomyces* (strains denoted as producing beta-glucosidase enzymes) their joint activity works to reveal the full aromatic potential of the fruit.

INITIA



For antimicrobial and antioxidation protection

When to add INITIA:

To freshly pressed juice to protect during transportation, thawing, or cold settling

When to add Saccharomyces:

Once the juice has been racked to the fermentation vessel

> **Optimal Conditions:** Free SO₂: <15 ppm Total SO₂: <40 ppm **Temp:** 39-64°F (4-18°C)

500g #15273 LEVEL² INITIA™ consumes oxygen to protect aroma and color from oxidative damage and to suppress the growth of native, volatile acidity (VA) producing microorganisms. This bioprotective effect means that juice can be protected from microbial spoilage during thawing, clarification or during short-term juice storage and chemical additives like sulfur dioxide (SO₂) can be minimized, and in some cases avoided.

- · Limits browning by quickly consuming oxygen and copper ions
- Preserves aromatic compounds from oxidative degradation
- Outcompetes native yeast and bacteria limiting their VA production
- Can reduce the use of SO, in canned or no- and low-SO, cidermaking
- · Very low fermentative abilities, grows well at low temperature and can tolerate up to 3% alcohol
- Metschnikowia pulcherrima strain
- Isolated in Burgundy by the Institut Français de la Vigne et du Vin (IFV) in Beaune, France

Usage: See pg 29 for rehydration instructions.

Storage: Dated expiration. Store at 39-52°F (4-11°C). Once opened use immediately.

Recommended Dosage	70-250 ppm	7-25 g/hL	0.6-2 lbs/1000 gal
--------------------	------------	-----------	--------------------

LAKTIA



Naturally acidifies ciders

When to add LAKTIA:

Directly to the fermentation vessel

When to add Saccharomyces:

24-72 hours after LAKTIA, or once lactic acid goal is met

Optimal conditions:

Free SO₂: <15 ppm Total SO₂: <40 ppm

Temp: 57-82°F (14-28°C)

500g #15253

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.

- 1 g/L glucose metabolized by LAKTIA results in 1 g/L lactic acid
- Can impact pH and titratable acidity
- The longer LAKTIA in is the juice prior to inoculation with Saccharomyces, the higher the lactic acid concentration will be
- Please note: Lactic acid >3 g/L can inhibit malolactic bacteria
- Very low fermentative abilities, but grows well at low temperatures and can tolerate up to 7% alcohol
- · Has a high demand for nitrogen and YAN should be determined prior to LAKTIA use and again prior to Saccharomyces inoculation
- Lachancea thermotolerans strain
- Isolated from Rioja, Spain by the Lallemand Oenology R&D team

To optimize lactic acid production: LAKTIA works most efficiently in juices free of SO₂. If SO₂ is present, the juice temperature must be >20°C (68°F). Delay Saccharomyces inoculation up to 72 hours post-LAKTIA addition.

Usage: See pg 29 for rehydration instructions.

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

Recommended Dosage	250 ppm	25 g/hL	2 lbs/1000 gal
--------------------	---------	---------	----------------

PROTOCOL

NON-SACCHAROMYCES YEAST: BEST PRACTICES & REHYDRATION INSTRUCTIONS

Consult charts below when using a non-Saccharomyces yeast for the following reasons:

- Different strains of non-Sacc yeast are added at different points in the cidermaking process
- Non-Sacc yeast cannot complete alcoholic fermentation because they are inhibited by alcohol. When using a non-Saccharomyces strain, subsequent inoculation with a Saccharomyces strain is required.
- Each non-Sacc yeast strain operates best under certain temperature and free SO₂ conditions.

TIMING OF INOCULATIONS:

	BIODIVA™	FLAVIA™	INITIA™	LAKTIA™
When to add non-Saccharomyces:	To the tank prior to alcoholic fermentation	To the tank prior to alcoholic fermentation	To freshly pressed juice to protect during transportation, thawing, or cold settling	To the tank prior to alcoholic fermentation
When to add Saccharomyces:	After 1.5-4 °Brix drop	24 hours after FLAVIA	Once juice is racked to fermentation vessel	24-72 hours after LAKTIA

OPTIMAL CONDITIONS:

	BIODIVA™	FLAVIA™	INITIA™	LAKTIA™
Free SO ₂ (ppm)	<15	<15	<15	<15
Temperature	>61°F (16°C)	59-71°F (15-22°C)	39-64°F (4-18°C)	57-82°F (14-28°C)

INSTRUCTIONS:

- **Step 1:** Rehydrate non-Sacc yeast in 10x its weight of chlorine-free water at 86°F (30°C). Stir.
- **Step 2:** Wait 15 minutes and stir again.
- **Step 3:** Slowly add juice to the yeast slurry until the temperature of the yeast slurry drops by 18°F (10°C). Wait 15 min. Repeat this step until slurry is within 18°F (10°C) of juice. NOTE: this step should not exceed 45 minutes total.
- **Step 4:** Inoculate.
- **Step 5:** After inoculating with your chosen non-Sacc yeast strain, consult the chart above to determine when to inoculate with *Saccharomyces* to finish alcoholic fermentation.





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

Additionally, there is a link between low vitamins and H₂S 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 H₂S is produced instead.

WHAT NUTRIENTS ARE PRESENT IN APPLES?

YEAST

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 seasons¹ 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 others². 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	Protect against oxidation	GLUTASTAR® or OPTI-WHITE®
During Yeast Rehydration	Provide yeasts vitamins, minerals and sterols to promote healthy populations that can withstand fermentation conditions	GO-FERM STEROL FLASH™ or GO-FERM PROTECT EVOLUTION™
At Inoculation	Nourish yeast with amino acids for steady fermentation kinetics	FERMAID O™
During Fermentation	Maintain steady fermentation rate, avoid off-odor production and stimulate positive aromas	STIMULA CHARDONNAY™ or FERMAID O™ and/or FERMAID K™
End of Fermentation	Enhance cider flavor profile Manage sulfur off-odors	OPTI-WHITE® or NOBLESSE™ REDULESS®
	Scavenge oxygen to prevent oxidation	PURE-LEES LONGEVITY™ (see page 68)

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 or GO-FERM STEROL FLASH (warm water not required).

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 39). If the juice is deficient, FERMAID O may be added at 2–3 °Brix drop after inoculation.

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

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.

NEW <

GO-FERM STEROL FLASH <a>



Rehydration nutrient for use with cool water

When to Add: During yeast rehydration

Provides:

Vitamins and minerals that help yeast withstand the conditions of fermentation, higher levels of survival factors allowing for cold water rehydration

YAN contribution: Insignificant

#15164 1 kg 2.5 kg #15166 10kg #15167

GO-FERM STEROL FLASH™ is a revolutionary new yeast rehydration nutrient that is fast, easy to use, and saves time, labor, and water without compromising on yeast viability and vitality.

- Has all the benefits of GO-FERM PROTECT EVOLUTION
- Allows yeast to be rehydrated in cool water 60°F (15°C) without any loss of viability or vitality
- Eliminates the need for acclimatization steps (rehydrated yeast can be added directly to juice after 15 minutes)
- Requires 50% less water than other rehydration nutrients
- · Non-clumping, instantly disperses in cool water
- Derived from autolyzed yeast, provides optimized levels of micronutrients (vitamins and minerals) and extremely high levels of survival factors including sterols and unsaturated fatty acids

Usage: See pg 22 for rehydration protocol.

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

5 1 15	70 / 1	0.511 #000
Recommended Dosage	30 g/hL	2.5 lb/1000 gal

GO-FERM PROTECT EVOLUTION



Rehydration nutrient for use with hot water; **OMRI** listed

When to Add:

During yeast rehydration

Provides:

Vitamins, minerals, and sterols that help yeast withstand the conditions of fermentation

YAN contribution: Insignificant

2.5 kg #15103 10 kg #15251 GO-FERM PROTECT EVOLUTION™ supports healthy fermentations while increasing varietal aroma uptake and aroma complexity.

- Benefits include: faster onset and cleaner finish of fermentation, healthier yeast that can better withstand fermentation stresses like ethanol, acid, sugar, and temperature, greater expression of varietal aromas, and fewer fermentation sensory issues like volatile acidity (VA) and hydrogen sulfide (H2S)
- Can replace the recommended second oxygen addition at 1/3 sugar depletion due to enhanced sterol content (especially useful for barrel fermentations)
- Derived from autolyzed wine yeast, provides optimized levels of micronutrients (vitamins and minerals) and high levels of survival factors including sterols and unsaturated fatty acids

Usage: See pg 23 for rehydration protocol. Note: Due to the unique nature of GO-FERM PROTECT EVOLU-TION, it 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 65°F (18°C). Once opened, keep

Fermentation Nutrients

Fermentation nutrients supply the yeast with nitrogen. We recommend adding these nutrients to the juice at inoculation and again partway through fermentation. Supplementing yeast assimilable nitrogen (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. While our FERMAID line is the gold standard in fermentation nutrition, the STIMULA line of fermentation nutrients can supply YAN while also stimulating yeast metabolic pathways that promote the production of desirable aroma compounds.

FERMAID O



YAN source supplying organic nitrogen (amino acids); OMRI listed

When to Add:

2-3 °Brix drop and/or 1/3 sugar depletion

Provides:

YAN in the form of organic nitrogen, small peptides, essential vitamins, and minerals

Measurable YAN at 40 g/hL dose: 16 ppm

YAN equivalents at 40 g/hL dose: 64-96 ppm

2.5 kg #15067 10 kg #15107 FERMAID 0^m is an organic nitrogen source that helps nourish yeast, improve aromas, and allow for good control over fermentation.

- Reliably lowers peak fermentation temperatures and improves fermentation kinetics (especially at the end of fermentation), resulting in fewer sulfur off-odors like H_oS
- Due to FERMAID O's highly consistent and balanced amino acid profile, the nitrogen lasts longer and less nutrient is needed than when using conventional nitrogen sources (DAP)
- FERMAID O use has been correlated with positive aromatic expression (esters) and enhanced mouthfeel
- For optimal results, FERMAID O should be used in conjunction with GO-FERM PROTECT EVOLUTION™ or GO-FERM STEROL FLASH™ rehydration nutrients (pg 33).
- Blend of highly specific inactivated yeast fractions that are rich in assimilable amino acids (organic nitrogen), small peptides, essential vitamins, and minerals

 $\textbf{Usage:} \ \text{Suspend FERMAID O in water or juice and mix well before adding to avoid CO}_2 \ \text{release and overflowing of vessel}.$

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

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

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 yeast can assimilate organic forms of YAN 4-6 times more efficiently 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. We have taken this efficiency into account throughout our recommendations.

STIMULA CHARDONNAY



YAN source that also stimulates yeast to produce white/yellow fruit and floral aromas (esters)

When to Add:

1/3 sugar depletion

Provides:

YAN in the form of organic nitrogen (amino acids), vitamins and minerals that stimulate yeast to produce white/yellow fruit and floral esters

Measurable YAN at 40 g/hL dose: 16 ppm

YAN equivalents at 40 g/hL dose: 64-96 ppm

1 kg #15245 10 kg #15260

STIMULA CHARDONNAY™ is an organic nitrogen source that contributes YAN while stimulating yeast's production of fruity and floral esters.

- Ciders are aromatically intense and complex with increased white fruit, yellow fruit, tropical, and floral aromas
- · Palate is lengthened and mouthfeel softened
- Add at 1/3 sugar depletion for maximum ester production
- Well-balanced nutrient rich in specific amino acids, small peptides, sterols. vitamins (biotin, pyridoxine), and minerals (magnesium and zinc)
- Latest generation of yeast-based nutrients focusing on nutrition and aroma production

Usage: Mix STIMULA CHARDONNAY in 10 times its weight of clean water or juice and add to the fermentation at ½ sugar depletion. STIMULA CHARDONNAY is not fully soluble. Stir to maintain

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

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

FERMAID K



YAN source for use in low YAN fermentations

When to Add:

1/3 sugar depletion

Provides:

YAN as a blend of organic nitrogen (amino acids) and inorganic nitrogen (ammonia)

Measurable YAN at 25 g/hL dose: 25 ppm

YAN equivalents at 25 g/hL dose: 25 ppm

2.5 kg #15073 10 kg #15070 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
- Best used at 1/3 sugar depletion if YAN needs cannot be met using FERMAID O™ or STIMULA CHARDONNAY™

Note: FERMAID K is a proprietary blend of ingredients. Some of the materials in FERMAID K are listed by the TTB as acceptable in good commercial cidermaking practices in 27 CFR 24.250 and some are listed in 27 CFR 24.246. For more information, please visit TTB.gov.

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

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

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

Yeast Derivative Nutrients

Yeast derivative nutrients are used for their ability to 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

GLUTASTAR



Acts as an antioxidant protecting aroma and color compounds against oxidative damage; OMRI listed

When to Add:

Directly to the juice post-pressing

Provides:

Glutathione in the active form (GSH) and specialized peptides which scavenge quinones to prevent oxidative damage

YAN contribution: Insignificant

1 kg #15265 10 kg #15266 GLUTASTAR® protects aroma precursors and color due to its unique antioxidant capacity.

- Positive impact on varietal and fermentation-derived aromas
- Effects are long-lasting, leading to prolonged shelf life
- Acts as an antioxidant due to its specialized (nucleophilic) peptides and reactive glutathione that scavenge quinones, halting the oxidation cascade
- Can reduce the use of sulfur dioxide (SO₂) in canned or no- and low-SO₂ cidermaking
- Unique and highly soluble autolyzed yeast that can be added to juice any time before the onset of fermentation

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 65°F (18°C). Once opened, keep tightly sealed and dry.

NOBLESSE



Contributes to balance, sweetness, and softness on the finish; OMRI listed

When to Add:

Anytime before the end of fermentation

Provides:

Polysaccharides that add a perception of sweetness and enhance mouthfeel

YAN contribution: Insignificant

2.5 kg #15105

 $NOBLESSE^{TM}$ releases polysaccharides which increases mouthfeel roundness and masks sensations of acidity, astringency, and bitterness.

- Ciders appear to have more fruit aromas and sweetness due to the contribution of low molecular weight polysaccharides
- Decreases tannin intensity and reduces drying and aggressive characters due to the softening effect of high molecular weight polysaccharides
- Can be used at any time during fermentation, and although immediate results are possible, full integration may take three to five months
- NOBLESSE[™] is a partially autolyzed yeast derivative nutrient

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

Storage: Dated expiration. Store in a cool and dry environment at $65^{\circ}F$ ($18^{\circ}C$). Once opened, keep tightly sealed and dry.

Recommended Dosage	30 g/hL	2.5 lb/1000 gal
--------------------	---------	-----------------

OPTI-WHITE



Promotes roundness and smoothness and provides some protection from oxidation; OMRI listed

When to Add:

Anytime before the end of fermentation

Provides:

Polysaccharides and antioxidant peptides that balance mouthfeel and protect aromas

YAN contribution: Insignificant

1 kg #15165 2.5 kg #15136 10 kg #15216 OPTI-WHITE® stabilizes and integrates aromas, brings smoothness and complexity, and can also help prevent oxidative damage*.

- Provides both peptides and polysaccharides; the peptides help protect aromatics and color, while the polysaccharides integrate and stabilize aroma compounds and enhance smoothness
- Use at the onset of fermentation for color and aroma protection*
- Use at the tail end of fermentation for smoothness and flavor integration

*Please note that if protection from oxidation is the primary goal, GLUTASTAR® (pg 36) is a better choice

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 65°F (18°C). Once opened, keep tightly sealed and dry.

REDULESS



Reduces sulfur off-aromas; OMRI listed

When to Add:

Anytime before the end of fermentation

Provides:

Specialized inactivated yeast with cell walls naturally rich in copper for the treatment of sulfur-off odors

YAN contribution: Insignificant

1 kg #15116 2.5 kg #15115 REDULESS® is used to reduce sulfur off-odors such as $\rm H_2S$, mercaptans, and some disulfides.

- Can increase fruitiness due to reduction in sulfur off-odors
- Can naturally enhance roundness
- Has also been shown to reduce vegetal and phenolic notes
- Inactivated yeast with cell walls rich in copper
- REDULESS should be removed from cider via a racking or filtration in case of the unlikely event that copper is released into the cider. Maximum copper transfer is 0.3 ppm when used at 30 g/hL

Usage: Mix REDULESS in 10 times its weight in water. Add immediately to the tank. If prepared in advance, re-suspend the product prior to its addition to the fermentor. Gently mix and rack off or filter after 72 hours. The maximum potential copper contribution when used according to the recommendation is 0.3 ppm. This product is partially soluble. Stir to maintain suspension before and during addition. **Storage:** Dated expiration. Store in a cool and dry environment at 65°F (18°C). Once opened, keep tightly sealed and dry.

/hL 0.8-2.5 lb/1000 gal
/

ARTICLE

THE IMPORTANCE OF YEAST REHYDRATION NUTRIENTS

BACKGROUND

GO-FERM®, the first yeast rehydration nutrient, was introduced over 20 years ago and it revolutionized the way we think about fermentation. It improved fermentation kinetics and helped avoid fermentation problems.

Since then, the GO-FERM line has expanded to include GO-FERM PROTECT EVOLUTION™ and the new GO-FERM STEROL FLASH™. These next generation nutrients maximize aromatic expression in addition to improving fermentation kinetics and avoiding fermentation problems.

THE FUNCTION OF REHYDRATION NUTRIENTS

GO-FERM PROTECT EVOLUTION™ and GO-FERM STEROL FLASH™ are important because they provide sterols, unsaturated fatty acids (UFAs), vitamins, and minerals that yeast need. These compounds prepare the yeast to withstand the high sugar levels of juice and the alcohol and temperature stress of fermentation. They can also help yeast release bound varietal aroma compounds present in apples and can stimulate ester production. While apples naturally contain some of these nutrients, they are often not enough to support healthy fermentations on their own, leading to sluggish fermentations.

Our rehydration nutrients are made from selected strains of autolyzed yeast and are developed to efficiently supply yeast with necessary compounds. Added during rehydration, rehydration nutrients exploit a narrow window of time when yeast cannot control what goes in and out of the cell. Because yeast cannot control what goes in and out of the cell, vitamins, minerals, and sterols are directly incorporated into the cell.* Additionally, when these compounds are added during rehydration, they are fully available to yeast because they are not consumed by native microflora or bound to other juice compounds.

*Harmful substances can also be incorporated into the cell at this time. This is why we recommend rehydrating in clean water and GO-FERM products only. Rehydrating in juice or using other nutrient formulations (e.g., DAP) during rehydration may harm yeast.

THE ROLE OF STEROLS, VITAMINS, AND MINERALS

Nutrient	Role	Benefits
Sterols	Stabilize cell membrane	Prevent unwanted diffusion of alcohol and other juice components, maintain intracellular pH, increase aromatic precursor uptake and expression
Vitamins	Affect cellular multiplication and metabolic functions	Improve fermentation rate, reduce off-odor production, and stimulate positive aroma production
Minerals	Cofactors for key enzymatic reactions	Needed for growth and carbohydrate metabolism, offset detrimental effects of stress

PROTOCOL

DEVELOP A YEAST NUTRITION PLAN

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

1. DETERMINE HOW MUCH NITROGEN TO ADD

A. Measure SUGAR (BRIX)	° Brix	and YAN	ppm	of the juice
A. Measure SUGAR (BRIX)		and <u>YAN</u>	FF	of the j

- B. **Choose a yeast strain**. Yeast strain product descriptions can be found on pgs 15-21
- C. Determine the chosen yeast strain's <u>NITROGEN NEED</u> low, medium, or high. This information is listed in the product description
- D. Determine YAN REQUIRED for fermentation by consulting table 1

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

E. If the YAN REQUIRED is higher than the JUICE YAN, then ADDITIONAL YAN is required

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

Table 1: Measurable yeast assimilable nitrogen (YAN) needs of yeast at different starting sugars

YAN Required for Fermentation

(ppm N)			
Low N need	Medium N need	High N need	
75	90	125	
90	108	150	
105	126	175	
120	144	200	
135	162	225	
150	180	250	
	Low N need 75 90 105 120 135	(ppm N) Low N need Medium N need 75 90 90 108 105 126 120 144 135 162	

2. MAKE NUTRITION PLAN

Using the <u>ADDITIONAL YAN</u> determined in step 1(E), consult the table below to **fill in the Nutrition Plan card** at the bottom of the page and determine what nutrient and dosage will be added at each stage of fermentation.

Stand of Cidomodian	Fermentation Goal*	ADDITIONAL YAN REQUIRED			
Stage of Cidermaking Fermentation Goal*		0-50 ppm	51-100 ppm	101-150 ppm	
At Rehydration	All Fermentation Goals	GO-F	FERM STEROL FLASH - 30 g/hl		
At 2-3 °Brix Drop	Fermentation Security	N/A	FERMAID O - 20 g/hL	FERMAID O - 40 g/hL	
At 1/3 Sugar Depletion	Fermentation Security	FERMAID O - 30 g/hL	FERMAID O - 20 g/hL + FERMAID K - 12.5 g/hL	FERMAID K - 50 g/hL	
	Fruit/Floral Ciders	or STIMULA CHARDONNAY - 40 g/hL		L	

NUTRITION PLAN					
At Rehydration	30	g/hL	GO-FERM STEROL FLASH		
At 2-3 °Brix Drop		g/hL			
At 1/3 Sugar Depletion		g/hL			

*All fermentation nutrients help ensure healthy fermentation, but some also enhance wine aroma. STIMULA CHARDONNAY stimulates yeast to produce certain fruity esters.

ARTICLE

OXIDATIVE DAMAGE: PROCESS & PREVENTION

Oxidative damage in cider is responsible for browning, loss of aroma, and bruised apple/sherry off-aromas. Ultimately these effects diminish cider quality and shorten shelf-life. Damage can occur when oxidation goes unchecked, triggering a series of reactions known as the oxidation cascade.

Damage can be prevented by disrupting the oxidation cascade. Sulfur dioxide is commonly used for this purpose, however other innovative enological tools can also be used. An understanding of the oxidation cascade is necessary to understand how all of these tools work.

THE OXIDATION CASCADE

The process of juice and cider oxidation is often described as "the oxidation cascade" because it occurs as a string of reactions. Preventing oxidation involves limiting quinone formation and/or limiting the reactions quinones can participate in. The oxidation cascade can be classified into two main groups of reactions:

Quinone Formation - Phenolic compounds are converted to guinones.

Quinones can be produced from susceptible apple phenolic compounds in one of two ways: enzymatically or chemically. In the enzymatic mechanism, polyphenol oxidase enzymes (tyrosinase) convert susceptible phenols into quinones. In the chemical mechanism, oxygen reacts with transition metals like iron and copper to form radical oxygen species (highly reactive). These radical oxygen species can then oxidize susceptible phenols into quinones. The chemical mechanism is shown below:

 O_2 phenolic ROS compounds (reactive oxygen species) metal ions quinone

Figure 1: Chemical Mechanism of Quinone Formation

CHOOSING ANTIOXIDANT PRODUCTS

Oxygen and metal ions gen-

erate reactive oxygen species

While GLUTASTAR, INITIA, and ESSENTIAL ANTIOXIDANT all offer antioxidant protection, each have functions that differentiate them:

• GLUTASTAR* is used during the pre-fermentation stage and provides textural impact

luice before

exposure to oxygen

- INITIA is used during the prefermentation stage and provides microbial control
- ESSENTIAL ANTIOXIDANT* can be used at any stage of cidermaking and provides added freshness

Reactive oxygen species can oxidize

phenolic compounds to create guinones

2. Quinone Reactions - Quinones react with many compounds in juice and cider.

Quinones are highly reactive and can interact with many compounds in juice and cider (Figure 2). Some of these interactions cause oxidative damage (browning, off-aroma production, loss of varietal aroma, etc...).

- 1. Browning occurs when quinones react with susceptible polyphenols in cider, producing brown pigments.
- Oxidative aroma production occurs via the Strecker degradation. In this reaction, quinones and amino acids interact to form aldehydes like methional and phenylacetaldehyde which have aromas of bruised apple and sherry.
- 3. If apple juice is blended with other fruits in a co-fermentation then quinones can trap aromatic thiols (if present), resulting in a loss of desired aromas.

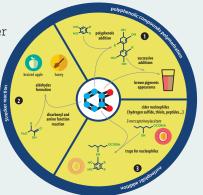


Figure 2: Quinone Reactions in Cider

PREVENTING OXIDATION

Preventing oxidation involves limiting quinone formation and/or limiting quinone reactions.

Sulfur dioxide (SO_2) is commonly used to protect cider from oxidation. SO_2 prevents quinone formation by inhibiting polyphenol oxidase enzymes. SO_2 also prevents quinone reactions by directly binding with the quinones and ensuring they cannot interact with other juice and cider compounds. However, SO_2 can have a negative impact on cider sensory properties and can delay the onset of malolactic fermentation. Additionally, SO_2 is of particular concern for ciders intended for canning and is a hot topic with consumers seeking "low chemical input" beverages.

Fortunately, there are several tools that can act as **alternatives to SO_2^*** in preventing oxidation including yeast derivative nutrients, tannins, and non-*Saccharomyces* yeast. These tools disrupt the oxidative cascade at different points:

GLUTASTAR® is a yeast derivative nutrient rich in antioxidant peptides that react with quinones, limiting quinone reactions. GLUTASTAR was developed for its extreme antioxidant protection and contains a variety of antioxidant peptides including glutathione. Glutathione is a tripeptide that can exist in two forms: reduced and oxidized. Only the reduced form (glutathione sulfhydryl or GSH) can interact with quinones and prevent them from participating in other reactions. Although GLUTASTAR is rich in GSH, it is more effective than GSH alone due to its unique profile of additional antioxidant peptides.

INITIA™ is a non-Saccharomyces yeast that rapidly consumes large amounts of oxygen and lowers copper levels, thereby limiting quinone formation. INITIA, a selected strain of Metschnikowia pulcherrima, consumes large amounts of oxygen to synthesize polyunsaturated fatty acids (PUFA) necessary for its cell membrane construction. M. pulcherrima contains approximately 100 times more PUFAs than Saccharomyces yeast, and unlike Saccharomyces yeast, cannot uptake PUFAs from the environment. Synthesizing PUFAs requires a significant amount of oxygen, leaving the environment oxygen depleted.

ESSENTIAL ANTIOXIDANT is a tannin that scavenges metal ions and quinones and inhibits polyphenol oxidase, disrupting the production of quinones and limiting the reactions they can participate in.

*Note: These products can be used in combination to maximize antioxidant properties and lower SO_2 use throughout the cidermaking process. However, these products do not completely replace the use of SO_2 – GLUTASTAR and ESSENTIAL ANTIOXIDANT do not offer antimicrobial protection, and INITIA only offers antimicrobial protection prior to fermentation (for more information see pgs 84–85).



Tannins are one of the most versatile and underestimated tools in the cidermakers' toolbelt. Often only appreciated for their contributions to structure and mouthfeel, tannins are also a natural way to prevent oxidative damage, as well as impact cider flavor and aroma. Whether you make cider from cider apples, culinary apples, or concentrate, tannins can add complexity and balance if nature has fallen short.



Tannins are naturally occurring polyphenolic compounds that contribute to cider structure, mouthfeel, and aromas as well as protect from browning.

Tannins have a broad range of applications: antioxidation (preserving aroma, minimizing browning); tannin impression; enhancing aroma; building volume/roundness and adding freshness. Tannins are versatile and, depending on the tannin, can be added before fermentation, during fermentation, aging, or prior to packaging 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

ANTIOXIDATION - All tannins have antioxidant abilities, though some are more effective than others at interacting with quinones and iron to interrupt the oxidation chain.

ENHANCES AROMA - Tannins can add aromas and/or enhance existing aromas.

STRUCTURE - Certain tannins can increase tannin intensity while decreasing bitterness and astringency.

INCREASES 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.

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

ANTIOXIDATION

ENHANCES AROMA

STRUCTURE

INCREASES VOLUME/ROUNDNESS

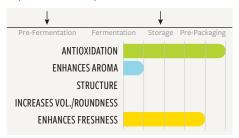
ENHANCES FRESHNESS

TANNINS

ESSENTIAL ANTIOXIDANT



Superior oxidation protection and freshness



1kg|#15984

ESSENTIAL ANTIOXIDANT helps to protect delicate aromas and color from oxidative damage. This tannin is highly purified and offers the highest rate of antioxidant protection of all the tannins within our portfolio.

- Protects aroma and color of juices and ciders that are susceptible to enzymatic browning
- Minimal impact on mouthfeel when used at low dosages
- Highly effective gallnut tannin
- Can be used pre-fermentation and/or during aging (up to 3 weeks prior to packaging)

Usage: Dissolve ESSENTIAL ANTIOXIDANT in about ten times its weight of water 95-104°F (35–40°C) until fully dissolved. Add gradually during a transfer or pumpover. 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.

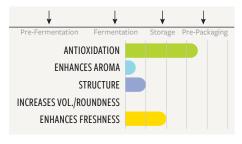
Storage: Dated expiration. Store in a cool, dry, odor-free environment. Once opened, the product must be used immediately.

Recommended Dosage - Bench trials recommended for cider				
Juice	3-6 g/hL	30-60 ppm	0.25-0.5 lb/1000 gal	
Oxygen sensitive Juice	5-10 g/hL	50-100 ppm	0.42-0.83 lb/1000 gal	
Cider	1-4 g/hL	10-40 ppm	0.08-0.32 lb/1000 gal	

FT BLANC



Enhances tannin perception and protects against oxidation



1 kg #15954 #15969 5 kg

SCOTT'TAN FT BLANC™ can be used to increase the tannin content of juices and ciders while protecting color and aromas from oxidative browning.

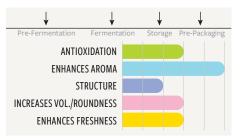
- Can increase tannin levels in low tannin juice and cider
- Can minimize the impact of hydrogen sulfide
- Provides antioxidative protection (for maximum antioxidant protection ESSENTIAL ANTIOXIDANT is the preferred tannin)
- · Gallnut tannin derived from Tara
- Can be used at any stage of production (up to 3 weeks prior to packaging)

Usage: Add FT BLANC to juice or cider during a tank mixing. When adding, dissolve in about ten times its weight of water 95–104°F (35–40°C) and add ensuring good homogenization. If an addition is made post-fermentation, we recommend waiting 3-6 weeks after the tannin addition before racking, fining,

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

FT BLANC CITRUS

Enhances and protects fruity and floral aromas



1 kg #15974 5 kg #15975 SCOTT"TAN FT BLANC CITRUS™ increases aromatic complexity, enhances freshness, and can impact volume and roundness.

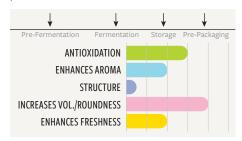
- Aromas are greater when FT BLANC CITRUS is used during fermentation and in conjunction with a yeast strain with beta-glucosidase activity (e.g., 58W3, ALCHEMY I, CROSS EVOLUTION, ELIXIR, ICV D47, ICV OPALE 2.0, NT 116, QA23, R2, R-HST, SENSY)
- Ciders show more intense citrus and floral aromas
- Small doses can be added to finished ciders to enhance freshness and aroma complexity
- Provides some antioxidative protection (for maximum antioxidant protection ESSENTIAL ANTIOXIDANT (pg 44) is the preferred tannin)
- Blend of tannins from citrus wood and gallnuts
- · Can be used at any stage of production (up to 3 weeks prior to packaging)

Usage: Dissolve FT BLANC CITRUS in about 10 times its weight of water 95–104°F (35–40°C) 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 packaging. **Storage:** Dated expiration. Store in a cool, dry, odor-free environment. Reseal opened packaging immediately.

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

FT BLANC SOFT

Mouthfeel enhancement and oxidation protection



1 kg #15955 5 kg #15980 SCOTT'TAN FT BLANC SOFT $^{\text{TM}}$ can be used to protect color and aromas from oxidative browning while improving mouthfeel and balance.

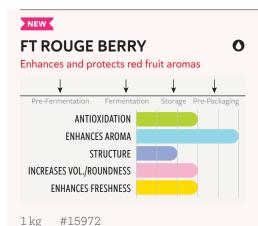
- Ciders have enhanced texture, fuller mid-palate, and a perception of sweetness
- Relatively small dosages can contribute to freshness
- Provides some antioxidative protection (for maximum antioxidant protection ESSENTIAL ANTIOXIDANT (pg 44) is the preferred tannin)
- Blend of gallic tannins derived from gallnuts and Tara
- Can be used at any stage of production (up to 3 weeks prior to packaging)

 $\label{lem:base:eq:b$

Storage: Dated expiration. Store in a cool, dry, odor-free environment. Reseal opened packaging immediately.

Recommended Dosage	20-200 ppm	2-20 g/hL	0.17-1.7 lb/1000 gal
--------------------	------------	-----------	----------------------

0



- Enhances strawberry, watermelon, and red apple aromas
- Aromas are greater when FT ROUGE BERRY is used during fermentation and in conjunction with a yeast strain with beta-glucosidase activity (e.g., 58W3, ALCHEMY I, CROSS EVOLUTION, ELIXIR, ICV D47, ICV OPALE 2.0, NT 116, QA23, R2, R-HST, SENSY)
- Blend of condensed tannins from red berry plants
- Can be used at any stage of production (up to 3 weeks prior to packaging)

Usage: Dissolve FT ROUGE BERRY in about 10 times its weight of water $95-104^{\circ}F$ ($35-40^{\circ}C$) 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 packaging.

Storage: Dated expiration. Store in a cool, dry, odor-free environment. Reseal opened packaging immediately.

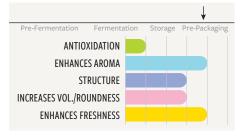
Recommended Dosage	20-150 ppm	2-15 g/hL	0.17-1.2 lb/1000 gal
--------------------	------------	-----------	----------------------

RADIANCE

#15973

5 kg

Enhances freshness, adds fruit and oak aromas; Can be added pre-packaging



250 g #15978 1 kg #15985 SCOTT'TAN RADIANCE™ integrates rapidly and helps to unmask and refine aromas, bringing an aromatic freshness to ciders.

- Highlights fresh fruit and adds vanilla, baking spice, and caramel notes
- Promotes balance and mouthfeel while maintaining acidity
- Rapidly integrates and is great for "last-minute" additions conduct filterability trials to avoid filtration challenges
- Blend of tannins from lightly toasted French oak
- Best used for final blend adjustments (up to 2 days prior to packaging)

Usage: Dissolve RADIANCE in about ten times its weight of water 95–104°F (35–40°C) until fully dissolved. Add to cider gradually during a transfer or pumpover. Good mixing is important. **Storage:** Dated expiration. Store in a cool, dry, odor-free environment. Reseal opened packaging immediately.

Recommended Dosage10-100 ppm1-10 g/h	hL 0.08-0.83 lb/1000 gal
--------------------------------------	--------------------------

RICHE EXTRA

Smoothness and rich oak characters

Pre-Fermentation Fermentation Storage Pre-Packaging

ANTIOXIDATION
ENHANCES AROMA
STRUCTURE

500 g #15963

INCREASES VOL./ROUNDNESS

ENHANCES FRESHNESS

SCOTT'TAN RICHE EXTRA™ enhances aromatic complexity and adds distinctive oak richness to the palate, making this an ideal tannin for producing barrel-aged style ciders.

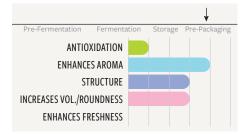
- Heightens the perception of vanilla and coconut
- Can help build mid-palate structure and a smooth finish
- Derived from 100% toasted American oak
- Best used for final blend adjustments (up to 3 weeks prior to packaging)

Usage: Dissolve RICHE EXTRA in about 10 times its weight of water 95–104°F (35–40°C) then add it to the cider and mix well. Good homogenization is important. Final additions should be made at least 3 weeks prior to packaging. After additions, proceed with normal racking.

Storage: Dated expiration. Store in a cool, dry, odor-free environment. Reseal opened packaging immediately.

ROYAL

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



250 g #15979 1 kg #15986 SCOTT'TAN ROYAL $^{\text{\tiny TM}}$ may be used to increase aromatic complexity, gently enhance structure, and add length to the palate.

- It is known to bring out aromas of cocoa, chocolate, coffee, and butterscotch
- Can help mask Brettanomyces off-aromas and flavors
- Rapidly integrates and is great for "last-minute" additions conduct filterability trials to avoid filtration challenges
- Extracted from American oak
- Best used for final blend adjustments (up to 2 days prior to packaging)

Usage: Dissolve ROYAL in about ten times its weight of water 95–104°F (35–40°C) until fully dissolved. Add to cider gradually during a transfer or pumpover. Good mixing is important. **Storage:** Dated expiration. Store in a cool, dry, odor-free environment. Reseal opened packaging immediately.

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



Bench Trial Protocol scottlab.com/bench



Finishing Kit scottlab.com/finishing-kit

ARTICLE

UNLOCKING THE FULL POTENTIAL OF CULINARY APPLES: ELEVATE YOUR CIDER WITH TANNINS

INTRODUCTION

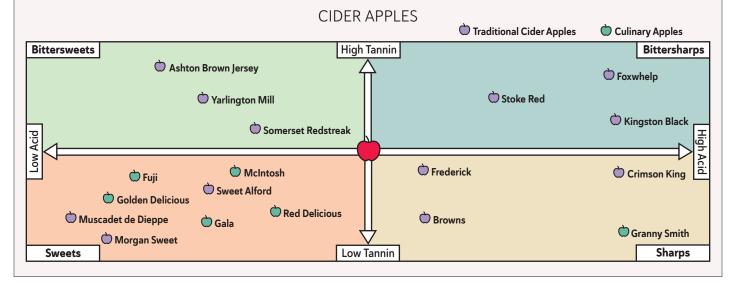
Cider fermentation begins with clarified juice from apples. Different juice sources, such as fresh-pressed apple juice, concentrate, and juice made from different varieties of apples, have unique advantages and disadvantages that can affect the final product. This article explores how apple juice source impacts resulting flavor profiles and how flavor profiles can be changed by using tannins.

APPLE CHEMISTRY AND CIDER PROFILES

Apples used in cidermaking can be broadly categorized based on their sweetness, acidity, and tannin levels. These characteristics play a crucial role in the final flavor and mouthfeel of the cider. The four categories of apples used in cidermaking are:

- Sweet: Low in tannins, low in acidity, and high in sweetness. They may lack structure and acidity. (Most culinary and dessert apples fall within this category)
- · Sharp: Low in tannins, high in acidity, and less sweet. They contribute tartness and brightness to ciders.
- Bittersweet: High in tannins, low in acidity, and relatively sweet. They contribute structure and complexity to ciders.
- Bittersharp: High in tannins and acidity, with lower sweetness levels. They contribute both structure and tartness.

Although cider apples are traditionally used, culinary apples have long been favored due to their affordability and accessibility. They provide a solid foundation for cider production, allowing the operation to remain economically sustainable. However, when used as the main juice source the resulting ciders might fall short in terms of complexity.



WHAT DOES THIS MEAN?

- Sweetness is due to the sugar (mainly fructose) from the apples. Post-fermentation other compounds can mimic sweetness, examples could be oak or mannoproteins. Sweetness is a good counterbalance to acidity and tannic intensity. However, if the cider is too sweet (i.e., it does not have enough acid or tannic intensity to balance the sweetness) then the ciders can taste flat and cloying.
- **Sharpness** is due to the malic acid which is the main apple acid. Malic acid can range from 3.73-6.58 g/L ⁽¹⁾. Sharpness can be counterbalanced with sweetness or polysaccharides from yeast derivative nutrients or mannoproteins.
- Bitterness is due to the polyphenolic (tannin) content. For apples to be classed as high tannin varietals they must have >0.2% tannin (>2g/L). The tannin content can be counterbalanced with sweetness or polysaccharides from yeast derivative nutrients or mannoproteins.

BUT TANNINS ARE MORE THAN JUST STRUCTURE

Tannins can do more in cider than just enhance mouthfeel and structure. These compounds can also impact color and aroma.

- Impact on color: Tannins possess antioxidant properties that can significantly affect the color profile of cider. While all tannins exhibit some level of oxidation inhibition, their effectiveness varies based on their botanical origin.
- Impact on Aroma Compounds: Tannins influence aroma compounds in diverse ways, including stabilization, reinforcement, and the introduction of compounds that enhance aroma perception.

CHOOSING TANNINS TO ELEVATE YOUR CIDER

The choice of tannin can substantially impact mouthfeel. For ciders that are lacking in tannin intensity (or ciders that are a bit too sweet or lacking acid) SCOTT"TAN FT BLANC or ROYAL can be used. If the ciders are too tannic or sharp (acid) then these attributes can be balanced using SCOTT"TAN FT BLANC SOFT or RICHE EXTRA

In addition to impacting mouthfeel, tannins have the potential to elevate the aroma of ciders. To increase fruity aroma perception, consider using SCOTTTAN FT BLANC CITRUS or FT ROUGE BERRY. For imparting oak-like qualities reminiscent of barrel aging, consider using SCOTTTAN RICHE EXTRA or ROYAL.

Note: These tannins can be introduced at different stages of production, read product descriptions for more information.

FT BLANC CITRUS

FT BLANC SOFT

FT BLANC

FT BLANC

FT BLANC

FT BLANC

FT BLANC

Oaky Aromas

Note: Tannins are not the only tools for modulating aroma perception and mouthfeel. Consider exploring yeast derivative nutrients such as OPTI-WHITE and GLUTASTAR, along with colloidal stabilizers like FLASHGUM R LIQUIDE, ULTIMA SOFT, and the FINAL TOUCH range of mannoproteins.

(I) https://www.researchgate.net/publication/276502270_Traditional_versus_modern_apple_cultivars-A_comparison_of_juice_composition



ENZYMES & FINING

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, which is why we offer a variety of package sizes and formats. No batch is too large or too small - we have you covered.

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.





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 production stages impacted by improper clarification: Proper clarification prevents yeast stress during fermentation. High turbidity can cause yeast stress resulting in H₂S production. However, during settling it is important not to over-clarify or yeast will **FERMENTATION** 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. Proper clarification prevents issues with filtration and stability. Poorly clarified ciders may prematurely clog filter media, making it very difficult to achieve filtration goals. Clarification of cider **FILTRATION** for filtration should start before fermentation. Attempting to clarify with only post-fermentation treatments may not be as effective. CLARIFICATION BY STAGE OF PRODUCTION Below we detail best practices for clarifying cider throughout the cidermaking process: Treating milled apples with enzymes improves clarity of the juice. Additionally, enzyme treatment **PRFSSING** 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. Clarification of juice can be achieved in multiple ways. First, determine if juice needs to be clarified: JUICE SETTLING ideally, juices should be clarified to 80-120 NTU or 1-2% solids. If juice does need to be clarified this & RACKING can be achieved via the addition of enzymes and fining agents (see pg 57). Bulk juice or concentrate may look clear but may still benefit from additional treatments. Finished ciders are complex colloidal solutions. The two main factors that complicate postfermentation 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 POSTefficient. **FERMENTATION** 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 (see pgs 56-57 for best practices). These products can also address other fining and stability concerns. Consult the chart on pgs 58-59 for assistance in choosing post-fermentation

clarification products.

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 juice and cider, 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, 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).	Time: The longer the enzyme is left to work, the more work	The dosage required varies depending on contact time,	Some products will immediately halt enzyme	
LOW TEMP: At temperatures <50 °F/10°C enzymes will still work, but slowly. HIGH TEMP: At temperatures	it can do. Unfortunately, due to processing demands, time is often the limiting factor.	level of pectin, stage of production, and presence of inhibitory substances.	 activity including: High SO₂ additions Bentonite additions Tannin additions 	
>140°F/60°C the enzyme can be denatured and destroyed.	Mixing: The more often a vessel is mixed, the greater the ability of the enzyme to come		Time these additions carefully and never mix enzymes directly with any of these additives.	
Be mindful of temperature when using enzymes during juice thawing or cold crashing.	in contact with its substrate (pectin).		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™ + SCOTTZYME PEC5L™		
Juice	Decrease pectin for improved clarity, faster settling, decreased solids, and compacted lees	SCOTTZYME HC TM + SCOTTZYME PEC5L TM RAPIDASE CLEAR EXTREME TM		
		SCOTTZYME HC TM + SCOTTZYME PEC5L TM		
Post-Fermentation, Pre-Filtration	Improve clarity, increase filtration efficiency, and minimize loss	SCOTTZYME KS™		
	3.13	SCOTTZYME SPECTRUM™		

RAPIDASE CLEAR EXTREME FAPIDASE

Superior juice clarification under difficult conditions

Add to:

Juice

Impact:

Rapid clarification under difficult conditions, lees compaction

Format:

Granular and Liquid

100 g #16257 1 L #16248 RAPIDASE CLEAR EXTREME[™] can be used to quickly reduce juice viscosity resulting in superior juice clarification, especially in difficult conditions (low temperature, low pH, high pectin content and/or hard-to-settle juices).

- · Rapidly breaks down pectin and promotes particle aggregation
- Aids in fast clarification
- Results in compact lees
- Preserves juice aromatic freshness
- Enzyme is active from 43–122°F (6–50°C)
- Recommended contact time 2-12 hours
- Pectinase with essential side activities

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 $39-45^{\circ}F$ ($4-8^{\circ}C$). Once rehydrated, use within a few hours

Recommended Dosag	ge	
Juice	Granular: 1-4 g/hL	Granular: 38-152 g/1000 gal
	Liquid: 1-4 mL/hL	Liquid: 38-152 mL/1000 gal

SCOTTZYME HC

Increase yield, clarity, and filterability

Add to:

Milled fruit, juice, or cider

Impact:

Improves clarification and filtration

Format:

Liquid

1 kg (890 mL) #16171 25 kg (22.25 L) #16161 SCOTTZYME HC^{TM} is a versatile enzyme that can be used throughout the cidermaking process where it can increase yield, reduce solids, and improve filtration.

- HC is useful in a variety of fruits and breaks down fibrous cellulose in pome fruits (apple or pear) that hinders settling and filtration
- HC is best used in conjunction with SCOTTZYME® PEC5L
- In juice use during settling until desired level of clarity is achieved. In cider, optimal contact time is 3 days at 60° F (15° C) and 4-7 days (with stirring) at $30-60^{\circ}$ F ($-1-15^{\circ}$ C).
- Pectinase with cellulase side-activities

Usage: Dilute SCOTTZYME HC to approximately a 10% solution in cool water. Pour the solution over the milled fruit or add to juice or cider during a thorough tank mixing.

Storage: Dated expiration. Store at 39°F (4°C). 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			

SCOTTZYME KS

Improved clarification and filtration

Add to:

Juice or cider

Impact: Improves filtration

Format: Liquid

1 kg (890 mL) #16174 25 kg (22.25 L) #16164 SCOTTZYME KS $^{\text{\tiny{TM}}}$ can be used anytime post-pressing to increase clarification rates and improve filtration throughput.

- The earlier KS is used, the more effective it will be
- Customers have reported very favorable results when used to solve "nightmare" filtrations
- In juice use during settling until desired level of clarity is achieved. In cider, optimal contact time is 3 days at 60° F (15° C) and 4-7 days (with stirring) at $30-60^{\circ}$ F ($-1-15^{\circ}$ C).
- Blend of pectinase enzymes with cellulase, hemicellulase, and protease side activities
- For very difficult to filter ciders, use SCOTTZYME® SPECTRUM

Warning: Never use SCOTTZYME KS before pressing. It has very aggressive enzymatic activities that will break down apple skins and create many fine solids that may remain in suspension.

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 thorough tank mixing. **Storage:** Dated expiration. Store at 39°F (4°C). Keep tightly sealed and refrigerated once opened.

Recommended Dosage-Bench trials recommended for cider						
Juice 2.6-4.0 mL/hL 100-150 mL/1000 gal						
Cider 5.3-7.9 mL/hL 200-300 mL/1000 gal						

SCOTTZYME SPECTRUM

Concentrated formulation for improved filtration

Add to: Cider

Impact: Improves filtration

Format: Liquid

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

and crossflow "cleaning"

SCOTTZYME SPECTRUM $^{\text{\tiny{TM}}}$ is formulated for use on finished cider only and can assist with settling and improve filtration issues prior to packaging.

- Highly concentrated blend of pectinase enzymes with cellulase, hemicellulase, and protease side activities
- In cider, optimal contact time is 3 days at $60^{\circ}F$ (15°C) and 4–7 days (with stirring) at $30-60^{\circ}F$ ($-1-15^{\circ}C$).
- See scottlab.com for a protocol on cleaning cartridge and crossflow membranes with SCOTTZYME SPECTRUM

Warning: Never use SCOTTZYME SPECTRUM before pressing or on juice. It is our most aggressive enzyme and may result in over-clarification of juice, leading to fermentation difficulties.

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

Storage: Dated expiration. Store at 39°F (4°C). Keep tightly sealed and refrigerated once opened.

Recommended Dosage-Bench trials recommended				
Cider	4 mL/hL	150 mL/1000 gal		

SCOTTZYME PEC5L

Improved pressing and clarification

Add to:

Milled fruit, juice, or cider

Impact:

Increase yield and improve clarification

Format:

Liquid

1 kg (890 mL) #16170 25 kg (22.25 L) #16160 SCOTTZYME PEC5L $^{\text{m}}$ is a versatile enzyme that can be used at many cidermaking stages.

- If added directly to milled fruit it can enhance pressabiliy and increase yield. When added to juice it decreases turbidity and improves settling.
- Improves post-fermentation processing, including filtration
- Also useful for berries and stone fruits and should be used in conjunction with SCOTTZYME $HC^{\text{\tiny TM}}$
- In juice use during settling until desired level of clarity is achieved. In cider, optimal contact time is 3 days at 60° F (15° C) and 4-7 days (with stirring) at $30-60^{\circ}$ F ($-1-15^{\circ}$ C).
- · Highly concentrated pectinase

Usage: Dilute SCOTTZYME PEC 5L to approximately a 10% solution in cool water. Pour over the milled fruit before pressing or add to juice or cider during a thorough tank mixing. **Storage:** Dated expiration. Store at 39°F (4°C). 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			

DID YOU KNOW?

NOT ALL PECTINASES ARE THE SAME

All enological enzymes are pectinase-based and some have overlapping uses, but they are inherently different on several fronts. Pectin is a large, branched molecule with many side chains. The degree of branching correlates to how difficult it is to break down, and the various side chains require different "side activities" of enzymes to be broken down. The degree of branching as well as the absolute pectin content varies by fruit and degree of ripeness.

Pectinases are useful in all cider production but are especially useful with certain cidermaking practices. Pectinases are great when making cider from concentrates because they have a higher residual branched pectin content than fresh pressed juice. Pectinases are also great when co-fermenting or backsweetening with fruits or concentrates like apricot, plum, blackcurrant, blackberry, or raspberry, all of which have higher pectin contents than apples or pears.

Not all pectinases are the same (and this is good!). The strain of *Aspergillus niger* used to produce the enzymes will vary. The secondary and tertiary (side) activities will differ. Even if two pectinases contain similar enzymes and activities, the concentrations of the components will differ. This means that different pectinase enzymes will be more effective at dealing with your cider's level of pectin and pectin branching. Remember, enzyme formulations are cocktails and the best way to know what works for you is to try them out.

Fining and stabilizing are complementary actions that treat and prevent off-odors, off-colors, unsightly hazes, and precipitates.

Fining products bind with unwanted elements and physically **remove** them from juice and cider. **Stability products** react with substances to **prevent** hazes and precipitates from occurring. A properly fined, stabilized, and filtered cider makes for a bottle-stable cider.

BENEFITS OF FINING & STABILITY AGENTS IN JUICE AND CIDER

IMPROVE CLARIFICATION	High solids can be problematic: they can cause off-odor production during fermentation, and they can make filtration difficult. A variety of fining agents including bentonite, chitosan, gelatin, and isinglass can be used for clarification.
TREAT AND PREVENT OXIDATION ISSUES	Oxidative damage in juice and cider is responsible for browning, loss of varietal aroma, and bruised apple/sherry off-aromas. The conditions leading to oxidative damage are not always understood, but treating problems early is always encouraged. Fining agents such as PVPP, casein, chitosan, and carbon can help treat and prevent oxidation issues.
SENSORY IMPROVEMENT	Fining agents can reduce astringency and bitterness (gelatin), counteract moldy and other unwanted aromas (carbon, PVPP, casein, certain chitosan formulations), and unmask some positive aromatics (gelatin).
COLLOIDAL STABILITY & HAZE PREVENTION	"Colloids" are a broad class of compounds that can cause a variety of hazes and precipitates, including polyphenol and polysaccharide hazes. Fining and stability agents can treat and prevent these issues, leading to colloidal stability: Fining agents can treat and prevent hazes due to phenolic compounds, and residual fining aids (silica gel), etc.
	Stability agents can broadly target and stabilize many colloidal compounds (gum arabic and mannoproteins).

THE ROLE OF FINING & STABILITY IN THE CIDERMAKING PROCESS

Throughout the cidermaking process, fining and stability agents work with enzymes and filtration to produce a bottle-stable cider without off-aromas, off-flavors, and visual flaws. Using enzymes makes the fining/stability process step more efficient. Furthermore, using enzymes and fining/stability agents makes filtration more efficient.



PROTOCOL

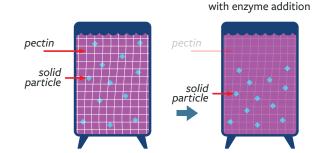
BEST PRACTICES FOR SETTLING WITH FINING AGENTS

Static settling is the most common method of using and removing fining agents. Agents are added to a tank, the tank is mixed, and the agent settles over time, binding and removing solids and other undesired compounds. Scott Laboratories recommends the following order of operations: 1st Add Enzymes; 2nd Add Fining Agent(s); 3rd Allow Time to Settle

ADD ENZYMES

Enzymes break down pectin in juice and cider. Pectin traps solids and other undesirable compounds in suspension and prevents settling. Pectin will also prevent fining agents from settling.

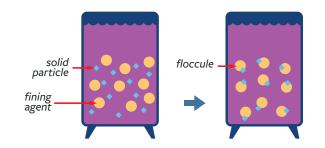
It is difficult to know if a cider has a problematic level of pectin without testing, and bench top trials can be unreliable. Typically, pectin problems are discovered when a fining agent won't settle out. At this point, it may be too late to use enzymes as some fining agents like bentonite can deactivate enzymes. Proactive use of enzymes is an inexpensive way to avoid this issue. Enzyme use during clarification will also make future filtration easier.



ADD FINING AGENT(S)

Fining agents bind with solids and other undesirable compounds, forming larger molecules called **floccules**, which fall out of solution more quickly than unbound solids. To determine the most appropriate fining agent and dosage, bench trials should be conducted.

When adding a fining or stability agent it is important to properly rehydrate the product, as well as adequately disperse it into the cider. Closed circulation after addition is recommended at all cidermaking stages.



ALLOW TIME TO SETTLE

The floccules created by the fining agent will settle to the bottom of the tank over time. Temperature is the main driver of settling rate, and cold temperatures (close to freezing) can inhibit settling and will also inhibit most enzyme activity.



FINING & 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.

QUICK GUIDE TO CHOOSING FINING AND STABILITY AGENTS

	CRISTALLINE PLUS	INOCOLLE	NACALIT PORE-TEC	QI'UP XC	BENTOLACT S	CASÉINATE DE POTASSIUM	FRESHPROTECT	No[ox]	POLYCACEL	POLYCEL
	pg 65	pg 65	pg 61	pg 64	pg 61	pg 62	pg 62	pg 64	pg 63	pg 63
	Clarification					Trea	t and Prevent	Oxidative Dam	nage	
Formulation	Isinglass	Gelatin	Bentonite	Chitosan- Tartaric acid blend	Bentonite- Casein blend	Casein	Bentonite- PVPP blend	Chitosan- Bentonite blend	PVPP-Casein blend	PVPP
Primary Use	Clarification (for brilliance after standard clarification)	Unmask positive aromatics	Clarification	Clarification	Treat and prevent oxidation issues	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
Secondary Use	-	Clarification	Compaction of lees	-	Reduce sulfur off odors, counteract moldy aromas	Counteract moldy aromas, diminish bitterness	Counteract moldy aromas, diminish bitterness	Counteract moldy aromas, diminish bitterness	Counteract moldy aromas, diminish bitterness	Diminish bitterness
Stage Of Production	Post- fermentation	Juice, Post- fermentation	Juice, Post- fermentation	Juice, Flotation, Post- fermentation	Juice, Fermentation, Post -fermentation	Juice, Post -fermentation	In press, Juice, Post -fermentation	In press, Juice, Post -fermentation	Juice, Fermentation, Post -fermentation	Fermentation, Post -fermentation
									A and GLUTASTAR	

prior to fermentation) and PURE-LEES LONGEVITY (can be used toward the end of fermentation)

(CONTINUED)

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 76–82). Proper fining, stabilization, and filtration ultimately leads to a package-stable cider.

FINAL TOUCH GUSTO	FINAL TOUCH TONIC	FINAL TOUCH	FLASHGUM R LIQUIDE	PURE-LEES LONGEVITY	ULTIMA SOFT	COLLE PERLE	GELOCOLLE	GRANUCOL FA	GRANUCOL GE
pg 66	pg 67	pg 67	pg 68	pg 68	pg 69	pg 65	pg 69	pg 60	pg 60
		Colloidal	Stability				Misc.	Goals	
Mannoprotein	Mannoprotein	Mannoprotein	Gum Arabic	Mannoprotein	Mannoprotein - Gum Arabic blend	Gelatin	Silica Gel	Carbon	Carbon
Confers colloidal stability	Confers colloidal stability	Confers colloidal stability	Confers colloidal stability	Confers colloidal stability	Confers colloidal stability	Removal of astringency and bitterness	Prevention of overfining, used in conjunction with animal- derived fining agents	Decolorization	Deodorization
Improves roundness	Protects aroma compounds, prevents premature aging	Improve bubble quality and bubble persistence in sparking ciders	Enhance perception of sweetness	Minimizes loss of fruit character and browning	Enhance perception of sweetness and mouthfeel, minimize bitterness and astringency	Clarification	Compaction of lees during settling	Treat and prevent oxidation issues	-
Immediately prior to packaging	Immediately prior to packaging	Immediately prior to packaging	Immediately prior to packaging	Fermentation, Post- fermentation	lmmediately prior to packaging	Post- fermentation	Flotation, Post- fermentation	In press, Juice, Post -fermentation	In press, Juice, Post -fermentation

Activated Carbon

GRANUCOL FA



Carbon with decolorizing properties

Stage of Cidermaking: Juice, cider

Juice, claer

Contact Time: 24 hours

Impact:

Removes color

1 kg #15331 10kg #15334 GRANUCOL FA™ is used to eliminate unwanted color in juice and cider.

- Can help remove brown pigments due to oxidation
- Can reduce other colored pigments
- For maximum effect, use during fermentation for highly colored juices
- Activated carbon in pellet form (non-dusting) 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 cool, dry, odor-free environment. Reseal opened packaging immediately.

Recommended Dosag	Pecommended Dosage - Bench trials recommended for cider			
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	

GRANUCOL GE



Carbon with deodorizing properties

Stage of Cidermaking:

Juice, cider

Contact Time:

24 hours

Impact:

Removes off-odors and flavors

1 kg #15332 10kg #15333 GRANUCOL GE™ is used to absorb off-aromas and off-flavors.

- Especially useful in removing moldy aromas from compromised fruit
- Also good at removing bitter notes
- Activated carbon in pellet form (non-dusting) for ease of use

Usage: 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.

Recommended Dosage - Bench trials recommended for cider			
Juice	100-1000 ppm	10-100 g/hL	0.83-8.3 lb/1000 gal
Cider	100-600 ppm	10-60 g/hL	0.83-5.0 lb/1000 gal

Bentonite

NACALIT PORE-TEC



Bentonite for clarification

Stage of Cidermaking:

Juice, cider

Contact Time:

Juice (16 hours or until settled) Cider (1-2 weeks)

Impact:

Clarification and compaction of lees

5 kg #15322 20kg #15324 NACALIT PORE-TEC™ is specifically formulated for instances where superior flocculation, adsorption, and clarification are required.

- · Helps to compact lees
- Produced using PORE-TECnology resulting in an almost dust-free bentonite
- Can be prepared in room temperature water
- Highly purified sodium-calcium bentonite

Usage: Add NACALIT PORE-TEC slowly to approximately 5-10 times its weight of room temperature water 59-77°F (15-25°C) under constant stirring. 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 cool, dry, odor-free environment. Reseal opened packaging immediately.

Recommended Dosage - Bench trials recommended		
500-1500 ppm	50-150 g/hL	4.2-12.6 lb/1000 gal

Casein and/or PVPP

BENTOLACT S



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

Stage of Cidermaking:

Juice, cider

Contact Time:

Juice (16 hours or until settled) Cider (1-2 weeks)

Impact:

Treatment and prevention of oxidation, cleans up off-odors and flavors

5 kg #15788

BENTOLACT S^{TM} is most commonly used to prevent and treat oxidative damage.

- Can be used in juice or cider, but is most effective when used early in the cidermaking process
- Can help refresh ciders with oxidized and moldy fruit aromas
- Can help to remove sulfur off-odors
- Can help to remove bitter characters
- Assists with clarification
- · Proprietary IOC blend of soluble casein and bentonite

 $\label{local_bound_bound_bound_bound} \textbf{Usage:} \ \ \text{Suspend BENTOLACT S in approximately 10 times its weight in cool water and mix vigorously to remove clumps. Allow the mixture to stand for 3 hours. Use BENTOLACT S the same day it is hydrated. Add to cider and mix to homogenize. BENTOLACT S additions may take up to 7-14 days to settle.$

Recommended Dosage - Bench trials recommended for cider				
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				

CASÉINATE DE POTASSIUM **DISC**



Casein to help prevent oxidation and remove oxidized components

Stage of Cidermaking:

Juice, cider

Contact Time:

Juice (16 hours or until settled) Cider (1-2 weeks)

Impact:

Treatment and prevention of oxidation

5 kg #15808 CASÉINATE DE POTASSIUM is used for the treatment of oxidized phenolics and bitter compounds.

- Helps freshen cider and reveal muted aromas
- Can also be used to help prevent oxidation of specific phenolic compounds
- · Can counteract moldy aromas
- Can help to minimize bitter characters
- Proprietary IOC formulation of casein which contains potassium to help with solubility

Usage: Suspend CASÉINATE DE POTASSIUM in approximately 10 times its weight of cool water. Mix well and ensure there are no clumps. Once hydrated, CASÉINATE DE POTASSIUM should be used within 2 hours. For juice, add before settling or at the start of alcoholic fermentation. For cider, mix

Storage: Dated expiration. Store in a cool, dry, odor-free environment. Reseal opened packaging immediately.

Recommended Dosag	Recommended Dosage - Bench trials recommended for cider			
Juice	500-1000 ppm	50-100 g/hL	4.2-8.4 lb/1000 gal	
<i>Cider</i> 200-1000 ppm		20-100 g/hL	1.7-8.4 lb/1000 gal	

FRESHPROTECT



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

Stage of Cidermaking:

Juice, cider

Contact Time:

Juice (16 hours or until settled) Cider (1-2 weeks)

Impact:

Softens ciders and removes oxidized characters

5 kg #15791 FRESHPROTECT™ is used to remove oxidized characters and bitterness.

- · Reduces aggressive mouthfeel and reveals fruit aromas
- Proprietary IOC blend of polyvinylpolypyrrolidone (PVPP), bentonite, and cellulose with gum arabic added as a processing aid
- 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 to juice or cider and mix thoroughly.

Recommended Dosage - Bench trials recommended for cider		
200-1000 ppm	20-100 g/hL	1.7-8.3 lb/1000 gal

POLYCACEL



PVPP-Casein blend for the treatment of oxidized juice or cider and for the prevention of browning

Stage of Cidermaking:

Juice, cider

Contact Time:

Juice (16 hours or until settled) Cider (1-3 weeks)

Impact:

Treatment and prevention of oxidation, freshens aromas

1 kg #15785 5 kg #15786 POLYCACEL is useful for removing phenolic compounds associated with browning.

- Can reduce bitterness and reveal hidden aromas
- · Can be used to treat oxidized juice and ciders
- · Can be used to refresh aged ciders
- Proprietary IOC blend of polyvinylpolypyrrolidone (PVPP), micropulverized cellulose, and casein
- 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 water $59-77^{\circ}F$ ($15-25^{\circ}C$). Mix well and allow to sit for 1 hour. Use POLYCACEL within 2 hours after it has been hydrated. 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 cool, dry, odor-free environment. Reseal opened packaging immediately.

Recommended Dosage - Bench trials recommended for cider			
Juice 300-700 ppm 30-70 g/hL 2.5-5.8 lb/1000		2.5-5.8 lb/1000 gal	
Cider	150-300 ppm	15-30 g/hL	1.25-2.5 lb/1000 gal

POLYCEL



PVPP for the treatment of browning, removal of bitter compounds

Stage of Cidermaking:

Juice, cider

Contact Time:

Juice (16 hours or until settled) Cider (1-2 weeks)

Impact:

Treatment and prevention of oxidation, removal of bitter compounds

1 kg #15784

POLYCEL was formulated to help prevent and/or treat browning.

- Can also be used to treat bitterness and oxidized aromas
- Can bind color molecules and small phenolic compounds (catechins); therefore, it
 is best to use in young ciders
- Blend of polyvinylpolypyrrolidone (PVPP) and cellulose
- 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 room temperature water $59-77^{\circ}F$ ($15-25^{\circ}C$). Mix well and allow to sit for 1 hour. Add to the juice or cider and mix thoroughly. Depending upon the cider, POLYCEL may take up to two weeks to settle out.

Recommended Dosage - Bench trials recommended for cider			
Juice	400-800 ppm	40-80 g/hL	3.3-6.7 lb/1000 gal
Cider (Prevention)	150-300 ppm	15-30 g/hL	1.25-2.5 lb/1000 gal
Cider (Treatment)	300-500 ppm	30-50 g/hL	2.5-4.2 lb/1000 gal

Chitosan

NO[OX]



Chitosan-bentonite blend to remove oxidized characters and increase freshness; non-animal alternative to casein

Stage of Cidermaking: Any stage

Contact Time:

Juice (16 hours or until settled) Cider (1-2 weeks)

Impact:

Treatment and prevention of oxidation, freshens aromas and reduces bitterness

5 kg #16421

 $NO[OX]^{TM}$ can be used to remove undesirable aromas and oxidized compounds.

- Non-animal, non-allergenic specialized preparation of chitosan blended with bentonite
- Can be used during juice settling to clean up musty and oxidized aromas
- Can be added during fermentation to remove bitter notes
- Can be used post-fermentation to remove oxidized characters including color, aromas, and flavors
- Ciders have a brighter color and increased aromatic freshness
- · Lees are compact and loss is minimal
- Viable alternative to casein for juice and cider fining

Note: Chitosan for the use of clarification is listed by the TTB in 27 CFR 24.250 but not on 27 CFR 24.246. For more information, please visit TTB.gov.

Usage: Slowly add NO[OX] in 10 times its weight of clean, chlorine–free water 59–77°F (15–25°C). Mix constantly until suspension is homogeneous without lumps, which can take up to one hour. Continue to mix the NO[OX] suspension while adding to the cider. Rack once lees are well settled. **Storage:** Dated expiration. Store in a cool, dry, odor–free environment. Once opened, use immediately.

Recommended Dosag	Recommended Dosage Bench trials recommended for cider			
7 11 5		30-80 g/hL	2.5-6.7 lb/1000 gal	
		20-60 g/hL	1.67-5.0 lb/1000 gal	

QI'UP XC



Chitosan for superior clarification; non-animal alternative to gelatin

Stage of Cidermaking: luice. cider

Contact Time:

Until target solids level reached

Impact:

Superior clarification

1 kg #16430

QI'UP XC is used for clarification, even in difficult conditions.

- Non-animal, non-allergenic specialized preparation of chitosan activated with tartaric acid
- The tartaric acid portion results in a high surface charge that allows for the rapid aggregation of solid particles
- This innovative floccing agent can also be used for juice flotation
- Viable alternative to gelatin for juice and cider clarification

Note: Chitosan for the use of clarification is listed by the TTB in 27 CFR 24.250 but not on 27 CFR 24.246. For more information, please visit TTB.gov.

Usage: Add QI'UP XC in 10 times its weight of clean, water 59–77°F (15–25°C), mixing constantly until suspension is homogeneous. Stir to maintain suspension during addition.

Storage: Dated expiration. Store in a cool, dry, odor-free environment. Once opened, use immediately.

Recommended Dosage Bench trials recommended for cider		
30-100 ppm	3-10 g/hL	0.25-0.83 lb/1000 gal

Gelatins

COLLE PERLE



Gelatin for the treatment of astringent ciders

Stage of Cidermaking: Cider

Contact Time:

1 week

Impact:

Removal of bitter and astringent compounds

1L #15798 5L #15799 20L #15800 COLLE PERLE™ is used to soften bitter and astringent tannins.

- It is particularly useful for young cider
- Can help with clarification
- Flocculates and settles well, especially when used in conjunction with GELO-COLLE (silica gel)
- Hydrolyzed gelatin solution

Usage: Add COLLE PERLE to cider and mix thoroughly. Racking should be done after settling (typically 1 week). It is not recommended to leave gelatins in cider for more than 30 days. COLLE PERLE can be used in conjunction with GELOCOLLE to improve settling or prevent overfining (see pg 69 for directions).

Storage: Dated expiration. Store in a cool, dry, odor-free environment. Once opened, use immediately.

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

INOCOLLE



Gelatin for clarification and aroma revelation

Stage of Cidermaking:

Juice, cider

Contact Time:

Juice (16 hours or until settled) Cider (1 week)

Impact:

Clarification and aroma revelation

1L #15795 5L #15796 INOCOLLE $^{\text{\tiny{TM}}}$ is a multi-purpose gelatin that is equally useful in juice and cider for clarification and improving aromas.

- Used for clarification to improve brilliance and suppleness
- Improves aromas and flavors of the finished cider
- It is particularly useful for juice fining and flotation
- Flocculates and settles well, especially when used in conjunction with the silica gel GELOCOLLE
- Partially hydrolyzed gelatin solution

Usage - Juice: Dilute INOCOLLE 1:1 in water. Add to juice gradually and mix thoroughly. Rack once settled. **Usage - Cider:** Dilute INOCOLLE 1:1 in water. Add INOCOLLE to cider gradually and mix thoroughly. Racking should be done after settling (typically 1 week). It is not recommended to leave gelatins in cider for more than 30 days. INOCOLLE can be used in conjunction with GELOCOLLE to improve settling or prevent overfining (see pg 69 for directions).

Storage: Dated expiration. Store in a cool, dry, odor-free environment. Once opened, use immediately.

Recommended Dosage Bench trials recommended for cider		
300-1000 ppm	30-100 mL/hL	1.1-3.8 L/1000 gal

Isinglass

CRISTALLINE PLUS



Isinglass to assist with clarification and brightening

Stage of Cidermaking: Cider

Contact Time: 2-4 weeks

Impact: Clarification

100 g #15770 1 kg #15771 CRISTALLINE PLUS™ can improve clarity and filterability even in difficult-to-filter ciders.

- Generally used to increase brilliance
- It is favored for its gentle fining effect and brightening of aromas
- Works more effectively in ciders with relatively low turbidity
- CRISTALLINE PLUS is not sensitive to cold temperatures but may be slow to complete settling; co-fine with GELOCOLLE (pg 69) for faster settling
- Blend of isinglass and citric acid stabilized with potassium metabisulfite

Usage: Dissolve CRISTALLINE PLUS in 150–200 times its weight of water 59–68°F (15–20°C). Allow to swell for 3 hours. Add additional water if solution is too viscous. Add solution to cider, taking care to mix well. Rack once lees has settled.

Storage: Dated expiration. Store in a cool, dry, odor–free environment. Once opened, keep tightly sealed and dry.

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

Mannoproteins & Gum Arabics

Mannoproteins are components of yeast cell walls and are released during alcoholic fermentation and aging. Mannoproteins are known to confer colloidal stability, reduce astringency, improve color, and improve cider texture, softness, and roundness.

The mannoproteins of different *Saccharomyces* strains vary in composition and molecular weight, which affects their properties. Even though the mannoprotein products in our portfolio have the same basic composition and all confer colloidal stability, they all have unique secondary impacts based on the strains they were prepared from.

NEW <

FINAL TOUCH GUSTO



Liquid mannoproteins for colloidal stability and "last minute" adjustments

Stage of Cidermaking: Pre-packaging

Requires racking:

Impact:

Smooths cider and confers colloidal stability

1 L #17032

FINAL TOUCH GUSTO™ is a specialized preparation of liquid mannoproteins that improves roundness and smoothness and can contribute to colloidal stability.

- Astringency and harsh acidity is reduced and the resulting cider is smoother and rounder
- Increases aroma intensity, freshness, and fruitiness
- Fully soluble and can be added 24-72 hours prior to packaging

Usage: Add FINAL TOUCH GUSTO directly to the cider and mix. If the cider will be filtered, add FINAL TOUCH GUSTO 24-72 hours before the final membrane filtration and conduct filterability trials. **Storage:** Dated expiration. Store in a cool, dry, odor-free environment. Once opened keep tightly

Recommended dosage Bench trials recommended		
100-400 ppm	10-40 mL/hL	0.38-1.5 L/1000 gal

NEW <

FINAL TOUCH TONIC



Liquid mannoproteins for colloidal stability and "last minute" adjustments

Stage of Cidermaking: Pre-packaging

Requires racking:

No

Impact:

Preserves fresh aromas, extends shelf-life, and confers colloidal stability

1L #17030

FINAL TOUCH TONIC™ is a specialized preparation of liquid mannoproteins that prevents premature aging, preserves quality, and can contribute to colloidal stability.

- Preserves freshness and prevents oxidative aromas
- · Ciders are more aromatically intense
- Fully soluble and can be added 24-72 hours prior to packaging

Usage: Add FINAL TOUCH TONIC directly to the cider and mix. If the cider will be filtered, add FINAL TOUCH TONIC 24-72 hours before the final membrane filtration and conduct filterability trials. **Storage:** Dated expiration. Store in a cool, dry, odor-free environment. Once opened keep tightly seeled and use within two weeks.

Recommended dosage Bench trials recommended		
200-400 ppm	20-40 mL/hL	0.75-1.5 L/1000 gal

NEW

FINAL TOUCH POP



Liquid mannoproteins for colloidal stability and "last minute" adjustments

Stage of Cidermaking:

Pre-packaging

Requires racking:

No

Impact:

Preserves fresh aromas, extends shelf-life, and confers colloidal stability

1L #17033

FINAL TOUCH POP $^{\text{TM}}$ is a special preparation of liquid mannoproteins that can contribute to colloidal stability. Although initially developed for sparkling wine, it does well in both still and sparkling ciders.

- Preserves freshness, elegance, and balance
- · Ciders are more aromatically intense
- · In sparkling ciders, helps improve bubble quality and bubble persistence
- Fully soluble and can be added 24-72 hours prior to bottling. It can be added directly to the cider (still or sparkling) or to the dosage of liqueur after disgorging (traditional method)

Usage: Add FINAL TOUCH POP directly to the cider and mix. If the cider will be filtered, add FINAL TOUCH POP 24-72 hours before the final membrane filtration and conduct filterability trials. **Storage:** Dated expiration. Store in a cool, dry, odor-free environment. Once opened keep tightly

Recommended dosage Bench trials recommended		
200-400 ppm	20-40 mL/hL	0.75-1.5 L/1000 gal

FLASHGUM R LIQUIDE



Liquid Gum Arabic for colloidal protection

Stage of Cidermaking: Pre-packaging

Requires Racking: No

Impact:

Colloidal protection, perception of sweetness

1 L #15772 5 L #15773 FLASHGUM R LIQUIDE™ helps reduce the risk of colloidal deposits in ciders.

- Gives perception of sweet and soft characters on the palate
- Reduces astringency and increases the perception of volume and fullness in the mouth
- Especially usefully in unfiltered ciders where it can minimize colloidal sediment
- Protects color in rosé-style ciders
- Fully soluble and can be added 24-72 hours prior to packaging
- If filtering post-addition, conduct filterability trials to avoid filtration challenges
- Gum Arabic derived from Acacia seyal

Usage: Add FLASHGUM R LIQUIDE directly to the cider and mix. If the cider will be filtered, add FLASHGUM R LIQUIDE 24-72 hours before the final membrane filtration and conduct filterability trials. Storage: Dated expiration. Store in a cool, dry, odor-free environment. Reseal opened packaging immediately.

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

PURE-LEES LONGEVITY



Powdered mannoprotein for colloidal stability and oxygen scavenging

Stage of Cidermaking:

End of alcoholic fermentation or prepackaging

Contact Time:

Minimum 24 hours

Impact:

Scavenges oxygen

Requires Racking: Yes

1 kg #15249 PURE-LEES LONGEVITY™ helps to increase shelf-life and protect color and aroma while also helping to stabilize colloids.

- Due to high oxygen uptake capacity, it minimizes browning and loss of fruitiness, which increases shelf-life
- Ciders are reported to be fresher, fruitier, and rounder
- Rapidly and irreversibly scavenges up to 1 mg/L O₂
- Inspired by the practice of traditional lees aging, PURE-LEES LONGEVITY will continue to scavenge oxygen until its capacity is exhausted
- Can replace SO₂ as an antioxidant in no- and low-SO₂ cidermaking, though it is not a direct substitute for SO2 as it has no antimicrobial activity
- PURE-LEES LONGEVITY was developed in collaboration with the National Research Institute for Agriculture, Food and the Environment (INRAe), France

Usage: Suspend PURE-LEES LONGEVITY in 10 times its weight of water 59-77°F (15-25°C), gently mix then add to cider. Mix thoroughly. Minimum of 24 hours of contact time is needed for optimal impact. Storage: Dated expiration. Store in a cool, dry, odor-free environment. Reseal opened packaging immediately.

Recommended Dosage		
200-400 ppm	20-40 g/hL	1.7-3.4 lb/1000 gal

ULTIMA SOFT



Powdered mannoprotein-gum arabic blend for colloidal stability and increased softness and roundness

Stage of Cidermaking: Pre-packaging

Requires Racking: No

Impact:

Colloidal protection, perception of softness

1 kg #17012

ULTIMA SOFT™ is used to stabilize colloids and can improve cider balance.

- Ciders appear softer with enhanced body, added length, and lower levels of astringency
- Enhances fruity aromas and imparts a rounder, fuller mid-palate
- Fully soluble and can be added 24-72 hours prior to packaging
- If filtering post-addition, conduct filterability trials to avoid filtration challenges
- Unique blend of mannoproteins and gum arabic

Usage: Add ULTIMA SOFT by mixing with 10 times its weight of water 59–77°F (15–25°C). 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, add ULTIMA SOFT 24–72 hours before the final membrane filtration and conduct filterability trials.

Storage: Dated expiration. Store in a cool, dry, odor-free environment. Reseal opened packaging immediately.

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

Silica Gel

GELOCOLLE



Silica gel for improved settling, lees compaction, and prevents overfining

Stage of Cidermaking:

Cider

Contact Time:

1-2 weeks

Impact:

Aids settling, compaction of lees

5 L #15783

GELOCOLLE™ reduces the risk of leaving residual protein-based fining agents behind (overfining), particularly in low tannin ciders or concentrates.

- Initiates the flocculation of fining agents
- Speeds up clarification
- Helps compact lees
- Can be used in hard-to-filter ciders where it binds proteins and other compounds, facilitating filtration throughput
- 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.

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, the vessel should be mixed thoroughly.

Storage: Dated expiration. Store in a cool, dry, odor-free environment. Once opened, keep tightly sealed and dry. Do not refrigerate or freeze! Gelocolle solidifies at temperatures of less than 32°F (0°C). This process is irreversible.

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

ARTICLE

REPLACING ALLERGENIC AND ANIMAL-BASED FINING AGENTS

Many common fining agents are derived from animal sources including gelatin (from livestock), casein (from milk), and more. These fining agents are effective because they contain proteins that have the ability to bind with solids and other undesirable compounds in cider.

While these products have been safely used in many food and beverage applications for centuries, evolving consumer preferences have caused cidermakers to look for alternatives. Milk, and therefore casein, is considered a major food allergen and animal-derived gelatins are of concern to those subscribing to vegan and vegetarian diets. Fortunately, there are non-animal-based alternatives to gelatin and casein.

WHAT ARE GELATIN & CASEIN USED FOR?

Gelatin is commonly derived from the hydrolysis of pig or other animal collagens. It is used for clarification, reducing astringency/bitterness, and removing some off-aromas.

Casein is derived from milk. It is used to treat and prevent oxidative damage (including browning/pinking), counteract moldy aromas, and diminish bitterness.

CHITOSAN AS AN ALTERNATIVE

Chitosan can replace both gelatin and casein depending on the chitosan formulation. Chitosan is derived through the deacetylation of chitin which is naturally produced by many living organisms and is the second most abundant polysaccharide on earth after cellulose. 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, thereby changing the cidermaking application.



GELATIN → QI'UP XC

QI'UP XC is a chitosan-based clarification agent that can be used instead of gelatin. This formulation for clarification has strong positive charges to promote flocculation and destabilization of colloids which increases clarification rates. QI'UP XC is blended with tartaric acid to allow it to carry an even higher charge, further increasing clarification efficiency.



CASEIN → NO[OX]

NO[OX]™ is an effective chitosan-based antioxidant and can be used instead of casein to treat and prevent oxidative damage, preserving color and aroma.

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.





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 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.



An important part of making cider is controlling microbes during pre-fermentation, fermentation, aging, and packaging.

Practices such as adding yeast, controlled sulfur dioxide additions, acidification, cellar hygiene, and filtration are all ways in which microbial control is applied throughout the cidermaking process. Though many cider spoilage problems can be prevented with good cidermaking practices, there are still circumstances that require extra microbial control. This section describes some of the tools that Scott Laboratories offers to inhibit or eliminate unwanted microorganisms.

MICROBIAL CONTROL AGENTS CAN ADDRESS:

INCREASING VOLATILE ACIDITY (VA)	VA can be increased by stressed yeast or by spoilage yeast and bacteria (acetic and lactic acid bacteria). In general, pre-fermentation VA increases are due to acetic acid bacteria and non-Saccharomyces yeast. Increasing VA can be prevented and addressed with SO ₂ , some non-Sacc yeast strains (see pgs 27-28), DELVOZYME, or BACTILESS™.
PROBLEMS ASSOCIATED WITH HIGH PH CIDERMAKING	The higher the pH, the more diverse the microbial population. Additionally, the antimicrobial activity of SO_2 is less effective at higher pHs and other microbial control strategies may need to be used. Careful attention to cider microbiology and chemistry is advised.
ACETIC ACID BACTERIA (AAB)	AAB are generally problematic in the pre- and post-fermentation phases. They can oxidize ethanol to acetic acid (VA), produce polysaccharides that can cause clarification and filtration issues, and cause changes in aromas and flavors. Control growth via BACTILESS and SO_2 and by limiting oxygen.
LACTIC ACID BACTERIA (LAB)	LAB are responsible for converting malic acid into lactic acid. $Oenococcus\ oeni$ can induce malolactic fermentation (MLF) and can also produce volatile acidity (VA) under certain conditions. $Pediococcus\ $ and $Lactobacillus\ $ are usually considered spoilage organisms. Control growth with BACTILESS, DELVOZYME or SO $_2$.
UNWANTED YEAST ACTIVITY	Yeast are a highly diverse group of organisms that can be beneficial or detrimental depending on the stage of cidermaking. Control growth post-fermentation with SO_2 . Control growth of Brettanomyces with NO BRETT INSIDE®.

ARTICLE

OVERCOMING COMMON CIDER SENSORY DEVIATIONS

Volatile acidity, oxidative damage, and sulfur off-odors are three of the most common cider sensory deviations (faults) that can arise during production. These sensory deviations are often the result of microbial and/or chemical spoilage.

Spoilage can exist on a spectrum of severity; it can be subtle (covert spoilage) or obvious (overt). When covert spoilage takes place there are no obvious indicators, but the ciders may lose some fruitiness and the color may appear more golden. In general, spoilage starts subtly and, in most cases, can be prevented before obvious damage occurs.

If spoilage is not prevented, sensory deviations may arise and faults may be detected, compromising quality unless appropriate treatments are used. Understanding the underlying mechanisms behind faults, as well as how to both prevent them from occurring and treat them once they have occurred is crucial for every cidermaker who seeks to produce exceptional ciders consistently.

Read on for our best recommendations for preventing and treating volatile acidity, and scan the QR code to read the full article which also covers oxidative damage and sulfur off-odors.



scottlab.com/faults

VOLATILE ACIDITY

Acetic acid, a major contributor to volatile acidity (VA), is a naturally occurring compound that can impart a sharp, acidic taste to cider. This is why elevated VA is often referred to as "vinegar taint." Beyond sensory impacts, acetic acid can be inhibitory to yeast at concentrations greater than 0.6 g/L and cause sluggish fermentations at concentrations greater than 0.8 g/L. Additionally, there are legal limitations in the United States for VA concentrations in cider, please see ttb.gov.

Acetic acid is produced by various microorganisms including bacteria (acetic acid and lactic acid) and yeast at all production stages (fruit, fermentation, and aging). Therefore, diligent antimicrobial and sanitation practices throughout the cidermaking process are key to preventing volatile acidity.

PREVENTING VOLATILE ACIDITY

BEST PRACTICE	EXPLANATION	RECOMMENDATION (product, dosage, notes)
Minimize time between processing and fermentation Juice is a nutrient-rich source that may be contaminated with spoilage organisms. These organisms can consume sugar, organic acids, and YAN and produce volatile acidity Consider adding an antimicrobial agent		Use one of the following antimicrobial agents: · SO₂: Potassium Metabisulfite · Non-Saccharomyces yeast: INITIA™
Employ good cleaning and sanitation practices in the cellar	Appropriate procedures prevent the growth of microorganisms in tanks, hoses, equipment, barrels etc., to ensure spoilage is minimized	Use DESTAINEX LF (see scottlab.com for details) to clean tanks and equipment
Run juice analysis, including VA (acetic acid) and malic acid	Analyzing juice gives a baseline. Proactive monitoring of VA levels throughout fermentation and storage helps to track trends and make data-based decisions	Send a sample to a service laboratory for analysis if you do not have in-house abilities

continue next page

PREVENTING VOLATILE ACIDITY (CONTINUED)

BEST PRACTICE	EXPLANATION	RECOMMENDATION (product, dosage, notes)
Initiate fermentation using an appropriate strain of yeast	By quickly starting fermentation the indigenous microflora will be quickly suppressed minimizing their ability to produce VA	Use one of the following to initiate alcoholic fermentation: Non-Saccharomyces yeast: BIODIVA™ (25 g/hL) Saccharomyces yeast: select strain based on cider style, see pgs 15-21 for suggested strains (25 g/hL)
Employ a complete fermentation nutrition plan - Measure YAN - Use a rehydration nutrient - Use fermentation nutrients	Avoid yeast stress and potentially sluggish fermentations by providing essential nutrients	See page 39 for assistance crafting a nutrition plan (choosing nutrients, dosages, and timing of additions)
Minimize oxygen pickup in the cellar	Elevated oxygen can accelerate growth of acetic acid bacteria and production of acetic acid	Keep headspace to a minimum (except during active fermentation) and blanket headspace with protective gases (CO ₂ , argon, or nitrogen) to minimize oxygen contact with liquid
Control bacteria growth by maintaining adequate cider chemistry and by employing appropriate antimicrobial agents	Control bacteria growth: Acetic acid bacteria growth can be suppressed at low temp and pHs, with moderate SO ₂ levels, or BACTILESS Lactic acid bacteria growth can be suppressed at low temps and pHs, with moderate SO ₂ levels, BACTILESS, or LYSOZYME	Use one of the following methods to prevent microbial activity: Use permitted acids to adjust cider pH and maintain adequate levels of SO₂ Add BACTILESS™ and/or LYSOZYME (25g/hL) to control applicable bacteria populations.

TREATING VOLATILE ACIDITY

BEST PRACTICE	EXPLANATION	RECOMMENDATION (product, dosage, notes)
Reverse osmosis	This is a membrane separation technique that allows undesirable molecules to be excluded based on molecular weight	For reverse osmosis providers see links here: https://wineindustry-network.com/suppliersearch.php?
Blending with lower VA lots	Blending dilutes VA	Please note: this dilution technique can lower VA but may have impacts on aroma, texture, and stability. Before blending out a high VA lot, conduct trials. Once blending is complete, run a full chemical panel and assess microbial stability (via in-house methods or testing at an outside laboratory).
Perform bench trials to These products may help to mask volatile		Perform bench trials with some of the following tannins
determine the most suitable treatment for your cider	acidity and refresh aromas	· SCOTT'TAN FT BLANC CITRUS™ (2-15 g/hL)
treatment for your cider		· SCOTT'TAN FT BLANC SOFT™ (5-20 g/hL)
		· SCOTT'TAN FT ROUGE BERRY™ (2-15 g/hL)
		· SCOTT'TAN RICHE EXTRA™ (3-10 g/hL)
		· SCOTT'TAN ROYAL™ (1-10 g/hL)
		· SCOTT'TAN RADIANCE™ (1-10 g/hL)
		or yeast derivative nutrients (add anytime before the end of fermentation):
		- NOBLESSE™ (30 g/hL)
		REDULESS® (10-30 g/hL)

QUICK GUIDE TO CHOOSING MICROBIAL CONTROL AGENTS

Cidermaking Stage	Cidermaking Goal	Recommended product
Incoming fruit/in press	Protect from indigenous yeast and bacteria	SO ₂
Juice	Protect from indigenous yeast and bacteria	INITIA (See pg 28), SO ₂ , DELVOZYME
	Protect from indigenous yeast and bacteria	INOCULATE WITH YEAST (see pgs 15-21)
Fermentation	Protect from lactic acid bacteria during sluggish/stuck fermentation SO ₂ , DELVOZYME	
	Inhibit MLF	BACTILESS, SO ₂ , DELVOZYME
	Control lactic acid bacteria	BACTILESS, SO ₂ , DELVOZYME
Post-fermentation	Control acetic acid bacteria	BACTILESS, SO ₂ ,
	Control Brettanomyces	SO ₂ , NO BRETT INSIDE
Pre-Packaging	Control spoilage organisms	SO ₃ , VELCORIN
i ie i ackaging	Control sponage organisms	JO ₂ , VLLCOKIIV

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 out organisms are not necessarily killed. Microbes may start to grow and multiply once the inhibitory pressure is removed. nhibition strategies include: Use of biocontrol agents like selected yeast that outcompete spoilage organisms Acidification to lower pH Use of sulfur dioxide or DELVOZYME at	Microorganisms are killed and will not survive to replicate. Destruction strategies include SO₂, NO BRETT INSIDE®, BACTILESS™, and DELVOZYME at lethal concentrations.

MICROBIAL CONTROL AGENTS

DELVOZYME LYSOZYME OENOBRANDS



Lactic acid bacteria control

5 kg #16404 DELVOZYME is used to control lactic acid bacteria (LAB) including Oenococcus oeni, Pediococcus spp., and Lactobacillus spp.

- Can be used at any stage of the cidermaking process
- · Protein purified from egg whites
- Lysozyme degrades the cell walls of lactic acid bacteria (gram-positive bacteria), but it is not active against acetic acid bacteria (gram-negative bacteria or yeast
- · Effectiveness depends on the total microbial load
- · Recommended contact time is seven days after which it should be deactivated from cider with 5-10 g/hL bentonite and followed by a clean racking

Warning: If spoilage yeasts such as Brettanomyces are suspected, NO BRETT INSIDE® and/or SO₂ addition should not be delayed.

Usage: Rehydrate DELVOZYME in 5-10 times its weight of water 68°F (20°C), stir gently for one minute and avoid foaming, then let stand for 45 minutes. Stir again until the solution is a clear, colorless liquid, then add DELVOZYME to juice/cider and mix thoroughly. Leave DELVOZYME in contact with the juice/ cider for at least 7 days before racking. To avoid false positives in microbial analysis, wait one week post-racking to conduct traditional plating, microscopic observations, or RT-PCR. If lysozyme-treated samples are assessed too quickly after treatment, results may show a false-positive for bacterial growth. Storage: Dated expiration. Store in a cool 41-59°F (5-15°C), dry, odor-free environment. Once rehydrated, DELVOZYME 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

DID YOU KNOW?

Theoretically the work of lysozyme should be completed within two days. However, various factors can have an influence on lysozyme activity. While lysozyme is uneffected by alcohol and SO2 concentrations present in cider, pH, temperature and bacterial cell counts do have an effect. Activity is also dependent on the concentration of lysozyme added as well as timing of addition. It is therefore advisable to add lysozyme to fermentations before lactic acid bacteria (LAB) cell counts start to increase.

BACTILESS



Acetic acid and lactic acid bacteria control

500g #15232

DELVOZYME or BACTILESS?

Which bacteria inhibitor you choose will depend on several factors. What type of bacteria are you dealing with? What is the microbial load? Is the cider destined for export?

DELVOZYME is a natural product isolated from egg whites that is active against lactic acid bacteria but not acetic acid bacteria. DELVOZYME can be used at any stage of cidermaking, even if malolactic fermentation is still desired. DELVOZYME should also be your inhibitor of choice if you are exporting the cider.

BACTILESS is fungal derived and targets lactic acid bacteria and acetic acid bacteria. BACTILESS is listed as an ingredient for domestic cider production and, at this time, should not be used in ciders destined for export.

BACTILESS™ is an allergen-free, innovative microbial control agent used to protect cider from acetic and lactic acid spoilage bacteria.

- Use in the pre-fermentation phase to control spoilage bacteria without negatively impacting alcoholic or malolactic fermentation (MLF)
- Use post-fermentation to control bacteria populations including those that may induce spontaneous MLF
- Allow 10 days of contact time, then conduct a clean racking
- Offers an alternative to lysozyme treatment and/or significant amounts of SO_2 but does not replace the use of SO_2 as it does not have antioxidant or antifungal properties
- BACTILESS is sensory neutral but cannot decrease any sensory contribution already produced by spoilage bacteria
- BACTILESS is a 100% natural, non-allergenic source of chitin-glucan and chitosan from a non-GMO strain of *Aspergillus niger*

Usage: Suspend BACTILESS in 5–10 times its weight of cool water and mix thoroughly (BACTILESS is insoluble, so it will not go into solution). Add to juice/cider and mix thoroughly. Leave BACTILESS in contact with juice/cider for 10 days, then conduct a clean racking. 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 77°F (25°C).

Recommended Do	sage		
200-500 ppm	20-50 g/hL	1.67-4.16 lb/1000 gal	45-113 g/60 gallon barrel

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.qov.

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



Brettanomyces spp. control agent

100g #16410

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.

NO BRETT INSIDE® is an allergen-free, innovative microbial control agent used to reduce *Brettanomyces* spp., thereby preserving the aromatic qualities of ciders.

- Use in ciders post alcoholic fermentation to reduce *Brettanomyces* populations
- Recommended contact time is 10 days
- Offers an alternative to significant amounts of SO₂but does not replace the use of SO₂ as it does not have antioxidant or antibacterial properties
- NO BRETT INSIDE cannot decrease any sensory contribution (barnyard, medicinal, smoky) already produced by Brettanomyces
- 100% natural, non-allergenic source of chitosan from a non-GMO strain of Aspergillus niger

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). Add to juice/cider and mix thoroughly. Leave the NO BRETT INSIDE in contact with the juice/cider for 10 days, then conduct a clean racking. 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 cool, dry, odor-free environment. Reseal opened packaging immediately.

Recommended D	osage		
40-80 ppm	4-8 g/hL	0.33-0.67 lb/1000 gal	9-18 g/60 gallon barrel

VELCORIN LANXESS

VELCORIN LANXESS

An alternative to pasteurization to prevent refermentation in package

6kg #18006

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®. Since 1988, Velcorin has been used in the United States in wine, low-alcohol wine, and non-alcoholic wine as well as 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. In addition, Velcorin can remain active for several hours (depending on hydrolysis rate) 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 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 a byproduct of VELCORIN addition, analysis of methanol can provide information about the success or dosage level of an addition.



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. 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.

TANNINS

SULFUR DIOXIDE (SO₂)

INODOSE TABLETS



Effervescent sulfur dioxide tablets

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

Note: Volume discounts are available. Please contact us for details

INODOSE TABLETS are ideal for adjusting ${\rm SO_2}$ levels in barrels and small tanks. They are pre-measured into convenient package sizes (2 g and 5 g) to make ${\rm SO_2}$ additions easier and safer.

- Blend of potassium metabisulfite and potassium bicarbonate (to assist with dispersion and has negligible effect on pH)
- Tablets start to dissolve upon addition releasing a precise dose of total SO_2 (free SO_2 will increase based on conditions)
- Pre-determined dose helps eliminate errors in the cellar
- Sealed strip packages keep unused tablets fresh for optimal efficacy

Usage: Remove tablet from blister pack and add directly to vessel. Larger vessels may require additional mixing to achieve full homogenization.

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

INODOSE Tablets Conversion Chart (ppm of Total SO₂)

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

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 or 5 g.

POTASSIUM METABISULFITE



1 kg #POTMETA1K

Potassium metabisulfite can be used throughout the cidermaking process from milling to packaging. $\,$



FILTRATION SUPPLIES

ARTICLE

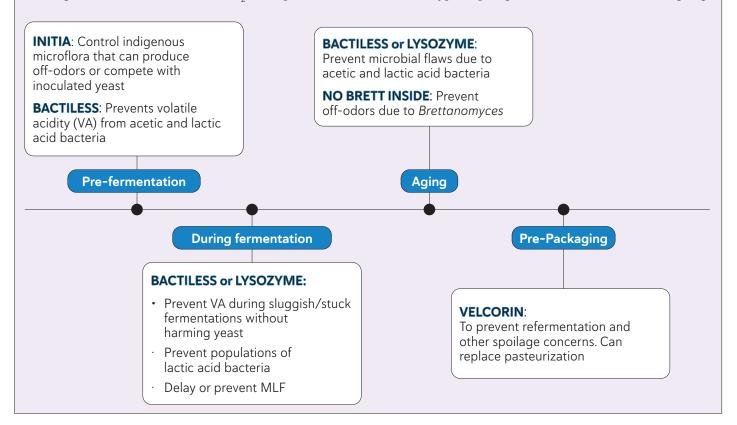
PREVENTING MICROBIAL ISSUES WITHOUT SO,

Sulfur dioxide (SO₀) has been used for millennia to prevent microbial spoilage in food and beverages. However, there are circumstances when SO₂ cannot be used or is not effective. For example:

- · Making organic or low-chemical input ciders
- Cider chemistry limits effectiveness of SO₂:
 - Pre-fermentation, the antimicrobial action of SO₂ is limited because it is bound to sugar and other juice components.
 - Post-fermentation, the antimicrobial action of SO_2 is limited by higher pH, because pH affects how much SO_2 is in the antimicrobial (molecular) form.
- Packaging cider in aluminum cans SO, must be limited throughout the cidermaking process to prevent H₂S from developing once canned

WHAT SO, ALTERNATIVES TO USE AND WHEN:

Microbial spoilage occurs when unwanted microbial activity results in off-odors, off-flavors, visual flaws, and/or impedes fermentation. Unwanted microbial activity can occur at many stages of cidermaking, leading to many different problems. When choosing antimicrobial alternatives to SO₂ it is important to understand what type of spoilage can occur at each cidermaking stage:



HOW SO, ALTERNATIVES WORK:

NON-SACCHAROMYCES YEAST

LEVEL² INITIA™ is a non-Saccharomyces yeast that is an effective pre-fermentation antimicrobial agent. It outcompetes indigenous organisms that can produce VA and other off-aromas, initiate alcoholic fermentation, and interfere with inoculated yeast.

INITIA outcompetes indigenous microorganisms via a phenomenon known as microbial crowding. Microbial crowding occurs when a microorganism occupies the entire ecological niche through large population numbers. INITIA will also rapidly consume large amounts of oxygen, which further deprives pre-fermentation spoilage organisms of the oxygen they require for growth. The antimicrobial activity of INITIA is more effective than SO_2 pre-fermentation because SO_2 can be bound by sugar and other juice components.

LYSOZYME

Lysozyme is an enzyme derived from egg whites that has been used in the food and beverage industry for decades. Lysozyme is compatible with low chemical input and organic cidermaking. Its antimicrobial properties come from its ability to cause cell lysis in gram positive bacteria including lactic acid bacteria.

Prior to the introduction of lysozyme to the cider industry, there was no way to target unwanted bacterial populations without affecting the activity of yeast. Lysozyme therefore opened the door to controlling the production of VA during stuck and sluggish fermentations.

CHITOSAN

Chitosan is an exciting non-allergenic and non-animal-based tool for traditional, vegan, and low chemical input cidermaking. NO BRETT INSIDE® and BACTILESS TM are chitosan-based antimicrobial agents that can be used instead of SO $_2$ to control *Brettanomyces* spp., lactic acid bacteria, and acetic acid bacteria. Both NO BRETT INSIDE and BACTILESS are more effective than SO $_2$ after fermentation, especially in high pH ciders.

Chitosan is derived through the deacetylation of chitin which is naturally produced by many living organisms and is the second most abundant polysaccharide on earth after cellulose. 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.

NO BRETT INSIDE and BACTILESS work by causing intense electrostatic interactions with negatively charged components on yeast and bacteria cell walls. Yeast and bacteria then attach to the surface of the chitosan and settle out with it. Additionally, the chitosan can cause cell membrane damage leading to an osmotic and energy imbalance, loss of growth capacity, and eventually cell death.

Note: These products do not completely replace the use of SO_2 - BACTILESS, Lysozyme, and NO BRETT INSIDE do not offer antioxidant protection, and INITIA only offers antioxidant protection prior to fermentation.



Filtration remains the one of the most assured ways to protect cider shelf-life and microbial stability. However, filtration is not an isolated process and every production activity can have an impact on filtration, sometimes making it easier, and other times making it 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.



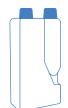
Cider filtration starts well before actual filtration. A variety of upstream choices will have a significant effect on ease of filtration.

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.

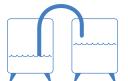
Did you use a good filterability enzyme

like SCOTTZYME SPECTRUM? It breaks down colloids like pectin and polysaccharides and prevents them from prematurely clogging filter media.



Did you rack off the lees cleanly before filtration?

The cleaner the cider, the more efficient filtration will be.



Did you choose the right porosity?



Filtering with a porosity that is too small, too soon can cause slow throughput and premature clogging. Measuring turbidity can be helpful in deciding the best combination of filter porosities/grades to prepare your cider for sterile filtration.

SUGAR

Did you back-sweeten or make other additions right before filtration?

Adding sugar, purees, or concentrates will affect the colloidal matrix of the cider. This means, if you make additions after pre-filtration and immediately prior to packaging, you risk clogging the final membrane. Try making additions earlier in the process, or running a filterability test prior to packaging.

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 80).

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	Membrane (surface) Media
Depth media has a high dirt or solids holding-capacity and	Membrane media does not trap solids, has a very low solids
retained solids are trapped in the media itself. Depth media	holding-capacity, and can be easily fouled by solids. How-
comes in a range of porosities, but the pore size rating is	ever, its pore size rating is absolute (can be relied upon to ex-
nominal (represents an average pore size). Depth media is	clude any solids larger than its pore size), making it ideal for
most appropriate for initial filtrations for clarity and	removing unwanted microorganisms. In other words, mem-
decreased solids in preparation for sterile filtration.	brane 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 that is ready for final stabilization at packaging.

FILTRATION EQUIPMENT AND MEDIA

CARTRIDGE FILTRATION



SCOTTCART Cartridge Filter Housings

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

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

SCOTTCART PreMembrane PP

Pleated depth filter cartridges designed for particle reduction

SCOTTCART pre-membrane polypropylene (PP) cartridges were optimized for a wide range of pre-filtration applications. These cartridges combine multiple layers of progressively tighter pleated polypropylene depth material to offer high dirt loading capacities, long service lives, and extremely high flow rates.

Size: Multiple lengths available

Porosity (μ): 0.65, 1.2, 3, 5, 10, 20, 30, 50

Code: Multiple codes available

SCOTTCART PreMembrane GF

Glass fiber cartridges designed for the reduction of positively charged colloids

SCOTTCART glass fiber (GF) cartridges are pre-membrane filters optimized for the specific adsorption of positively charged colloids, making them ideal for difficult-to-filter beverages like cider. These cartridges are built with glass fiber membrane media, offering a defined but high retention rate.

Size, porosity and code: 30", 0.5μ

Available in Code 7 and Code 8

SCOTTCART Membrane PES

Single layer asymmetric membrane cartridges designed for removal of yeast and bacteria (microbial stability)

SCOTTCART final membrane polyether sulfone (PES) cartridges were optimized for sterile filtration. The inert and highly asymmetric PES membrane provides validated microbial retention to typical spoilage organisms. These cartridges can be integrity tested, can be chemically regenerated, and are compatible with pH range of 1-14

Size: Multiple lengths available

Porosities (μ): 0.45μ, 0.65μ **Code:** Multiple codes available

SCOTTCART Membrane PES PRO

Single layer asymmetric membrane cartridges designed for removal of yeast and bacteria (microbial stability) in high throughput applications

These cartridges offer the same features as the SCOTTCART Membrane PES cartridges (above) but feature an integrated pre-filter layer and a 33% larger filtration surface area. This offers higher flow rates, greater resistance to fouling, and a longer service lifetime. These cartridges are especially well-suited for high-throughput applications.

Technical specifications: 30", 0.45µ, Code 7

CROSSFLOW FILTRATION





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 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 m2 of filtration surface.



VLS UNICO Filter

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

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.



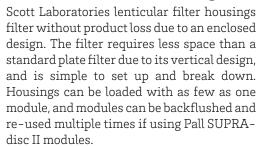
VLS LEES-STOP Filter

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 7.5m2 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



- · Material in 316L stainless steel, sanitary construction with electro polish
- · Sanitary pressure gauges, two butterfly valves and fittings included
- · Vent valve and drain included with the housing
- Available in 12" and 16" sizes from 1 to 4 module stacks.

A 12" 3-high lenticular housing can hold the equivalent of almost 36 40x40 filter sheets

Seitz® SUPRAdisc II Lenticular Modules



SUPRAdisc II modules offer a multitude of benefits that overcome the disadvantages of the classical stacked disc design. These benefits result in important cost savings, and make them ideal for many food and beverage applications.

- **Regenerable**: Longer filter life and repeated use is possible due to regenerability of the modules with backflushing
- Reliable: resilient against vacuum or back pressure shocks, and no cell or module deformation from hot operation or sanitization and steaming.
- Minimal losses and oxygen pickup: Unlike other types of lenticular modules, SUPRAdisc modules are compatible with the use of compressed gas during initial setup and final product discharge, resulting in less oxygen pickup and minimal product loss during filtration.

Seitz SUPRAdisc II modules are also available in ZD series. The ZD series sheets are made of 100% pure cellulose fiber matrix material, without any use of diatomaceous earth (DE) or Perlite.

SHEET FILTRATION



Seitz® Depth Filter Sheets

Seitz® depth filter sheets by Pall® are available in multiple grades suitable for microbial reduction and applications requiring fine, clarifying, and coarse filtration.

- Homogenous and consistent media available in multiple grades with reliable microbial reduction with tighter grades
- High solids retention due to the combination of surface, depth, and adsorptive filtration
- Full traceability as each individual filter sheet is laser etched with the sheet grade, batch number, and production date

Seitz® depth filter sheets by Pall® offered in the **K Series** and **ZD Series**. The ZD series sheets are made of 100% pure cellulose fiber matrix material, without any use of diatomaceous earth (DE) or Perlite.

VLS Plate & Frame Setup

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

FILTRATION SUPPLIES

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.

HOW TO ORDER

We're here to make your life easy! You can order from Scott Laboratories in a variety of convenient ways:

PLANNING YOUR ORDER

PDF ORDER PLANNER: To make planning your orders easy, fill out the pdf form at **scottlab.com/order-planner** before ordering online or by phone.

ORDER ONLINE AT SCOTTLAB.COM

Our easy-to-use website makes planning and submitting your orders easier than ever. Try one, or all, of these convenient features:

QUICK-ORDER SHOPPING CART: Our website's shopping cart allows you to quickly enter orders without navigating to every item page. Simply open the site directly to scottlab.com/shop/basket and start entering search terms or item numbers.

REORDER: Head to the My Account section (scottlab.com/profile) of the site and you can search back through your past Invoices and Shipments. If you have an order that you want to recreate, click the handy "Reorder" button to load the items from that invoice or shipment into your shopping cart.

ORDER TEMPLATES: If you have groups of items that you order regularly or want to save for quick reordering, nothing beats our Order Templates feature. Just assemble a shopping cart by browsing the site or using any of the handy tools listed above, and from the Shopping Cart page choose "Save as Order Template." Next time you want to start an order from this list of items you can load it from either your "My Account" section of the site, or directly from the Shopping Cart page. Great for recurring purchases.

ORDER BY PHONE AT 707-765-6666

INDEX

NUMBERS

27 CFR 24.250

71B, LALVIN 9, 12, 15

approvals for BACTILESS 78
approvals for FERMAID K 35
approvals for NO[OX] 64
approvals for QI'UP XC 64
1895C™ 5, 9, 12, **15**58W3™, VITILEVURE 9, 12, **15**, 45-46

Δ

Acetic acid bacteria 28, 73-78, 84-85 ALCHEMY I 9, 12, **15**, 45-46 Amino acids 31-32, 34-35 Animal-Based Fining Agents 70 Antioxidant 9, 25, 36-37, 40-41, 43-45, 49, 70, 85

В

BAII™ 9, 12, **16**BACTILESS™ 9, 73, 75-76, **78**, 84-85

BE FRUITS™, IOC 9, 13, **19**BENTOLACT S 9, 58, **61**Bentonite 51-52, 56-57, 58, 61-62, 64, 90, 92

BIODIVA™, LEVEL² 9, 13, 25-26, **27**, 29, 74 *Brettanomyces* 47, 73, 76-77, 79, 84-85

Browning 25, 28, 40-41, 43-45, 56, 58-59, 63, 68, 70

C

Carbon, activated 56, 59, 60
Cartridge Filtration 88-89
Casein 9, 56, 58, 61-64, 70
CASÉINATE DE POTASSIUM 58, **62**Chitin-glucan 78
Chitosan 51, 56, 58, 64, 70, 78-79, 85

Clarification 28, 51-59, 61, 64-66, 69-70, 73, 90

CLEAR EXTREME, RAPIDASE 9, 52, **53**COLLE PERLE 59, **65**, 69
Colloidal stability 9, 56, 59, 66-69
CRISTALLINE PLUS 9, **66**, 69
CROSS EVOLUTION® 9, 12, **16**, 45, 46
Crossflow Filtration 88, 90
CVW5TM 9, 12, **16**

D

DELVOZYME 9, 73, 75-78, 85
DIAMMONIUM PHOSPHATE (DAP) 34, 38
Diatomaceous Earth 88, 91
DV10™, LALVIN 9, 12, **16**

Ε

ECI118™, LALVIN 12, 16, 17

ELIXIR™, VITILEVURE 9, 12, 17, 45-46

Enzymes 9, 14, 40-41, 50-57

ESSENTIAL ANTIOXIDANT 9, 40-41, 44, 45

Esters 14-17, 19, 21, 25-27, 34-35, 39

EXOTICS MOSAIC 17

F

FFERMAID K™ 32, 35

FERMAID O™ 32, 34-35

Filtration 87-92

Media 92

see also:

Cartridge Filtration 88-89

Crossflow Filtration 88, 90

Lenticular Filtration 88, 90-91

Pressure Leaf Filtration 88

Sheet Filtrations 88, 91

FINAL TOUCH GUSTO™ 9, 66

FINAL TOUCH POP™ 9, 67

FINAL TOUCH TONIC™ 9, 67

Fining 9, 44-45, 50-51, 56-59, 64-66, 69-70, 76, 90, 92

Finishing 9, 47

FLASHGUM R LIQUIDE 9, 49, 68

FLAVIA, LEVEL² 9, 13, 25-27, 29

FRESHPROTECT 9, 59, 62

FT BLANC, SCOTT'TAN™ 9, 44, 49

FT BLANC CITRUS, SCOTT'TAN™ 9, 45, 49, 75

FT BLANC SOFT, SCOTT'TAN™ 9, 45, 49, 75

FT ROUGE BERRY, SCOTT'TAN™ 9, 46, 49, 75

G

Gelatin 51, 56, 58-59, 64-65, 69-70

GELOCOLLE 59, 65-66, **69**GLUTASTAR® 9, 32, **36**, 40-41

Glutathione 36, 41

GO-FERM PROTECT EVOLUTION™ 9, 23, 32-34, 38

GO-FERM STEROL FLASH™ 9, 22, 32-34, 38-39

GRANUCOL FA™ 9, 59, **60**GRANUCOL GE™ 59, **60**Gum arabic 56, 58-59, 62, 66, 68-69

Н

H₂S (see Sulfur off-odors) HC, SCOTTZYME 9, 52, **53**, 55

1

ICV D21[™], LALVIN 9, 12, **17**ICV D47[™], LALVIN 9, 12, **18**, 45-46
ICV OKAY[™], LALVIN 9, 12, **18**

ICV OPALE 2.0[™], LALVIN 9, 13, **18**, 45-46 Inactivated yeast 34, 37 INITIA[™], LALVIN 9, 13, 25-26, 28-29, 40-41, 74, 76

INOCOLLE 9, 58, **65**, 69 Inorganic nitrogen 34-35 Isinglass 51, 56, 58, 66, 69

K

K1 (V1116) 13, **19** KS, SCOTTZYME 9, **54**

L

Lachancea thermotolerans 25-26, **28**Lactic acid bacteria 73, 75-78, 84-85
LAKTIA, LEVEL² 9, 13, 25-26, 28-29
Lenticular Filtration 88, 90
Lysozyme 9, 73, 75-78, 85

M

Malolactic Fermentation (MLF) 73, 78, 84

Mannoproteins 3, 5, 7, 19, 25, 27, 49, 56, 59, 66-67, 69, 87

Metschnikowia pulcherrima 25-28, 41

Milling 6, 9, 82

Minerals 31-35, 38

Mouthfeel 5, 9, 11, 13, 15-17, 20-21, 25-27, 34-37, 42-46, 48-49, 59, 62

Ν

NaCaLit PORE-TEC[™] 9, 52, 58, **61**NO[OX][™] 9, 58, **64**, 70

NOBLESSE[™] 9, 32, **36**, 75

NO BRETT INSIDE® 9, 73, 76, **79**, 84-85

Non-Saccharomyces yeast 9, 13-14, 23, 25-27, 29, 41, 73-74, 85

NT 116 13, **19**, 45-46

Nutrients, yeast:

Fermentation Nutrients 34, 39

Rehydration Nutrients 33, 38-39 Yeast Derivative Nutrients 36-37, 39

0

OMRI 33-34, 36-37

OPTI-WHITE 9, 32, **37**, 49

Organic nitrogen 34-35

Oxidative damage 9, 26, 28, 36-37, 40-42, 44, 56, 59, 61, 70, 74

Oxygen scavenging 25, 68

P

Pectin 6, 51-55, 57, 87

POLYCACEL 9, 58, **63**POLYCEL 9, 58, **63**Polysaccharide 11, 16, 18, 26-27, 36-37, 43, 49, 52, 56, 70, 73, 85, 87

Potassium metabisulfite 74. **82**

PEC5L, SCOTTZYME 9, 52-53, 55

Pressure leaf filtration 88

PURE-LEES LONGEVITY™ 9, 32, 59, **68**PVPP 56, 59, 61-63

Q

QA23[™], LALVIN 9, **20**, 45 Ql'UP XC 9, 58, **64**, 70

R

R2™, LAVLIN 13, **20**, 45-46

RADIANCE™, SCOTT'TAN 9, **46**, 75

REDULESS™ 9, 32, **37**, 75

RHONE 4600™, LALVIN 9, 13, **20**RICHE EXTRA™, SCOTT'TAN 9, **47**, 49, 75

R-HST™, LALVIN 9, 13, **20**, 45-46

ROYAL™, SCOTT'TAN 9, **47**, 49, 75

9

SENSY™, LALVIN 13, **21**, 45-46

Sheet Filtration 88, 91
Silica gel 51, 56, 59, 65, 69
SM102™, FERMIVIN 13, **21**SO₂ (see Potassium metabisulfite)
SPECTRUM, SCOTTZYME 9, 52, **54**, 87
Sterols 31-33, 35, 38
STIMULA CHARDONNAY™ 9, 32, **35**Sulfur off-odors 11, 18-19, 32, 34, 36-37, 61

1

Tannins 9, 15, 41-46, 48-49, 65, 75 Terpenes 14, 17, 20-21, 25-27 Torulaspora delbrueckii 25, 27

U

ULTIMA SOFT 9, 49, 59, 69

V

VELCORIN® 4, 80 VIN 13 9, 13, **21** Vitamins 31-35, 38 Volatile Acidity 15-16, 24, 27-28, 33, 73-75

W

W15 9, 13, **21**

γ

YAN equivalents 34-35
YAN (Yeast Assimilable Nitrogen) 31-35
Yeast derivative nutrients 36, 41, 49, 75
Yeast Rehydration 4-5, 22-23, 32-33, 38
Non-Saccharomyces yeast rehydration 29

Saccharomyces yeast rehydration 22-23
Yeast Rehydration Nutrients (see Nutrients, yeast)



WHO WE ARE

Scott Laboratories is the leading supplier for the North American wine and specialty beverage industry. We are a team of educators and innovators, helping winemakers, cidermakers and beverage producers hone their craft and refine their skills.

Our history began in 1933 just days prior to the end of prohibition providing consulting and analysis to an industry reborn. In 1934, we inherited the original California yeast library from UC Berkeley and brought the first commercially available cultured yeast strains to the US wine industry. In the 1960s we began drying our yeast, introducing the industry's first active dry yeast strains. **EARLY BEGINNINGS** In 1974 we partnered with Lallemand, a then baking yeast company, to grow our production. This partnership introduced Lallemand to a world of specialty microorganisms outside baking. Their established Oenology division now drives innovation in the wine, cider, and fermented beverage industries through research, education, and product development. In 2019, Scott Laboratories and Lallemand officially joined the destinies of our thirdgeneration family-owned companies. Our portfolio is driven on the engine of Lallemand THE NEXT GENERATION products but is interpreted through local expertise. As a part of Lallemand, we benefit from being the manufacturer of many of the products we offer, though we retain our own flavor focused on the needs of the North American maker. In 2023, we became a certified B Corporation. The B in B Corp™ stands for Benefit for all, meaning that Scott Laboratories business must positively impact all stakeholders including employees, communities, customers, and the planet. For us, the B Corp Certification helps us quantify our commitment to diversity, equity, **B CORP** and inclusion, helps us define value for our sustainability projects, and emphasizes the importance of our community support efforts. In short, B Corp Certification helps us Certified continue our progress toward being a better company. As a B Corp, our values have renewed meaning for us: • Education: as a B Corp, we will educate when we can provide value and we will be educated when our practices need revision or improvement. • Honesty: we are founded on transparency which builds credibility, trust, and value.

decisions that will create a positive impact for all.

• Doing the right thing: as a B Corp, we continue to consider all stakeholders and make