As we draft this welcome text each year, it provides a wonderful opportunity to reflect on another year, and examine the current creative wave in the cider industry. This year, we chose to highlight one of the most recent movements that we’ve swung with our cover design. Ciders made with botanicals are popping up all over, and we’ve been very interested to learn more about this imaginative technique. We were lucky enough to have some wonderful insight from Andrew Byers of Finnriver Farm & Cidery on the subject included this year. We are also grateful to have continued contributions and new research from Virginia Tech, WSU Mount Vernon, and Michigan State University.

In responding to customer demand, we have added another new strain to our non H2S and SO2 producing portfolio of strains, IOC Be Thiols™. This fast-fermenting strain maximizes thiols for more aromatic ciders. We’ve also added a unique new genre of product with Stimula Chardonnay™. Though first introduced to the wine industry, we have had trial feedback from many cider customers already with great results. We are so appreciative of the dialogue and response we continue to get from you, our customers. You help drive our research and product development as we strive to help you perfect your craft. Please feel free to contact us anytime for more product information or technical guidance. Wishing you all the best for another successful year!

Scott Laboratories
OVERVIEW
Yeast has been an important part of our portfolio ever since our predecessor company (Berkeley Yeast Laboratory) was founded in 1933. Our first commercial yeast offerings consisted of strains given to us from the collection of the University of California in 1933. The College of Agriculture at Berkeley had safeguarded them throughout the dark years of prohibition. In each of the 85 subsequent years, we have learned and evolved. We are uniquely positioned to assist cider-makers in meeting each year’s new challenges.

BASICS
Every cider fermentation presents different challenges. Issues begin with the product to be fermented. Is it freshly processed fruit, purchased juice or from concentrate? Even if the source is the same, critical factors will vary from month to month and year to year. Sugars, nutrient levels, nitrogen, acidity and NTU levels will be different. For fermentations to be successful, it is important for cider-makers to know and understand their juice. Analysis for Brix, pH, TA and nitrogen levels should always be done and conditions of the fermentation should be considered. This should always occur prior to inoculating with yeast. In particular:

BRIX
What is the Brix of the juice? The yeast strain chosen should be able to tolerate the alcohol produced from this Brix level. (See yeast strain selection charts on page 7.)

pH AND SO2
The effectiveness of SO2 is directly related to the pH. SO2 additions should never be standardized. They must ALWAYS be adjusted according to the pH and conditions of the fruit. Additional SO2 may be necessary if the fruit is overripe, underripe, or compromised.

YAN
What is the YAN (Yeast Assimilable Nitrogen) of the juice? The correct nutrient additions can be decided once the YAN and Brix have been determined. The nutrient needs of the specific yeast strain being used must be considered.

TEMPERATURE
What will the fermentation temperature be? Choose a yeast strain that fits within the determined temperature range. Do not stress your yeast by keeping it at the lowest or highest end of its temperature tolerance range.

YSEO
YSEO is a unique and innovative process for yeast developed by Lallemand. The benefits of using the YSEO process are:
• Reduced lag phase
• Better adaptation to stressful conditions
• Optimized fermentation
• Reduced potential for VA
Proper yeast rehydration is one of the most important steps to help ensure a strong and healthy fermentation. Normal inoculation for active dried yeast is 2 lb/1000 gal (25 g/L). When added properly, a 2 lb/1000 gal (25 g/L) addition of active dried yeast results in an initial cell concentration of 3–4 million viable cells per milliliter of juice. Under favorable conditions, the initial cell population may increase up to 100–150 million viable cells per milliliter of juice before growth stops and alcoholic fermentation begins. This biomass increase is critical for healthy fermentations. When juice is at a higher initial Brix, increased inoculation rates are recommended. When using higher rates, be sure to maintain a ratio of 1 part yeast to 1.25 parts yeast rehydration nutrient. Careful rehydration, asepsis, and inoculation are all important to help prevent sluggish or stuck fermentations.

**PROTOCOL**

**EASY STEPS FOR OPTIMAL YEAST REHYDRATION**

**Step 1**
1. Suspend 2.5 lb/1000 gal (30 g/L) of Go-Ferm or Go-Ferm Protect Evolution in 20 times its weight of clean, chlorine-free, 40°C (104°F) water. (For example: 2.5 lb rehydration nutrient + 50 = 63.75 lb of water + 6 gal water) If the water temperature is not high enough, the yeast rehydration nutrient may not go entirely into solution. Please see page 27 for information on yeast rehydration nutrients.

**Step 2**
Importantly: If not using a yeast rehydration nutrient, water temperature should begin at 40°C (104°F) to avoid harming the yeast.

**Step 3**
1. Once the temperature of the yeast rehydration nutrient solution has dropped to 40°C (104°F), add 2 lb/1000 gal (25 g/L) of active dried yeast. Stir gently to break up any clumps. Let suspension stand for 20 minutes, then stir gently again. Low yeast populations decline when allowed to stand for more than 30 minutes. Note: Aeration is not an indicator of yeast viability.

**Step 4**
1. Slowly (over a period of 5 minutes) combine an equal amount of the juice to be fermented with the yeast suspension. This will help the yeast adjust to the cooler temperature of the juice and will help avoid cold shock caused by a rapid temperature drop exceeding 10°C (18°F). This asepsis step may need repeating for very low temperature juices. Each asepsis step should last about 15–20 minutes.

For every 10°C (18°F) temperature difference between the juice and the yeast slurry, an asepsis step must be performed.

**For example,** for a juice temperature of 20°C (68°F) and yeast slurry temperature of 40°C (104°F), two asepsis steps are required.

### CIDER YEAST STRAINS

<table>
<thead>
<tr>
<th>Strain</th>
<th>5.0%</th>
<th>5.5%</th>
<th>6.0%</th>
<th>6.5%</th>
<th>7.0%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yeast Hybrid</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Yeast Blend</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</tr>
<tr>
<td>Neutra</td>
<td>Yes</td>
<td>Yes</td>
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<td>Estivo</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</tr>
<tr>
<td>Enhanced Varietal Character</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</tr>
<tr>
<td>Microbial</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</tr>
<tr>
<td>Degrades Malic Acid</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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<tr>
<td>Non H2S or SO2 Producing</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Preserves Natural Fruity</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

### Yeast Strain Type

- Highly Recommended
- Moderately Recommended
- Weakly Recommended
- Not Recommended
- Neutral
- Sensitive
- Average

**Cider Strain**

1. The alcohol tolerance column indicates performance possibilities in good circumstances and conditions. Alcohol tolerance may vary on circumstances and conditions.

2. Relative nitrogen needs refer to how much nitrogen one strain requires relative to the other strains on this chart.

3. Relative oxygen needs refer to how much oxygen one strain requires relative to the other strains on this chart.

4. The temperature column indicates general performance possibilities. It is not substitute for sound cidermaking. Yeast may be restricted or die if temperatures are sustained at extremes of their tolerance. Keep in mind that yeast's ability to ferment within the given range also depends on alcohol and other environmental conditions.

**Important Notes**

This chart is only used as a quick reference guide. For more information on selected yeast strains, please refer to the yeast section of this handbook.
Alchemy I blend

S. cerevisiae & S. bayanus

Selected in 1997 near the Estação Vitivinicola de Barbacena, Minas Gerais, Brazil. Designed for aromatic ciders with high alcohol potential (15% v/v) and low fermentation temperatures (14°C(57°F)). This strain has reasonable low nitrogen requirements. Cross Evolution® contributes an increased mouthfeel component resulting in aromatic ciders with a balanced mouthfeel. Ciders have shown increased fresh fruit and floral aromas, characteristics favored by some commercial cider producers.

#15640 500 g $46.60
#15641 10 kg $278.90

Lalvin C  blend

S. cerevisiae & S. bayanus

Isolated in France.Produces very clean, fruity styles of cider. Lalvin C® can also naturally degrade up to 45% of malic acid, depending on the fruit you are fermenting and the style you are trying to achieve.

#15649 500 g $33.20

Cross Evolution®  blend

S. cerevisiae & S. bayanus

Selected in 1997 near the Estação Vitivinicola de Barbacena, Minas Gerais, Brazil. Designed for aromatic ciders with high alcohol potential (15% v/v) and low fermentation temperatures (14°C(57°F)). This strain has reasonable low nitrogen requirements. Cross Evolution® contributes an increased mouthfeel component resulting in aromatic ciders with a balanced mouthfeel. Ciders have shown increased fresh fruit and floral aromas, characteristics favored by some commercial cider producers.

#15640 500 g $46.60
#15641 10 kg $278.90

CVW5  blend

S. cerevisiae & S. bayanus

Selected from the Lallemand yeast collection, CVW5 is a daughter strain of the Lallemand strain CVW. Works well under low temperatures and low turbidity. Very high ester producer and has the lowest nitrogen demand in the Lallemand yeast collection. CVW5 produces low levels of VA and SO. Strong fermenter even under difficult conditions.

#15227 500 g $43.45
#15228 10 kg $547.00

D21  blend

S. cerevisiae & S. bayanus

Selected from the Lallemand yeast collection, D21 can develop fresh fruit aromas, volume and acidity. In highly clarified juices, maintain fermentation temperatures greater than 16°C(60°F) and supplement with proper nutrition.

#15143 500 g $43.85
#15146 10 kg $647.00

Fermevin Champion  blend

S. cerevisiae & S. bayanus

Strain selected by INRA, Narbonne, France. A neutral, very clean, robust and reliable, produces high amounts of SO2 (up to 50 ppm) and, as a result, may inhibit malolactic fermentation.

#15303 500 g $27.95
#15306 10 kg $403.45

Fermevin PDM  blend

S. cerevisiae & S. bayanus

Selected in France and a favorite of Normandy cider producers. Short lag phase, rapid and steady fermentation kinetics. Preserves the characteristics of the fruit.

#15152 500 g $27.70

IonysWF  blend

S. cerevisiae & S. bayanus

Selected from the Lallemand yeast collection, IonysWF™, the result of a multi-year research project between Lallemand and INRA Montpellier. Selected for its ability to significantly retain must/juice acidity during fermentation. IonysWF is recommended for fermenting fruit with high pH. The acidification ‘power’ of IonysWF may result in a total acidity difference of 0.4-1.4 g/l Tartaric acid and a pH decrease of between 0.4-0.2.

Low producer of VA, SO and H2S, with an alcohol tolerance of up to 16% (v/v). IonysWF has very high nitrogen requirements and a balanced nutrient protocol is essential. Maintaining a temperature range of 25-28°C(77-82°F) optimizes glycerol production (up to 15 g/l) and may decrease alcohol production between 0.4-0.8%. IonysWF has a moderate fermentation speed with a long, but steady stationary phase. With proper nutrition and temperature control, ciders made with IonysWF are characterized as having fresh fruit and mineral characters.

Note: IonysWF is an innovative yeast selection and is protected by or International Patent pending (W0/2015/1141 Propagation of IonysWF is an infringement of the Patent).

Storage
Store at 4°C(40°F).

K1 (V1116)  blend

S. cerevisiae & S. bayanus

Selected by the ICV in Montpellier, France, among numerous killer strains isolated and studied by Pierre Barre at INRA. When fermented at low temperatures 16°C(60°F) with proper nutrition, it is a strong, clean-fermenting, fruity aroma producer. Can also produce notes of stone fruit and citrus. Not ML compatible.

Among the high producer production strains, Lalvin VITIFEX™ is the most tolerant of difficult fermentation conditions such as extreme temperatures, high alcohol (18% v/v) and low turbidity. Fermenters well on stressed conditions and is useful in restarting stuck fermentations, especially when relative fruitose levels remain high.

#15643 500 g $26.85
#15077 10 kg $263.65

M2  blend

S. cerevisiae & S. bayanus

Isolated in Stellenbosch, South Africa. Enoviferm™ is a medium-rate fermenter and needs a high level of balanced nutrients for a strong fermentation finish. Requires some temperature control for ciders production. Neutral to low one-dimensional ‘workhorse’ strains such as PM.

#15630 500 g $46.60
#15631 10 kg $578.80

Note: IONYSWF is an innovative yeast selection and is protected by or International Patent pending (W0/2015/1141 Propagation of IonysWF is an infringement of the Patent).
S. cerevisiae • cayetanensis

**Rhône 4600**

Selected in France in collaboration with the research center of Lyon.

Lalvin Rhône 4600™ has a short lag phase, low nutrient demand and can ferment efficiently at low temperatures 10°C(50°F).

Produces high levels of polyphenolases which contribute intense mouthfeel and volume.

Complex aromatic notes and elevated ester production. 

**VIN 13**

S. cerevisiae • hybrid

Selected by the INRA for no SO2 or H2S production.

Reveals fruity esters (strawberry, pineapple, citrus, apple notes) in ciders. The pure expression of the fruit is emphasized by the ability of the yeast to reduce the acetaldehyde formation, while limiting sulfite production.

**NON H2S OR SO2 PRODUCING STRAINS**

**IOC Be Fruits**

S. cerevisiae • cayetanensis

Selected in collaboration with the INRA, SupAgro Montpellier, the ICV and Lallemand for its ability to produce no SO2, or H2S.

Lalvin IOC Be Fruits™ has a very short lag phase, low nutrient requirements and alcohol tolerance to 16% (v/v). Very low production of acetaldehyde.

Recommended for fresh and aromatic ciders. Very good compatibility with malolactic fermentation.

**Sensy**

S. cerevisiae • bayanus

Selected in collaboration with the INRA, SupAgro Montpellier, the ICV and Lallemand for no SO2, or H2S production.

Lalvin Sensy™ has a short lag phase, low nutrient and oxygen requirements, an alcohol tolerance of 14% (v/v) and low VA production. Optimal conditions for fruity ester expression is juice that is clarified (80 NTU 20), pH > 3.2, and fermentation temperatures between 12-15°C(56-59°F).

**NEW! IOC Be Thiols**

S. cerevisiae • cayetanensis

Selected by the INRA for no SO2, or H2S production.

Reveals fruity thiols (citrus and exotic fruits) in ciders. Enhances 3-MH potential (grapefruit, passion fruit) without excessive plant-based notes. The purity of the fruity expression is heightened by this strain's inability to produce negative sulfur compounds that can mask aromas. Fermaid O is recommended for nutrition.

**ICV OKAY**

S. cerevisiae • hybrid

Selected in collaboration with the INRA, SupAgro Montpellier, the ICV and Lallemand for its ability to produce no SO2, or H2S.

Lalvin ICV OKAY™ has a very short lag phase, low nutrient requirements and alcohol tolerance to 16% (v/v). Very low production of acetaldehyde.

Recommended for fresh and aromatic ciders. Very good compatibility with malolactic fermentation.

**ICV Opale**

S. cerevisiae • cayetanensis

Selected in France by the ICV.

Opale™ has been shown to enhance varietal character and aromatics in juice that might otherwise produce neutral odors.

Can enhance apple, pear and light blossom aromas. Improved mid-palate volume and structure. Astringent components can be softened, especially when acids are stressed during aging.

Lalvin ICV Opale™ has excellent fermentation qualities with a short lag phase and medium nitrogen requirements. Can produce significant amount of SO2 and, as a result, may inhibit malolactic fermentation.

**QA23**

S. cerevisiae • bayanus

Selected in Portugal.

Lalvin QA23™ has low nutrient and oxygen requirements. It has been known to ferment juice at low temperatures 10°C(50°F) to dryness.

Enhances fruit for a fresh style. Positive for dynamic fermentations and highly clarified juice.

**R2**

S. cerevisiae • bayanus

Isolated in France.

Has excellent cold temperature properties and has been known to ferment in conditions as low as 5°C(41°F).

Tends to produce VA without proper nutrition.

Lalvin R2™ helps produce intense, direct fruit style ciders by liberating fruity and floral aromas.

**Rhône 4600**

S. cerevisiae • cayetanensis

Isolated in France in collaboration with the research center of Lyon.

Lalvin Rhône 4600™ has a short lag phase, low nutrient demand and can ferment efficiently at low temperatures 10°C(50°F).

Produces high levels of polyphenolases which contribute intense mouthfeel and volume.

Complex aromatic notes and elevated ester production.

**VIN 13**

S. cerevisiae • hybrid

Selected in collaboration with the research center of Lyon.

Lalvin Rhône 4600™ has a short lag phase, low nutrient demand and can ferment efficiently at low temperatures 10°C(50°F).

Produces high levels of polyphenolases which contribute intense mouthfeel and volume.

Complex aromatic notes and elevated ester production.

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S. cerevisiae • cayetanensis

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Enhances fruit for a fresh style. Positive for dynamic fermentations and highly clarified juice.

**R2**

S. cerevisiae • bayanus

Isolated in France.

Has excellent cold temperature properties and has been known to ferment in conditions as low as 5°C(41°F).

Tends to produce VA without proper nutrition.

Lalvin R2™ helps produce intense, direct fruit style ciders by liberating fruity and floral aromas.
Q: Do you ferment in contact with the botanical, or add to the base after fermentation? I do both, depending on the ingredient. For example, lemon balm is a light and thin-leaved herb that deteriorates after 30 hours in my blending cider (fermented and filtered). So, I do overnight infusions with light leafy herbs to avoid degrading the chlorophyll and allowing a rough herbaceous profile. The same notion goes for dry, whole cones hops, but because they are pulpier, they can last a lot longer before getting the scarring green herb profile. Both also color (the leaves of the herb) as a clear indicator of “infusion is done”.

The co-fermenting notion tends to yield a much mutli-flavored profile in general. I tend to wait until the cider is fermented and crossinfused for additions. Spices, fresh ginger root, lavender buds, silkaphore... all of these are done in infusion bags in finished cider. To different degrees... the star anise needs four days, while the saffron is spent in two. Lavender keeps going if you let it... but longer, but gets bitter eventually.

The rhubarb co-ferment I’m running right now seems to follow these rules as well... wishing I juiced raw rhubarb and added it as a fermented fruit instead of this infusion bags of 100% of rhubarb I’ve got in store. In opposition to this, I enjoy co-fermenting on oak products as they have less resin profile but help to develop structure in the cider-supported by anecdotal accounts, not phenolic science.

Q: Which flavor combinations have not worked out the way you hoped? Makai? A mushy vegetable. It was amazing in an draft, but then pasteurizing brought the most sulfur change. Think about making Brussels sprouts in wine. So, pasteurization can add energy to the system and that changes some aromatics and less on others. Also, a clear reference to the final question below. I did not do a trial run through the pasteurizer, and so we lost time, money, and a fair bit of color that would have been great if we kept it to draft options.

The other contribution that has thwarted me is apple type. When working with dessert fruit there are organoleptic limits to what you can shape in a cider. At some point, the manipulation is so great that the consumer can tell that they are spiking in an un-natural condition. Just because Makai and ice in apple doesn’t imply that you can compensate a complex acidity with malic additions. When your blending cider is thin and flabby, consider natural acid levels as a guide. I mean to say that sometimes adding another ingredient just won’t make your color better—composition, process, and product plan are the fix, not dosing it up afterward.

Q: What techniques have worked best? Juicing? Macerating? Tea bags? Other? This depends on the profile you want, what form the ingredient is in (loch, dried, prunes, etc.). We use a lot of giant tea bags, and I use a lot of multi-spec- trum treatments with HC, PC, and KS. When I use the enzymes I also macerate in some way to aid the process, especially with whole fruit co-ferments like blueberries or cherries. It is lovely to leave them as big as possible so they are easier to rack off later but all that the saffron goes. So enzymes, maceration, rack off, then with the lees and the fruit mass I make a settling tank, rack again, and then use a little Lucias water press to get all the wine from the fruit pulp. If you can get the pits out first it is totally worth it. It is much more irritating later in the game.

Q: Do you approach finishing and packaging any differently for these flavored ciders vs. those with other fla- vored ciders in your portfolio? How does filtrat- ion go compared to your standard cider?

We have a brand identity that allows some freedom here, but we are aware of sedimentation or fruit pulp and less overwhelming the bottle or the keg. Because

Q&A

CIDERMAKING WITH BOTANICALS

Q&A WITH ANDREW BYERS
CODemaker, Fennbok Farm & Coigey Chimaicum, WA

Storage
Store for 24 months at 4°C (39°F). Use immediately once opened.

Ny: The optimum temperature for Biodeva is 15°C (59°F). If the must juice is under 15°C (59°F), it could result in long lag phase, slow growth of the yeast, and other problems.

#15685 125 g $33.90
#1697 500 g $104.00

New Size!!

Exotics SPH

S. cerevisiae + S. paradoxus hybrid

Anchor Exotics SPH is a product of the yeast hybridization program of The Institute for Vine Biotechnol- ogy at the University of Stellenbosch in South Africa. It is a hybrid between S. cerevisiae and S. paradoxus. S. paradoxus is the closest relative to S. cerevisiae. This hybrid inherited the aromatic capabilities of both its parents, thereby expanding the aromatic potential and complexity from what S. cerevisiae strains have to offer. Ciders produced using this yeast are described as having exotic aromas and flavors, as well as good mouthfeel. Exotics SPH enhances guava, passion fruit, tropical and stone fruit aromas and flavors. It can also contribute to a slightly fruity body.

QA WITH ANDREW BYERS

CODemaker, Fennbok Farm & Coigey Chimaicum, WA

Q: Any suggestions you might have for someone looking to experiment with different herbs and spices? Bench trials!!! That includes cold and hot stabilization checks – meaning leaving in a cooler for two days and look at it. Also, for pasteurization, make a mock bottle and cap it so you know what it is like after the heat energy thing gets to bowl or bottle or keg. It is foolish to base or bottle or keg without knowing if it will have the flavor you expect. So, during cold settling of juice or when thawing frozen juice, it is an excellent idea to multiply and rapidly help it to prevalent yeast types or yeasts. Use of Gaia MF98.3 needs to be followed by a S. cerevisiae strain to complete alcoholic fermentation. If the temperature of your cool soak is higher than 10°C (50°F) or lower, you may cold soak for up to 5 days before adding your Saccharomyces yeast. If the temperature of your cool soak is higher than 10°C (50°F), inoculation of Saccharomyces yeast should be done at 2 days. Gaia MF98.3 is able to grow in low pH and high sugar environments, as well as being able to tolerate an initial SO2 addition up to 50ppm.

Usage
Rehydration of Gaia MF98.3 is done at 30°C (86°F) and does not require a rehydration nutrient. Inoculate at 0.5% (2 lbs/1000 gallons). After 15 minutes, stir gently. Slowly combine an equal amount of juice into rehy- dration solution to avoid cold shock. Total rehydration time should not exceed 45 minutes. After cold soak, add selected Saccharomyces cerevisiae strain with standard yeast rehydration protocol.

#14044 500 g $104.05

Gaia MF98.3

Saccharomyces cerevisiae (Saccharomyces uvarum) selected in Burgundy in 1974 is a high producer of acetic acid and ethyl acetate. Early inoculation allows for good implantation of Gaia MF98.3, which can help control undesirable flavors during cold settling of juice or when thawing frozen juice. It is an excellent idea to multiply and rapidly help it to prevalent yeast types or yeasts. Use of Gaia MF98.3 needs to be followed by a S. cerevisiae strain to complete alcoholic fermentation. If the temperature of your cool soak is higher than 10°C (50°F) or lower, you may cold soak for up to 5 days before adding your Saccharomyces yeast. If the temperature of your cool soak is higher than 10°C (50°F), inoculation of Saccharomyces yeast should be done at 2 days. Gaia MF98.3 is able to grow in low pH and high sugar environments, as well as being able to tolerate an initial SO2 addition up to 50ppm.

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Rehydration of Gaia MF98.3 is done at 30°C (86°F) and does not require a rehydration nutrient. Inoculate at 0.5% (2 lbs/1000 gallons). After 15 minutes, stir gently. Slowly combine an equal amount of juice into rehy- dration solution to avoid cold shock. Total rehydration time should not exceed 45 minutes. After cold soak, add selected Saccharomyces cerevisiae strain with standard yeast rehydration protocol.

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ENCAPSULATED
YEAST TECHNOLOGY
FOR IMPROVED
CIDERMAKING

Encapsulated yeast are alginate beads (a natural polysaccharide extracted from seaweed) containing yeast cells. Encapsulation allows substrates and metabolites to diffuse easily throughout the beads without releasing yeast cells into the juice. Once encapsulated, the beads are partially dehydrated in a fluidized bed column and are stored at 4°C (40°F) until ready for use. The dry beads average 2 mm in diameter.

Each of our encapsulated yeast products has a unique cider-making application. ProDessert is for fermenting premium dessert/ice ciders, and ProElif is for secondary fermentation in sparkling ciders.

ProElif

Double encapsulated yeast for secondary fermentation in méthode champenoise-style cider production

ProElif is an encapsulated yeast product developed by Proenol for secondary fermentations. The yeast cells are double encapsulated in an alginate bead. The beads can be directly inoculated into the bottle (eliminating the need to prepare a starter culture). This helps ensure control of the number of cells per bottle. Upon fermentation completion, the beads have a greater density than the cider and will quickly drop to the neck of the bottle when inverted.

The beads accumulate more tightly than traditional riddling, therefore less cider is lost during disgorging. Traditional freezing and disgorging methods are used to finish the process. The use of ProElif results in a fresh sparkling cider.

For ProElif to be successful, the base cider should fall within these parameters:

- Alcohol < 11.5% (v/v)
- Calcium < 80 mg/L
- Free SO₂ < 15 mg/L
- Protein Stability = stable
- pH > 3.0
- Fermentation > 10°C (50°F)
- Temperature
- Free Assimilable Nitrogen > 100 mg/L

The base cider must be stable to avoid agglomeration of the beads which could cause subsequent difficulty during disgorging. All of these parameters act in synergy with one another. It is critical to manage them together. If one parameter is over the limit, try to compensate with the others or ferment at a higher temperature.

Recommended Dosage

100 g/L. 8.0 lb/1000 gal

Note: 1 kg (2.2 lb) will treat approximately 260 gallons.

ProElif

Double encapsulated yeast for secondary fermentation in méthode champenoise-style cider production

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Recommended Dosage

100 g/L. 8.0 lb/1000 gal

Note: 1 kg (2.2 lb) will treat approximately 260 gallons.
PROTOCOL
RECOMMENDED METHOD TO RESTART STUCK FERMENTATIONS

Sluggish and stuck fermentations present particular challenges. To address them, issues of yeast biomass buildup and low nutrient levels must be met head-on. Failure to do this will compound the problems.

Appropriate yeast rehydration nutrients such as Go-Ferm and Go-Ferm Protect Evolution are useful tools. Both are rich in micronutrients and survival factors. When added to the rehydration water, these factors promote increased biomass of the selected yeast strain. As a consequence, the selected yeast can acclimate more easily in the hostile environment associated with stuck fermentations.

When stuck ciders include high residual sugar levels, an addition of a complex nutrient to the stuck cider is also recommended. In addition, spoilage organisms like Lactobacillus and Pediococcus are often present in stuck fermentations. These microorganisms can compete for nutrients and release metabolites that inhibit yeast growth. Adding lysozyme to the stuck cider prior to restarting the fermentation may help control such unwanted bacteria and provide an improved environment for the restart to take place (see page 51).

Adding Reskue to the stuck cider prior to restarting the fermentation may also help reduce accumulated toxins and improve chances for a successful restart.

For Ciders Stuck at >3° Brix

Steps 1–8: Build-up for Stuck Cider

1. Add 40 g/hL (3.3 lb/1000 gal) of Reskue 24–48 hours prior to restarting.

2. After 24–48 hours, rack off from the Reskue.

3. Add a complex yeast nutrient (Fermaid®) directly to the tank of stuck cider at a rate of 0.5–1.0 lb/1000 gal (7–14 g/hL). Many cidermakers also add lysozyme at this time to reduce potential bacterial problems.

4. In another clean container, mix equal volumes of stuck cider and water. Generally, this would total 2% of the total cider volume. (Example: For 1000 gal of stuck cider, use 10 gal water + 10 gal cider.)

This container will be the “Mother Restart Tank”.

5. Calculate the amount of Go-Ferm or Go-Ferm Protect Evolution at 1.25 times the amount of yeast to be used. Dissolve this yeast rehydration nutrient in 20 times its weight of clean, chlorine free, 43°C (110°F) water. (Example: 5 lb Go-Ferm x 20 = 100 lb, divided by 8.33 lb/gal water = 12 gal water needed.) Mix the solution and cool to 40°C (104°F).

6. Select a yeast strain that is both alcohol tolerant and a vigorous fermenter such as K1 (YeastEx) or VIN 13. Calculate the amount of yeast required for the total volume of stuck cider at 3–5 lb/1000 gal (36–40 g/hL). When the Go-Ferm/water solution temperature has cooled to 40°C (104°F), slowly (over 5 minutes) add yeast. Stir gently to mix and avoid clumping. Let this yeast suspension stand for 15–20 minutes.

7. Check the temperature of the yeast suspension. There should not be more than 10°C (18°F) difference between the yeast suspension and the diluted cider in the Mother Restart Tank. If there is too great a temperature difference, a thermometer may be required. Cold temperatures may shock the yeast cells.

8. When the yeast suspension is properly rehydrated and proper consideration has been given to temperature differences, add the yeast to the Mother Restart Tank and wait 20–30 minutes.

Steps 9–12: Inoculation of Stuck Cider

6. Add 10% of stuck cider to the Mother Restart Tank and wait 20–30 minutes. (Example: For 1000 gal stuck cider, add 100 gal cider.)

10. Add 20% of stuck cider to the Mother Restart Tank and wait 20–30 minutes. (Example: For 1000 gal stuck cider, add 200 gal cider.)

11a, 11b, 11c. Repeat step 10.

12. Add any remaining cider to the Mother Restart Tank.

*Fermaid A, Fermaid K or Fermaid O.

FOR CIDERS STUCK AT >3° BRIX

STEPS 1–8: BUILD-UP FOR STUCK CIDER

FOR CIDERS STUCK AT 1–2° BRIX

Follow this restart protocol, except in Step 3 reduce the complex yeast nutrient addition to 0.5 lb/1000 gal (6 g/hL).

FOR CIDERS STUCK AT <1° BRIX

Follow this restart protocol, except in Step 3 eliminate the addition of a complex yeast nutrient.

Visit www.council.org for a video animation of this protocol.
In the US, cider is currently made by large and diversified beverage companies, large cider-focused producers, wineries of all scales, and small-scale specialized cider producers. These producers use a range of starting materials, including fresh apples of both cider, dual-purpose and dessert cultivars, juice and concentrate, with feedstocks both domestically produced and imported. Here, we highlight key differences in apple and grape juice YAN concentrations and composition that may necessitate the development of strategies and products specific for cider fermentation.

Endogenous YAN in Apples

In Figure 1, the average concentration of YAN observed in apple juice samples is compared to the average values for samples of different grape species. Relative to grape, apples tend to have lower endogenous YAN concentrations. As such, supplementation with yeast nutrients rich in YAN is a common practice for cider fermentation.

Endogenous YAN in Cider

In Figure 2, yeast assimilable nitrogen concentrations observed in 12 apple cultivars grown in Virginia in 2014 and 2015. (Boudreau et al. 2016, unpublished)

Endogenous YAN in Cider

Figure 3. Fresh cider sensory attribute standards prepared daily for training of panelists.

Endogenous YAN in Cider

Figure 2. Yeast assimilable nitrogen concentrations observed in 12 apple cultivars grown in Virginia in 2014 and 2015. (Boudreau et al. 2016, unpublished)

Endogenous YAN in Cider

Figure 3. Free amino nitrogen and ammonium ion concentration in apple juices from 12 cultivars grown in Virginia in 2014 plotted against total YAN concentration for each sample. (Boudreau et al. 2016, unpublished)

Endogenous YAN in Cider

Figure 3. Free amino nitrogen and ammonium ion concentration in apple juices from 12 cultivars grown in Virginia in 2014 plotted against total YAN concentration for each sample. (Boudreau et al. 2016, unpublished)

Endogenous YAN in Cider

Figure 3. Yeast assimilable nitrogen concentrations of samples of different grape species exit apples. Samples were analyzed at VITIS Technology Services Ltd and in the Purdue University Food Lab, 2010-2014. (Stewart, Harper, Sandoval, unpublished)

Endogenous YAN in Cider

YAN variation is also to be expected within apple cultivars. As shown in Figure 2, observations of YAN by cultivar over two growing seasons are reported. The cultivars in this study were grown in Virginia, and represent dual purpose and dessert cultivars currently utilized in cider production.

Endogenous YAN in Cider

Figure 2. Yeast assimilable nitrogen concentrations observed in 12 apple cultivars grown in Virginia in 2014 and 2015. (Boudreau et al. 2016, unpublished)

Endogenous YAN in Cider

Figure 3. Yeast assimilable nitrogen concentrations observed in 12 apple cultivars grown in Virginia in 2014 and 2015. (Boudreau et al. 2016, unpublished)

Endogenous YAN in Cider

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Endogenous YAN in Cider

Figure 3. Yeast assimilable nitrogen concentrations observed in 12 apple cultivars grown in Virginia in 2014 and 2015. (Boudreau et al. 2016, unpublished)
A planting consisting of ten replicates of each of 30 cider apple varieties was established at the Michigan State University Plant Pathology farm in April 2016. The planting included ‘GingerGold’ and ‘McIntosh’ as grower standards because these varieties are relatively resistant to fire blight and apple scab, respectively. ‘GoldRush’ and ‘Liberty’ were used as grower standards because these varieties are highly susceptible to fire blight and apple scab, respectively.

In 2017, five replicate trees of each variety: ‘McIntosh’ and ‘Liberty’ were left untreated and exposed to apple scab pathogen Venturia inaequalis inoculum; we inoculated the trees with ‘McIntosh’ leaves that were infected in 2016. The shoots of five replicate trees of each variety: ‘GingerGold’ and ‘Liberty’ were inoculated with the fire blight pathogen Erwinia amylovora on June 7, 2017. After each respective disease was established, the trees were rated by assessing the percent incidence of apple scab on June 23, 2017, and the percent incidence of shoot blight symptoms of fire blight on June 27, 2017.

The incidence of apple scab infection was greater than 40% on the highly susceptible variety ‘McIntosh’, and on four cider varieties including ‘Frequin Rouge’, ‘Harrison’, ‘Stembridge Cluster’, and ‘Virginia Crab’ (Fig. 1). Scab infection of ~25% was noted on ‘Porter’s Perfection’ and ‘Spitzenberg Esopus’. No scab infections were noted on the relatively resistant variety ‘Liberty’ and also on ‘Ashton Bitter’ and ‘Chisel Jersey’. Very little scab incidence (less than 5%) was noted on the remaining 21 cultivars in the study (Fig. 1).

Many of the hard cider varieties exhibited a late bud break and delayed development in the spring compared to ‘McIntosh’/ ‘Haros’. It is possible that these varieties escaped primary scab infection because susceptible tissue was not present on these later varieties when the ascospore inoculum was released.

In 2018, we will repeat the apple scab sensitivity experiment and conduct a modified fire blight experiment in which the shoots will be inoculated by spraying shoot tips with a cell suspension of the pathogen. This modified assay will require a more natural mode of infection by the fire blight pathogen and may enable us to visualize differential responses to fire blight infection among more of the cultivars in the test. Results from all years of the trial will be used to develop a recommendation guide to help select disease resistant cider apple varieties.
OVERVIEW
Classic yeast strains of Saccharomyces cerevisiae perform best when their specific needs are considered. In addition to issues like temperature and turbidity, nutritional factors are critical. If requirements are met, yeast can thrive and perform at their peak while converting juice into cider.

Nitrogen is an important part of yeast nutrition and has a significant impact on the fermentation outcome. Yeast assimilable nitrogen (YAN) content in juice directly influences fermentation speed. It impacts the yeast biomass at the beginning of fermentation, as well as the sugar transport kinetics during fermentation.

Interestingly, it is normal for juice to be nitrogen depleted at the end of the yeast growth phase even though the majority of the sugars remain to be fermented. This results in a decrease in both protein synthesis and sugar transport activity. An addition of YAN at the end of the growth phase reactivates protein synthesis and the sugar transport speed which corresponds to an increased fermentation rate.

HOW MUCH YAN IS NEEDED?
As alluded to elsewhere, the range of YAN in raw material for cider can vary tremendously. As a general rule, we recommend aiming for YAN’s of 150–200 mg/L in cidermaking. If natural levels are lower, the juice should be considered to be nitrogen deficient and an addition of YAN containing nutrients should be made.

In addition, nutrient management also requires consideration of the following factors:

INITIAL SUGAR CONTENT
The higher the initial concentration, the more YAN required. Quality and quantity of the nitrogen initially present and supplemented (organic versus inorganic) must be considered.

TEMPERATURE
An increase in temperature stimulates the growth of yeast and the fermentation rate. This, in turn, increases the need for nitrogen.

TURBIDITY
When juice is over-clarified or when using concentrate, many nutritional factors for yeast are removed. This creates the need to supplement with complete and balanced nutrients.

YEAST STRAIN
Selected for the fermentation is also a consideration. Different strains thrive in different conditions.

OXYGEN
When adding more O₂ to the juice, nitrogen is captured faster. More is needed when compared to fermentations taking place under anaerobic conditions.

FRUIT QUALITY
The sanitary condition of the fruit, juice chemistry, as well as pre-fermentation cidermaking practices also directly influence the YAN.

BASICS
Fruit provides nitrogen in the form of proteins, peptides, alpha amino acids and ammonium ions, but to a lesser degree than grapes. Yeast assimilable nitrogen (YAN) is comprised of both organic nitrogen and ammonium ions (inorganic nitrogen). When determining the YAN in juice, it is critical to take the nitrogen contribution from both of these into account. Healthy fermentations contain a balance of yeast assimilable nitrogen from both sources. Low levels of YAN can put undue stress on yeast cells and significantly hinder their performance. In some cases, yeast may create unpleasant flavors and/or aromas or even stop fermenting.

Nutritional factors are critical. If requirements are met, yeast can thrive and perform at their peak while converting juice into cider.

Yeast assimilable nitrogen (YAN) content in juice directly influences fermentation speed. It impacts the yeast biomass at the beginning of fermentation, as well as the sugar transport kinetics during fermentation.

Interestingly, it is normal for juice to be nitrogen depleted at the end of the yeast growth phase even though the majority of the sugars remain to be fermented. This results in a decrease in both protein synthesis and sugar transport activity. An addition of YAN at the end of the growth phase reactivates protein synthesis and the sugar transport speed which corresponds to an increased fermentation rate.

YEAST NUTRIENT YAN CONTRIBUTION

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Dose 25 g/hL (2.4 lb/1000 gal)</th>
<th>Dose 30 g/hL (2.4 lb/1000 gal)</th>
<th>YAN Source</th>
</tr>
</thead>
<tbody>
<tr>
<td>DAP</td>
<td>50 mgN/L</td>
<td>63 mgN/L</td>
<td>Inorganic nitrogen</td>
</tr>
<tr>
<td>Fermaid A</td>
<td>30 mgN/L</td>
<td>34 mgN/L</td>
<td>Inorganic nitrogen (from DAP) and organic nitrogen from autolyzed yeast</td>
</tr>
<tr>
<td>Fermaid K</td>
<td>25 mgN/L</td>
<td>30 mgN/L</td>
<td>Inorganic nitrogen (from DAP) and organic nitrogen from autolyzed yeast</td>
</tr>
<tr>
<td>Fermaid O</td>
<td>10 mgN/L</td>
<td>12 mgN/L</td>
<td>Organic nitrogen from autolyzed yeast</td>
</tr>
<tr>
<td>Go-Ferm</td>
<td>7.5 mgN/L</td>
<td>10 mgN/L</td>
<td>Organic nitrogen from autolyzed yeast</td>
</tr>
<tr>
<td>Go-Ferm Protect Evolution</td>
<td>7.5 mgN/L</td>
<td>10 mgN/L</td>
<td>Organic nitrogen from autolyzed yeast</td>
</tr>
<tr>
<td>Nutrient VII End</td>
<td>7 mgN/L</td>
<td>8.5 mgN/L</td>
<td>Organic nitrogen from autolyzed yeast</td>
</tr>
<tr>
<td>Phosphate Titres</td>
<td>50 mgN/L</td>
<td>63 mgN/L</td>
<td>Inorganic nitrogen</td>
</tr>
</tbody>
</table>

YEAST NUTRIENT: RECOMMENDED ADDITION RATES

<table>
<thead>
<tr>
<th>Step 1: Yeast Rehydration*</th>
<th>Step 2: Fermentation Nutrition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Juice YAN</td>
<td>Start of Acetate Fermentation</td>
</tr>
<tr>
<td>&gt; 200 mg/L</td>
<td>Go-Ferm 10 g/hL (0.8 lb/1000 gal)*</td>
</tr>
<tr>
<td>Go-200 mg/L</td>
<td>Go-Ferm 10 g/hL (0.8 lb/1000 gal)*</td>
</tr>
<tr>
<td>&lt; 125 mg/L</td>
<td>Go-Ferm Protect Evolution 10 g/hL (0.8 lb/1000 gal)*</td>
</tr>
</tbody>
</table>

Note: Knowing the initial YAN in the juice is only one piece of the puzzle. Other factors are critical as well.

Do not forget to consider the balance and availability of nitrogen, microelements and reprotectors, relative nitrogen needs of the selected yeast strain, SO₂, temperature, fruit condition, oxygen, and the variety of other factors which can impact yeast health and a successful fermentation.

*Quantity may change based on yeast dose.
**DAP may be required to further adjust the YAN.

STRATEGY: YEAST PROTECTION AND NUTRITION

YEAST NUTRIENT: RECOMMENDED ADDITION RATES

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*Quantity may change based on yeast dose.
**DAP may be required to further adjust the YAN.
If GoFerm or GoFerm Protect Evolution are used, any increase in yeast inoculation should be matched by a similar increase in these nutrients.

Only turn to the enological yeast but many also choose:

- GoFerm
- GoFerm Protect Evolution
- Reskue
- Stimula Chardonnay
- Inocel

If you are not using a yeast strain in our portfolio, please consult your supplier to determine the parameters recommended for your chosen strain.

Some factors are more critical at the fermentation’s onset (vitamins and minerals), some at mid-point (nitrogen and oxygen) and some later on (polyunsaturated fatty acids and sterols). To achieve optimal fermentation results we recommend that these needs be anticipated with a multi-stage nutrition program including both rehydration and fermentation nutrients. Any program should be tailored to the individual needs of the particular yeast you have chosen, the condition of the juice chemistry, the prefermentation processes, the individual needs of the organism and the initial nitrogen levels. Notably, if nitrogen is deficient, we can also assume that other essential nutrients are lacking as well.

The Importance of Organic Sources of Nitrogen
Yeast assimilable nitrogen (YAN) comes in two forms. The first is in the form of ammonia compounds. These are inorganic and the yeast assimilate them quickly. The second type of nitrogen is in the form of amino acids. This can lead to a depletion of the key membrane components and overall less vigor in the yeast.

Note: with the exception of Fermaid K, all ingredients of the products shown in the nutrient section of this handbook are listed by the TTB as acceptable in good commercial cidermaking practice in 27 CFR 24.246. The ingredients in Fermaid K are listed as acceptable in good commercial cidermaking practice in either 27 CFR 24.250 or 27 CFR 24.246. For more information please visit www.TTB.gov.
This is the first stage of your nutrient strategy. Yeast rehydration nutrients provide natural micronutrients (vitamins and minerals) to the yeast during the yeast rehydration phase. If these micronutrients were added directly to the juice, competitive microorganisms would use a significant amount of them and others would be chelated by polyphenols or inactivated by SO₂. By adding these bio-available nutrients at the rehydration stage, yeast cells benefit most directly.

Cell viability and vitality are enhanced, resulting in fermentations that finish stronger, with reduced chances of sensory deviations. Never use nutrients containing ammonia salts, such as DAP, during yeast rehydration—they are toxic to the yeast.

Final Point:
Keep your yeast in suspension until the last third of the fermentation.

Recommended Dosage
30 g/hL     2.5 lb/1000 gal

Usage
1. Mix Go-Ferm in 20 times its weight in clean 43°C(110°F) water. For every 1 kg (2.2 lb) Go-Ferm, use approximately 5 gallons (20L) of water.
2. Let the mixture cool to 40°C(104°F) then add the selected active dried yeast.
3. Let stand for 20 minutes.
4. Slowly (over 5 minutes) add equal amounts of juice to be fermented to the yeast slurry. Do not allow more than 10°C (18°F) difference. Atemperate as necessary (see page 6 for more details).

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

Usage
1. Mix Go-Ferm Protect Evolution in 20 times its weight in clean 43°C(110°F) water. For every 1 kg (2.2 lb) Go-Ferm Protect Evolution, use approximately 5 gallons (20L) of water.
2. Let the mixture cool to 40°C(104°F) then add the selected active dried yeast.
3. Let stand for 20 minutes.
4. Slowly (over 5 minutes) add equal amounts of juice to be fermented to the yeast slurry. Do not allow more than 10°C (18°F) difference. Atemperate as necessary (see page 6 for more details).

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

Go-Ferm Protect Evolution
Next generation yeast rehydration nutrient for challenging conditions.

Go-Ferm Protect Evolution® is the next generation of yeast rehydration nutrient with improved stress tolerance (quality and quantity) together with microorganisms which help to increase yeast cell viability and vitality. This second generation formulation improves yeast stress tolerance and enhances fermentation security (especially in difficult conditions).
Fermaid O

Inocel

Phosphate Titres

Fermaid K is a complex yeast nutrient that contains inactivated yeast, free amino acids (organic nitrogen), and diammonium phosphate (DAP). There are no supplemented vitamins or minerals. The nitrogen blend in Fermaid K is aimed at encouraging a balanced rate of fermentation. An addition elevates the yeast's intracellular amino reserve, reducing the chances of a stuck or sluggish fermentation. The available YAN in the fruit directly impacts the fermentation rate and the formation of flavor active volatile compounds. For best results, Fermaid K should be used in conjunction with an appropriate yeast nutrition nutrient (such as Go-Ferm or Go-Ferm Protect Evolution) to assure proper nutrition of selected yeast from rehydration through completed fermentation.

Recommended Dosage
10–30 g/1L
0.8–2.4 lb/1000 gal

Usage
Nutrient Vit End

Inocel is purified cellulose powder. Inocel increases the turbidity of cider. It may be used alone or in combination with complex nutrients to improve alcoholic and malolactic fermentation kinetics. Add to freshly pressed juice at the beginning of fermentation.

Recommended Dosage
40–100 g/1L
3.3–8.3 lb/1000 gal

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

Nutrient Vit End

Inactivated yeast for compromised fruit and/or treating sluggish and stuck fermentations; OMRI Listed

Fermaid®A is a complex yeast nutrient blend of inactivated yeast, free amino acids (organic nitrogen), and diammonium phosphate (DAP). There are no supplemented vitamins or minerals. The nitrogen blend in Fermaid A is aimed at encouraging a balanced rate of fermentation. An addition elevates the yeast's intracellular amino reserve, reducing the chances of a stuck or sluggish fermentation. The available YAN in the fruit directly impacts the fermentation rate and the formation of flavor active volatile compounds. For best results, Fermaid A should be used in conjunction with an appropriate yeast nutrition nutrient (such as Go-Ferm or Go-Ferm Protect Evolution) to assure proper nutrition of selected yeast from rehydration through completed fermentation.

Recommended Dosage
25 g/1L
2.0 lb/1000 gal

Usage

In order to avoid CO2 release and overflowing of fermentation vessels, all processed products should be mixed with room temperature water before adding to an active fermention. The amount of water used is not critical. Simply add enough water to make a slurry.

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

Note: Due to high nutrient requirements, some yeast strains may benefit from additional nutrient supplementation (see yeast reference chart on page 7).

DAP + all Fermaid products

Inocel is cellulose powder for over-clarified juice

Usage

Phosphate Titres

DAP and thiamine blend for optimized fermentations

Fermaid®O is a blend of highly specific fractions from inactivated yeast that are rich in assimilable amino acids (organic nitrogen). Organic nitrogen is known to be a highly effective nutrient source (especially when compared to inorganic nitrogen) consistently resulting in lower peak fermentation temperatures, lower levels of negative sugar compounds and cleaner fermentation kinetics. Organic nitrogen use has been correlated with positive aromatic expression. Fermaid O does not contain any DAP or supplemental micronutrients.

For optimal results, Fermaid O should be used in conjunction with an appropriate yeast nutrition nutrient (Go-Ferm or Go-Ferm Protect Evolution) to assure proper micronutrient nutrition of selected yeast from rehydration through completed fermentation.

Recommended Dosage
40–100 g/1L
3.3–8.3 lb/1000 gal

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

Nutrient Vit End

Inactivated yeast for compromised fruit and/or treating sluggish and stuck fermentations; OMRI Listed

Fermaid®K is a complex yeast nutrient that contains inactivated yeast, free amino acids (organic nitrogen derived from inactivated yeast), sterols, unsaturated fatty acids, key nutrients (magnesium sulfate, thiamine, folic acid, niacin, calcium pantothenate) and ammonium salts (DAP). The unsaturated fatty acids and sterols that Fermaid K provides are important survival factors needed to maintain alcohol resistance and permease (sugar uptake) activity.

The nitrogen from the alpha amino acids contained in Fermaid K is utilized much more efficiently than from the ammonium salts. The cell wall fractions in Fermaid K absorbs short and medium chain fatty acids that are toxic to the yeast. They also provide nucleation sites to help keep the yeast in suspension. For best results, Fermaid K should be used in conjunction with an appropriate yeast nutrition nutrient (such as Go-Ferm or Go-Ferm Protect Evolution) to assure proper nutrition of selected yeast from rehydration through completed fermentation.

Recommended Dosage
25 g/1L
2.0 lb/1000 gal

Usage

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

Recommended Dosage
40 g/1L
3.3 lb/1000 gal

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

Recommended Dosage
10–60 g/hL
0.8–5 lb/1000 gal*

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

Recommended Dosage
30 g/hL
2.5 lb/1000 gal

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

Recommended Dosage
2 release and overflowing of fermentation vessels, all processed products should be mixed with room temperature water before adding to an active fermentation. The amount of water used is not critical. Simply add enough water to make a slurry.

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

Recommended Dosage
40 g/hL
3.3 lb/1000 gal

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

Recommended Dosage
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Recommended Dosage
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Recommended Dosage
2 release and overflowing of fermentation vessels, all processed products should be mixed with room temperature water before adding to an active fermentation. The amount of water used is not critical. Simply add enough water to make a slurry.

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

Recommended Dosage
40 g/hL
3.3 lb/1000 gal

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

Specific inactivated yeast for treating stuck fermentations.

Reskue™ is a chosen cider yeast that has been inactivated and treated with a specific autolysis process to create cell wall fractions with very high bio-adsorptive properties for saturated short and medium chain fatty acids and fungicide residues. It was designed for use when restarting stuck fermentations. Saturated fatty acids can be created by yeast during stressful fermentation conditions. These fatty acids and fungicide residues can interfere with membrane sugar transport proteins. Use of Reskue™ helps improve these toxic conditions allowing for an easier finish of alcoholic fermentation.

**Recommended Dosage**

40 g/hL  3.3 lb/1000 gal

**Usage**

Suspend Reskue in 10 times its weight of clean 30–37°C (86–98°F) water and mix. Wait 20 minutes then add to stuck or sluggish fermentation. For stuck fermentations, allow Reskue to settle for 48 hours then rack off and reinoculate with a restart yeast.

**Storage**

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

**#15224 1 kg $40.20**

**#15242 10 kg $304.45**

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**SIY Cell Hulls**

Yeast hulls for difficult fermentation conditions.

SIY Cell Hulls™ (yeast ghosts or skeletons) are a preparation of the insoluble fraction of whole yeast cells (i.e. cell walls). The addition of yeast hulls has been shown to increase the number of viable yeast cells and to help increase the surface area of over-clarified juice and cider. In difficult or sluggish alcoholic or malolactic fermentations, yeast hulls assist by absorbing toxins such as hexanoic and decanoic acids and their esters. Yeast hulls are highly beneficial in oxygen deficient juice and cider as they contribute sterols and unsaturated fatty acids. Together with adequate assimilable nitrogen, yeast hulls can help promote cell growth and increase fermentation kinetics. For severe conditions, such as high sugar juice, over-fined juice or warm cellar conditions, higher doses (>25 g/hL) are recommended. Racking will remove yeast hulls and may necessitate a second addition.

**Recommended Dosage**

25 g/hL  2 lb/1000 gal

**Usage**

In order to avoid CO2 release and overflowing of fermentation vessels, SIY Cell Hulls should be mixed with room temperature water before adding to an active fermentation. The amount of water used is not critical. Simply add enough water to make a slurry.

**Storage**

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

**#15069 1 lb $18.25**

**#15079 5 lb $80.00**

**#15080 44 lb $571.35**

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**Yeast Stimulants for Optimizing Aromatics**

Stimula Chardonnay provides you the most innovative nutrients within the Lallemand portfolio. This yeast autolyzate is truly unique. Instead of being used for nourishing the yeast and optimizing cell growth and fermentation rate, it stimulates the yeast by increasing their ability to produce desirable aromatic compounds. This new 100% yeast autolyzate is formulated to supply the optimal levels of specific amino acids and sterols, along with the natural vitamins and minerals.

**Recommended Dosage**

40 g/hL  3.3 lb/1000 gal

**Usage**

Mix Stimula Chardonnay in 10 times its weight in clean, chlorine free water or juice and add to an active fermentation. The amount of water used is not critical. Simply add enough water to make a slurry.

**Storage**

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

**#15245 1 kg $42.10**

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**NEW! Stimula Chardonnay**

Stimulates volatile ester production.

Stimula Chardonnay™ is added at the end of the yeast growth phase (this equates to approximately 1/3 sugar depletion). At this time, the yeast is not utilizing the amino acids as a nitrogen source for growth, but they are using them along with the naturally occurring riboflavin, biotin, vitamins B6 complexes, sterols, manganese and zinc to produce esters. These desirable compounds are recognized as being fruity and floral in nature. By using Stimula Chardonnay, you are optimizing the aromatic potential of your ciders.

**Recommended Dosage**

25 g/hL  2 lb/1000 gal

**Usage**

Mix Stimula Chardonnay in 10 times its weight in clean, chlorine free water or juice and add to the fermentation at 1/3 sugar depletion. It is essential that this timing of addition is respected. Stimula Chardonnay is not fully soluble so it will not fully dissolve. Stir to maintain suspension before and during addition.

**Storage**

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

**#15245 1 kg $42.10**
ICV Booster Blanc

Increases smooth mid-palate intensity and fresh fruit notes.

ICV Booster Blanc® was developed from a specific ICV yeast strain. This yeast derivative nutrient is produced by the inactivation of yeast cells and through this process soluble fractions of the cells walls are made readily available.

When added to juice, Booster Blanc participates in the colloidal balance of the cider resulting in smooth mid-palate intensity and increased fresh fruit aromas. Interactions take place that diminish bitterness and chemical perceptions. Booster Blanc helps to maintain freshness and aroma stability in ciders that go through MLF.

If used at the beginning of the primary fermentation, it can be helpful in lowering the production of off-sulfur compounds. It can be added toward the end of fermentation to help reveal muted aromatics.

**Recommended Dosage**

30 g/hL     2.5 lb/1000 gal

**Usage**

Mix Booster Blanc in 10 times its weight in water or juice. Booster Blanc is only partially soluble. Stir to maintain suspension before and during addition.

**Note:** With the exception of Fermaid K, all ingredients of the products shown in the nutrient section of this handbook are listed by the TTB as acceptable in good commercial fermenting practice listed in 27 CFR 24.246. The ingredients in Fermaid K are listed as acceptable in good commercial fermenting practice in either 27 CFR 24.251 or 27 CFR 24.246. For more information please visit www.TTB.gov.

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ICV Noblesse

Contributes to balance and softness on the finish; OMBI listed

ICV® ‘Noblesse’ is a yeast derivative nutrient which adds a perception of sweetness to balanced ciders. The production process used for Noblesse inactivates sulfite-reductase potential, greatly limiting sulfur off-odors. Ciders made using Noblesse exhibit a more intense perception of ripe fruit together with an overall roundness and smoothness on the finish. Noblesse can help reduce undesirable aggressive characters or sensations of dryness due to the release of low molecular weight polysaccharides. Although immediate results are possible, full integration may take three to five months.

**Recommended Dosage**

30 g/hL     2.5 lb/1000 gal

**Usage**

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

**Note:** With the exception of Fermaid K, all ingredients of the products shown in the nutrient section of this handbook are listed by the TTB as acceptable in good commercial cider-making practice listed in 27 CFR 24.246. The ingredients in Fermaid K are listed as acceptable in good commercial cider-making practice in either 27 CFR 24.251 or 27 CFR 24.246. For more information please visit www.TTB.gov.
OVERVIEW

Tannins come from a variety of sources. These include oak (both American and European, toasted and untoasted), chestnut, grapes (both skins and seeds), exotic woods (such as tara and quebracho) and gall nuts. Though all tannins provide some degree of antioxidant protection, each is also quite distinctive. The selection, processing and blending are all critical when developing commercial tannins. The descriptors often used to characterize tannin types are inadequate to the task. Words such as ellagic (meaning oak or chestnut wood) or proanthocyanidins (meaning from grapes and some exotic woods) are very broad. The producer of tannins needs to understand and quantify the potential of specific raw materials and then apply this knowledge. Tools such as GC/MS (gas chromatography/mass spectrometry), reverse phase HPLC (high performance liquid chromatography) and TLC (thin layer chromatography) analysis (silica/fluorescence; cellulose) are common in this process.

Raw materials need to be tasted in different concentrations in different ciders. Though lab tools are useful for understanding products, tasting still remains the key. There is no substitute if we wish to understand issues such as mouthfeel, relative astrigency and increasing roundness. In particular, the polysaccharides linked with tannins contribute to the overall impact on the palate.

BASICS

The tannins we offer for cider can be used during the fermentation, or after fermentation during cellaring. Common objectives for tannins when used during fermentation are to enhance structure and mouthfeel, to protect from browning, and to deal with the consequences of mold or rot. Uses of tannins during cellaring and finishing include improved mid-palate and texture, perceptions of minerality or sweetness, and improved aging potential.
**FT Blanc Citrus**

Promotes the expression of fruity aromas.

**Usage**

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

**Recommended Dosage**

50–200 ppm  2–10 g/L  0.42–16 lbs/1000 gal

**Dosage**

2–10 ppm  0.02–0.10 g/L  0.02–0.06 lbs/1000 gal

**Storage**

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

**Usage**

Add FT Blanc Soft to the juice or the cider during a tank mixing. Good homogenization is important. Additions should be made at least 48 hours prior to bottling.

**Recommended Dosage**

50–200 ppm  5–20 g/L  0.42–16 lbs/1000 gal

**Dosage**

5–20 ppm  0.05–0.20 g/L  0.05–0.12 lbs/1000 gal

**Storage**

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

**FT Blanc Citrus**

Protects from oxidation and mouthfeel enhancement.

**Usage**

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

**Recommended Dosage**

50–200 ppm  2–10 g/L  0.42–16 lbs/1000 gal

**Dosage**

2–10 ppm  0.02–0.10 g/L  0.02–0.06 lbs/1000 gal

**Storage**

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

**FT Blanc Soft**

Oxidation protection and mouthfeel enhancement for cider.

**Usage**

Add FT Blanc Soft to the juice or the cider during a tank mixing. Good homogenization is important. Even relatively small dosages can contribute to minerality in ciders.

**Recommended Dosage**

50–200 ppm  5–20 g/L  0.42–16 lbs/1000 gal

**Dosage**

5–20 ppm  0.05–0.20 g/L  0.05–0.12 lbs/1000 gal

**Storage**

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

**FINISHING KITS**

**Finishing Kit**

Finishing agents can be valuable tools for perfecting a cider. We now offer finishing kits with liquid tannins and stability agents for ease of trials. These touches can help you achieve specific goals for any given cider.

**Luxe Tannin Kit**

The LUXE tannins are ultra-premium finishing tannins designed to bring out elegance, complexity and balance in ciders. They have been highly refined and carefully extracted so additions may be made as late as 48 hours prior to bottling.

Our LUXE liquid tannin kits include samples of each tannin in the range: Radiance, Onyx, and Royal. These kits are a great tool to make final touches to your cider.

Please feel free to contact Scott Laboratories for any other product recommendations.

Note: Tannin kits are prepared liquids for ease of use in bench trials. All tannins in our portfolio are powder in nature.

**Micropipettes for bench trials**

- #37101  20–200µL Micropipette  $134.50
- #37102  50–500µL Micropipette  $134.50
- #37103  5–200µL Micropipette tips (96 tips)  $10.25
- #37112  100–1250µL Micropipette tips (96 tips)  $12.75

Pipettes sold separately.

#SLQDTAN $91.35

#SLQDLUX $15.25

#SLQDLUX $15.25
Enzymes are natural protein catalysts that facilitate and increase the rate of chemical reactions. Enzymes are used to accelerate natural reactions that would otherwise occur slowly in cider. Enzyme use can promote fruit and spice attributes while reducing sulfur off-odors and undesirable herbaceous and mineral characteristics. (D. Delteil, 2003, personal communication).

If time permits and pressing technology allows, the addition of enzymes to the milled apples as soon as possible helps with extraction of aroma precursors, and helps increase juice yield.

**OVERVIEW**

Enzymes are a natural tool to optimize the potential of your fruit. They perform best when remembering a few basics:

**TIMING**
In general, enzymes should be added as early as possible on crushed fruit or juice to provide your fermentation with the natural components of the fruit. Enzymes that contain beta-glucosidase (Lallzyme Beta and Scottzyme BG) are inhibited by sugars and should not be used prior to fermentation. Beta and BG are useful in releasing flavor and aroma compounds. Scottzyme KS and Scottzyme Spectrum are used after pressing to enhance clarification and filterability in cider.

**SO₂**
Enzyme activity is inhibited by SO₂. In high concentrations (around 200 ppm) SO₂ will denature and inactivate the enzymes. SO₂ can be added after an enzyme addition has been adequately dispersed or vice versa, but do not add SO₂ and enzymes at the same time.

**BENTONITE**
Bentonite will bind with enzymes and inactivate them, so the timing of additions is important. It is best to use bentonite after the enzyme activity has completed. If adding enzymes after using bentonite, make sure to rack cider off of the bentonite prior to adding enzymes.

**CONDITIONS**
High alcohol, low temperature, high SO₂, fining agent additions and the amount of movement in a tank can inhibit enzyme action. If conditions are not optimal for the enzymes, extra time may be required for the enzyme activity to be completed before proceeding with other additions.

**LIQUID AND GRANULAR/POWDERED**
The enzymes are granular/powdered or liquid. The granular/powdered enzymes are marked with the symbol \( \text{G} \). The liquid enzymes are marked with the symbol \( \text{L} \).
**PROTOCOL**

**TIMING OF ADDITIONS: SO₂, ENZYMES AND TANNINS**

Add SO₂ and mix well prior to adding enzymes. Tannins can be added 6–8 hours later. Yeast derivative nutrients (e.g. Opti-WHITE) can be added at any point during fermentation.

**CHOOSING THE RIGHT ENZYME**

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<th><strong>Lallzyme</strong></th>
<th><strong>Rapidase</strong></th>
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**LALLZYME**

All Lallzymes are granular and most are sourced from *Aspergillus niger* fermentations (not sourced from genetically modified organisms).

**Beta**

Aroma enhancement. Lallzyme Beta™ is a blend of pectinase and beta-glucosidase for use in ciders with high levels of bound terpenes. Lallzyme Beta has been formulated so that it will not lead to an over-expression of aromas. The glucosidase activity is inhibited by sugars. The cider should have less than 0.5% residual sugar for full enzyme activity. Bench trials are highly recommended before using.

**Recommended Dosage**

<table>
<thead>
<tr>
<th>Juice</th>
<th>5-10 g/hL</th>
<th>190-379 g/1000 gal</th>
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**Usage**

Dissolve Lallzyme Beta in 10 times its weight in water, gently stir and allow to sit for a few minutes. Then add to cider. For use in cider only since the betaglucosidase activity is inhibited by glucose levels in juice. Note: Results can take 1–6 weeks.

**Storage**

Dated expiration. Store dry enzyme at 25°C (77°F). Once rehydrated, use within a few hours.

**MMX**

Enzyme to improve filterability. Lallzyme MMX™ is a beta-glucanase and pectinase blend. Due to the synergistic activities of the glucanase and pectinase blend, Lallzyme MMX improves the filterability of ciders. Enzymes from this source are listed on CFR 24.250.

**Recommended Dosage**

<table>
<thead>
<tr>
<th>Juice</th>
<th>Not recommended</th>
</tr>
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</table>

**Usage**

Dissolve Lallzyme MMX in 10 times its weight in water, gently stir, allow to sit for a few minutes and then add to the cider. Note: Glucans are slow to break down. M mixture contact time with MMX is up to 6 weeks.

**Storage**

Dated expiration. Store dry enzyme at 25°C (77°F). Once rehydrated, use within a few hours.

**Cider Clear**

Juice clarification and settling. Lallzyme Cider Clear is a new enzyme created specifically for cider. It is a pectinase for juice clarification and settling.

**Recommended Dosage**

<table>
<thead>
<tr>
<th>Juice</th>
<th>2-3 g/hL</th>
<th>76-114 g/1000 gal</th>
</tr>
</thead>
</table>

**Usage**

Dissolve Lallzyme Cider Clear in 10 times its weight in water, gently stir, allow to sit for a few minutes and then add to cider.

**Storage**

Dated expiration. Store dry enzyme at 25°C (77°F). Once rehydrated, use within a few hours.

**Note:** The ingredients in MMX are listed by the TTB as acceptable in good commercial cidermaking practice in CFR 24.250. For more information, please visit [www.TTB.gov](http://www.TTB.gov).
Enzyme for settling, clarification, and reducing solids. Rapidase Clear is a clarification enzyme preparation. It is a granular pectolytic enzyme that aids in decreasing viscosity, allowing for more compact lees and cleaner juice, resulting in cleaner ciders.

**Recommended Dosage**
- *Juice*: 3–4 g/hL, 38–45 g/1000 gal
- *Cider*: Not recommended

**Usage**
- Dissolve Rapidase Clear in 10 times its weight in water, gently stir and then add to juice.

**Storage**
- Dated expiration. Store dry enzyme refrigerated at 4–8°C (40–45°F). Once rehydrated, use within a few hours.

**Rapidase Clear Extreme**
Enzyme for settling, clarification, and reducing solids in difficult and extreme conditions. Rapidase Clear Extreme is an enzyme preparation for use in difficult juice conditions (low temperature, pH, and/or hard-to-settle varietals). It is a granular pectolytic enzyme that decreases viscosity and promotes solid particle aggregation.

**Recommended Dosage**
- **Juice**
  - > 15°C (59°F): 1 g/hL, 38 g/1000 gal
  - 10-15°C (50–59°F): 2 g/hL, 75 g/1000 gal
  - < 10°C (50°F): 4 g/hL, 153 g/1000 gal
- **For settling time under 6 hours at**
  - > 10°C (50°F): 3 g/hL, 113 g/1000 gal

- **Cider**: Not recommended

**Usage**
- Dissolve Rapidase Clear in 10 times its weight in water, gently stir and then add to juice.

**Storage**
- Dated expiration. Store dry enzyme refrigerated at 4–8°C (40–45°F). Once rehydrated, use within a few hours.

**Revelation Aroma**
Enzyme for the extraction of aroma precursors. Revelation Revelation Aroma contains α and β-glycosidase activities to breakdown glycosylated aroma precursors. It helps release varietal aromatic precursors for intense and complex aromas. It is known for respecting varietal character. It can be used on the juice or finished cider to release aromas and help clarify, but best results may be seen when added to the juice.

**Dosage**
- **Crushed Fruit**: 15–22 g/ton
- **Juice**: 1–1.5 g/hL, 35–55 g/1000 gal

**Usage**
- Dissolve Rapidase® Revelation Aroma in 10 times its weight in water, gently stir and then add to juice.

**Storage**
- Dated expiration. Store refrigerated at 4°C (40°F) for 1–2 years. Once opened, keep tightly sealed and refrigerated once opened.

**SCOTTZYMES**

**BG**
Aroma releasing enzyme. Scottzyme® BG is a powdered pectinase with beta-glucosidase activity for the release of bound terpenes. It is generally used for the release of aroma and flavor compounds. Scottzyme BG should be used only in cider, not juice. Scottzyme BG should be used only at the end of fermentation. The glucosidase activity is inhibited by sugars. The cider should have less than 0.5% residual sugar for proper enzyme activity. Bench trials are highly recommended before using.

**Recommended Dosage**
- **Juice**: Not recommended
- **Cider**: 3–5 g/hL, 114–190 g/1000 gal

**Usage**
- Powdered enzymes tend to scatter across water or cider. It is best to add just enough cool 21–25°C (70–77°F) water to Scottzyme BG to create a paste. Then add more cool water to dissolve the enzyme completely. It is now ready to be added to the cider. Make sure you have gentle motion in the tank to disperse Scottzyme BG. Use only on cider because the glucosidase activity is inhibited by sugar.

**Note**: Results may take 1–6 weeks.

**Storage**
- Store at room temperature for 1–2 years. Once opened, keep tightly sealed and dry. Once hydrated, use within a few hours.

**SCOTTZYMES**

**HC**
Enzyme for increasing yield and reducing solids. Scottzyme® HC is a pectinase and hemicellulase blend designed to increase yield, reduce solids and improve filtration. It is a strong enzyme, useful for pome (apple or pear) or stone (pitted) fruits. It is best used in conjunction with Scottzyme Pec5L.

**Recommended Dosage**
- **Juice**: Not recommended
- **Cider**: 3–5 g/hL, 114–190 g/1000 gal

**Usage**
- Dilute Scottzyme HC to approximately a 10% solution in cold water. Sprinkle the solution over the crushed fruit or add during a tank mixing before alcoholic fermentation. If adding to cider, gently mix a 10% solution into the tank for even dispersion.

**Storage**
- Store at 4°C (40°F) for 1–2 years. Keep tightly sealed and refrigerated once opened.

**Recommended Dosage**
- **Juice**: 5.3–7.9 mL/hL, 200–350 mL/1000 gal
- **Cider**: 6.6–9.2 mL/hL, 250–350 mL/1000 gal

**Recommended Dosage**
- **Juice**: 200 mL cylinder, 20 mL enzyme
- **Cider**: 180 mL H2O, 30 mL enzyme

**How to Make a 10% Solution**

1. Dissolve Rapidase Clear Extreme in 10 times its weight in water, gently stir and then add to juice.

2. If using a dose of 20 mL/ton, mix 20 mL of liquid enzyme with approximately 180 mL of water.
**Spectrum**

Enzyme blend for enhanced clarification and filtration of difficult lots.

Scottzyme Spectrum is a blend similar to that of KS, but with increased pectinase activity for the most difficult cider clarification tasks. Scottzyme Spectrum should only be used on finished cider after settling or to solve filtration issues before bottling.

**Recommended Dosage**

- **Fruit**: Not recommended
- **Juice**: Not recommended
- **Cider**: 2–4 mL/hL, 75–150 mL/1000 gal

**Usage**

Dilute Scottzyme Spectrum to approximately a 10% solution in cool water. Add to the cider after alcoholic fermentation during a tank mixing.

**Storage**

Store at 4°C (40°F) for 1–2 years. Keep tightly sealed and refrigerated once opened.

**Warning**

Never use Scottzyme Spectrum before pressing or on the juice. It has our most aggressive enzymatic activity and may result in over clarification of the juice.

#16177 1 kg (890 mL) $114.90

#16167 25 kg (22.25 L) $1610.00

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**KS**

Blend of enzymes for enhanced settling and filtration

Scottzyme® KS is a blend of enzymes designed for difficult to settle or hard-to-filter juices or ciders. Scottzyme KS is most effective when used early in processing. It should not, however, be used before pressing. It is never too late to use Scottzyme KS.

Customers have reported very favorable results when used to solve “nightmare” filtrations before bottling.

**Recommended Dosage**

- **Fruit**: Not recommended
- **Juice**: 2–4 mL/hL, 100–150 mL/1000 gal
- **Cider**: 50–60 mL/1000 gal

**Usage**

Dilute Scottzyme KS to approximately a 10% solution in cool water. Add to the juice after pressing or to the cider after alcoholic fermentation during a tank mixing. Do not use prior to pressing.

**Storage**

Store at 4°C (40°F) for 1–2 years. Keep tightly sealed and refrigerated once opened.

**Warning**

Never use Scottzyme KS before pressing.

Scottzyme KS has very aggressive enzymatic activities that will break down the fruit and create too many fine solids. After pressing, these activities will help with settling and the breakdown of sticky solids. The goal is to make the juice or cider more manageable.

#16174 1 kg (890 mL) $77.75

#16164 25 kg (22.25 L) $995.85

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**Pec5L**

Enzyme for pressability, settling and clarification

Scottzyme® Pec5L is a highly concentrated pectinase blend.

It is used for berries, pome and stone fruits for easier pressing and higher yields. It is also used in juice for improved settling, clarification and filtration. When adding to fruit, it is sometimes beneficial to use in conjunction with Scottzyme HC.

**Recommended Dosage**

- **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

**Usage**

Dilute Scottzyme Pec5L to approximately a 10% solution in cool water. Sprinkle over the fruit before pressing or add to the juice before the start of alcoholic fermentation.

**Storage**

Store at 4°C (40°F) for 1–2 years. Keep tightly sealed and refrigerated once opened.

#16170 1 kg (890 mL) $77.75

#16160 25 kg (22.25 L) $876.55

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**Spectrum**

Enzyme blend for enhanced clarification and filtration of difficult lots.

Scottzyme Spectrum is a blend similar to that of KS, but with increased pectinase activity for the most difficult cider clarification tasks. Scottzyme Spectrum should only be used on finished cider after settling or to solve filtration issues before bottling.

**Recommended Dosage**

- **Fruit**: Not recommended
- **Juice**: Not recommended
- **Cider**: 2–4 mL/hL, 75–150 mL/1000 gal

**Usage**

Dilute Scottzyme Spectrum to approximately a 10% solution in cool water. Add to the cider after alcoholic fermentation during a tank mixing.

**Storage**

Store at 4°C (40°F) for 1–2 years. Keep tightly sealed and refrigerated once opened.

**Warning**

Never use Scottzyme Spectrum before pressing or on the juice. It has our most aggressive enzymatic activity and may result in over clarification of the juice.

#16177 1 kg (890 mL) $114.90

#16167 25 kg (22.25 L) $1610.00

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Image at left: Scottzyme Spectrum trial showing four days post enzyme addition, settling at room temperature. Fruit left to right: Control, 50 NTU, Enzyme A 46 NTU, Spectrum 20-16 NTU.
**OVERVIEW**

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

For those interested in experimenting with malolactic fermentation, please first select products in this section. More information and specific protocols can be found on our website at www.scottlab.com.

**BASICS**

It is very important to know the status of the cider prior to inoculating with malolactic bacteria. Analyze the cider for pH, SO₂, residual sugar, malic acid and alcohol level. Creating an optimal environment for malolactic bacteria includes:

- **Temperature**
  - Between 20-25°C (68-77°F).
- **pH**
  - Above 3.4.
- **SO₂**
  - Free SO₂ below 10 ppm, total SO₂ below 25 ppm.
- **Alcohol**
  - Normally, alcohol levels in ciders are not an impediment to malolactic fermentations. Cider makers should, however, be aware that elevated alcohol (e.g., >15% v/v) can cause problems.

**VOLATILE ACIDITY (VA)**

If the pH is high, other bacteria strains may already be growing causing an elevated VA. The cider should be monitored for unwanted bacteria.

**NUTRITIONAL STATUS**

Was a complete yeast nutrient used during primary fermentation? Was a high nutrient demanding yeast strain used for primary fermentation? Good nutrition is important for malolactic bacteria. Malolactic nutrients such as Acti-ML, Opti-Malo Blanc, and Opti-Malo Plus will help with the growth and survival of specific malolactic bacteria.

**YEAST STRAIN**

Choose a yeast strain which is compatible with the selected malolactic bacteria. See MFL Compatibility in the yeast charts on page 7.

**MALIC ACID**

Measure malic acid levels. Cider conditions are difficult for bacteria if the malic level is <0.5 g/L or >70 g/L.

**CULTURE GROWTH CONDITIONS**

When selecting a bacteria culture, take note that limiting conditions have a compounding inhibitory effect.

For example, if low pH is combined with high SO₂, conditions in a cider will be more antagonistic to the bacteria than low pH alone.

**DIRECT INOCULATION CULTURES**

Since cider environments can be hostile, direct inoculation starter cultures must be conditioned to this environment during their production. The direct inoculation process was developed to prepare the cell membrane in advance for these difficult conditions. The result is highly active cultures which are ready for easy and quick inoculation of cider.

**Alpha**

O. oeni for enhancing mouthfeel and complexity while reducing perceptions of green and vegetative characters.

**PN4**

O. oeni adapted to difficulties conditions of pH, alcohol and SO₂.

**MBR PN4** was isolated in the Trentino region of Italy. This strain has been known to perform under difficult conditions such as low pH (3.0-3.1) and high alcohol.

**MBR 31**

Lalvin MBR #15607 25 hL (660 gal) dose $118.85

**VP41**

Lalvin MBR VP41® was isolated in Italy. Performs well even under stressful conditions such as low pH (3.3) and low temperature (greater than 13°C/55°F).

**MBR 31**

Lalvin MBR VP41® was isolated in Italy. Performs well even under stressful conditions such as low pH (3.3) and low temperature (greater than 13°C/55°F).

**O-MEGA**

O. oeni adapted to high alcohol and cooler cellar temperatures

**For all Direct Inoculation Cultures**

**Usage**

Direct inoculation cultures can be added directly to the cider without rehydration. Once opened, bacteria packet must be immediately used.

**Storage**

Sealed packets can be delivered and stored for a few weeks at ambient temperature (<25°C/77°F) without significant loss of viability. For longer term storage, direct inoculation cultures can be stored in original sealed packaging for 18 months at 4°C (57°F) and 36 months at 18°C (65°F).
Even under ideal conditions Oenococcus oeni malolactic bacteria grow slowly. The nutrient needs of the yeast chosen for primary fermentation affect nutrients available for malolactic bacteria. Apples and pears tend to have lower nutrient levels, and this situation is often even more difficult when concentrates are used.

Indigenous microflora utilize the same nutrients. Highly clarified ciders are often stripped of nutrients. All of these factors contribute to the need for sufficient nutrition for O. oeni. A small yeast population with little autolysis or a yeast strain that does not fully autolyze may not provide the needed nutrient release. O. oeni have complex nutrient needs and cider is often a poor source of these nutrients. Malolactic bacteria nutrients help create a better environment in the cider. Used properly, they help the selected bacteria get a faster start, increase survival rates and lower the risk of problems from undesirable bacteria (biogenic amines, VA, off-flavors and aromas, etc.).

**MALOLACTIC BACTERIA NUTRITION**

**Acti-ML**

Bacteria rehydration nutrient

Acti-ML® is a bacteria nutrient used during rehydration of the direct addition malolactic bacteria strains. Acti-ML is a specific blend of inactive yeasts rich in amino acids, mineral cofactors, vitamins. These inactive yeasts are mixed with cellulose to provide more surface area to help keep bacteria in suspension. Acti-ML can help strengthen the development of bacteria growth under difficult conditions.

**Recommended Dosage**

20 g/L  50 g/60 gal  1.7 lb/1000 gal

**Usage**

Mix Acti-ML into 5 times its weight in 25°C(77°F) chlorine-free water. Add bacteria, then wait 15 minutes before adding the suspension to the cider.

**Storage**

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

**Opti’Malo® Plus**

Complete malolactic nutrient

Opti’Malo Plus™ is a natural nutrient developed by Lallemand specifically for MLF. It is a blend of inactive yeasts rich in amino acids, mineral cofactors, vitamins, cell wall polysaccharides and cellulose. The cellulose provides surface area to help keep the bacteria in suspension and to help adsorb toxic compounds that may be present at the end of primary fermentation.

**Recommended Dosage**

20 g/L  50 g/60 gal  1.7 lb/1000 gal

**Usage**

Suspend in a small amount of water or cider and add directly to the cider at the same time as the malolactic culture. It should not be added to the rehydration water.

**Storage**

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

**Opti’Malo Blanc**

Malolactic nutrient for difficult cider fermentation

Malolactic fermentation in ciders can often be difficult. Opti’Malo Blanc™ is a unique malolactic nutrient, formulated from a blend of selected inactivated yeasts. It helps compensate for amino nitrogen and peptide deficiencies. The bioavailability of certain peptides stimulates the growth of selected bacteria and shortens the duration of MLF, especially under difficult cidermaking conditions.

**Recommended Dosage**

20 g/L  50 g/60 gal  1.7 lb/1000 gal

**Usage**

Suspend in small amount of water or cider and then add directly to the cider 24 hours before adding the malolactic bacteria.

**Storage**

Dated expiration. Store at 18°C(65°F). Once opened, keep tightly sealed and dry.
### OVERVIEW
Practices such as adding yeast and ML starter cultures, regular sulfur dioxide additions, acidification, sanitation, and filtration are common ways in which microbial control is applied during cidermaking. 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 prevent, inhibit or eliminate unwanted microorganisms.

### BASICS
**Removal**
Microorganisms are physically removed from the cider. Removal strategies include filtration, centrifugation and some types of fining when followed by racking.

**Inhibition**
Microbial replication is stopped or slowed, but organisms are not necessarily killed. Microbes may start to grow and multiply once the inhibitory pressure is removed. Inhibition strategies include acidification to lower pH and use of sulfur dioxide at non-lethal concentrations.

**Deactivation**
Microorganisms are killed and will not survive to replicate. Deactivation strategies include Velcorin treatment. No Brett Inside additions, use of lysozyme (especially at pH >4.0), addition of alcohol (as in the case of fortified ciders), and pasteurization.

### CHOOSING THE RIGHT MICROBIAL CONTROL AGENT

<table>
<thead>
<tr>
<th>Lysozyme</th>
<th>SO₂</th>
<th>Chitin Glucan</th>
<th>Chitin Glucan 1:10</th>
<th>Chitin Glucan 1:20</th>
<th>Chitin Glucan 1:100</th>
</tr>
</thead>
<tbody>
<tr>
<td>Protection against indigenous yeast</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
</tr>
<tr>
<td>Control gram-positive bacteria (LAB)</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
</tr>
<tr>
<td>Control gram-negative bacteria (Acetobacter)</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
</tr>
<tr>
<td>Inhibit oxidation</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
</tr>
<tr>
<td>Control spoilage yeast (Ketosaccharomyces)</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
</tr>
<tr>
<td>Prevention during stuck and sluggish fermentations</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
</tr>
<tr>
<td>Delay MLF</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
</tr>
<tr>
<td>Helps prevent refermentation in bottle</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
<td>??</td>
</tr>
</tbody>
</table>

**Lysozyme SO₂**
Lysozyme and SO₂ are complementary microbial control strategies, as they target different stages in microbial growth.

**Lysozyme**
Lytic enzyme isolated from egg white that specifically targets gram-positive bacteria (LAB), including Oenococcus spp., Pediococcus spp., and Lactobacillus spp. Lysozyme is favored over SO₂ for MLF because it is not subject to pH inhibition and has no effect on the yeast.

**SO₂**
Sulfur dioxide is known to prevent growth of LAB and ML cocci, and help with floculation during yeast flocs.

**Lysozyme applications**
- **Protection from indigenous yeast**
- **Control gram positive bacteria (LAB)**
- **Protection during stuck and sluggish fermentations**
- **To encourage yeast growth in the absence of SO₂**

**Lysozyme dosages**
- **Lyso-Easy**
  - **Recommended dosage**
  - **Usable immediately**
  - **Storage**
  - **Timing**
  - **Lysovin**
  - **Recommended dosage**

**Lysovin**
Lysovin is a powdered lysozyme that needs to be properly rehydrated.

**Lysozyme usage**
- **Protection from indigenous yeast**
- **Protection during stuck and sluggish fermentations**
- **To encourage yeast growth in the absence of SO₂**

**Lysozyme timing**
- **Add prior to fermentation**
- **Add at first signs of a stuck fermentation**
- **Add at signs of a stuck fermentation**
- **Add during blending**

**Lysozyme effects**
- **Inhibit MLF when blending partial and complete ML ciders**
- **Inhibit MLF when blending partial and complete ML ciders**
- **Inhibit MLF when blending partial and complete ML ciders**
- **Inhibit MLF when blending partial and complete ML ciders**

**Lysozyme storage**
- **Store in dry form for 5-10 years at 18°C (65°F).**
- **Once rehydrated, Lysovin should be refrigerated and will retain 90% of activity after 12 months.**

**Lysozyme advantages**
- **Inhibit growth of LAB in juice**
- **To inhibit spoilage characters due to uncontrolled microbial growth**
- **To encourage yeast growth in the absence of SO₂**

**Lysozyme disadvantages**
- **Prevent malolactic fermentation**
- **Prevent malolactic fermentation**
- **Prevent malolactic fermentation**
- **Prevent malolactic fermentation**

**Lysozyme applications**
- **Inhibit growth of LAB in juice**
- **To inhibit spoilage characters due to uncontrolled microbial growth**

**Lysozyme dosages**
- **Lyso-Easy 91 mL/hL 3.4 mL/gal**
- **Lysovin 250 ppm 8.75 g/gal**

**Lysozyme timing**
- **Add prior to fermentation**
- **Add at signs of a stuck fermentation**
- **Add during blending**

**Lysozyme effects**
- **Inhibit MLF when blending partial and complete ML ciders**

**Lysozyme advantages**
- **Inhibit growth of LAB in juice**
- **To inhibit spoilage characters due to uncontrolled microbial growth**
- **To encourage yeast growth in the absence of SO₂**

**Lysozyme disadvantages**
- **Prevent malolactic fermentation**
- **Prevent malolactic fermentation**
- **Prevent malolactic fermentation**
- **Prevent malolactic fermentation**

**Lysozyme dosages**
- **Lyso-Easy 104–182 mL/hL 3.5–8.6 mL/gal**
- **Lysovin 250–400 ppm 8.75–12.5 g/gal**
  - **Timing**
  - **Add at signs of a stuck fermentation**
  - **Add during blending**

**Lysozyme effects**
- **Inhibit MLF when blending partial and complete ML ciders**
- **Inhibit MLF when blending partial and complete ML ciders**
- **Inhibit MLF when blending partial and complete ML ciders**
- **Inhibit MLF when blending partial and complete ML ciders**

**Lysozyme advantages**
- **Inhibit growth of LAB in juice**
- **To inhibit spoilage characters due to uncontrolled microbial growth**

**Lysozyme disadvantages**
- **Prevent malolactic fermentation**
- **Prevent malolactic fermentation**
- **Prevent malolactic fermentation**
- **Prevent malolactic fermentation**

**Lysozyme dosages**
- **Lyso-Easy 136–227 mL/hL 5–8.6 mL/gal**
- **Lysovin 300–500 ppm 10–16 g/gal**
  - **Timing**
  - **Add during blending**

**Lysozyme effects**
- **Inhibit MLF when blending partial and complete ML ciders**
- **Inhibit MLF when blending partial and complete ML ciders**
- **Inhibit MLF when blending partial and complete ML ciders**
- **Inhibit MLF when blending partial and complete ML ciders**

**Lysozyme advantages**
- **Inhibit growth of LAB in juice**
- **To inhibit spoilage characters due to uncontrolled microbial growth**

**Lysozyme disadvantages**
- **Prevent malolactic fermentation**
- **Prevent malolactic fermentation**
- **Prevent malolactic fermentation**
- **Prevent malolactic fermentation**

**Lysozyme dosages**
- **Lyso-Easy 154–182 mL/hL 4.5–5 g/gal**
- **Lysovin 250–400 ppm 0.94–1.50 g/gal**
Sulfur Dioxide

Cider quality can be preserved with sulfur dioxide. Sulfur dioxide is used in cider for its anti-oxidant and anti-microbial properties. The effectiveness of sulfur dioxide as an anti-microbial is dependent upon pH. As pH increases, the portion of sulfur dioxide that is active against microorganisms decreases. Therefore, increases in pH require the addition of more sulfur dioxide to maintain adequate anti-microbial activity. Inodose granules and tablets are an easy and effective way to add sulfur dioxide to fruit, juice or cider.

**Inodose Granules**

Effervescent sulfur dioxide granules

Inodose Granules are small, effervescent granules made of potassium metabisulfite and potassium bicarbonate. As they dissolve into cider or juice, the granules release a precise dose of SO₂. Inodose Granules come in pre-measured packs.

A pack of Inodose Granules 100, for example, will release 100 grams of pure SO₂. Inodose Granules are perfect for SO₂ additions to incoming juice and to ciders prior to clarification and fining. The potassium bicarbonate fraction in these granules has little or no effect on pH.

**Inodose Tablets**

Effervescent sulfur dioxide tablets

Inodose Tablets are a blend of potassium metabisulfite and potassium bicarbonate. They are packaged in 2 g and 5 g dosage levels. The effervescent action of the bicarbonate provides mixing in barrels or small tanks while reducing time and labor needed for stirring. The easy-to-use tablet form helps prevent overdose problems associated with traditional forms of SO₂ additions. Sealed strip packages keep unused tablets fresh for optimal potency. The potassium bicarbonate fraction in these tablets has little or no effect on pH.

**Inodose Granules + Tablets**

**Usage**

Various applications include:
- During transport of juice.
- To inhibit indigenous yeast and bacteria.
- In tanks before fermentation and directly into barrels after fermentation.
- To make sulfite additions to barrels.

**Storage**

Store in a dry, well ventilated environment at temperatures below 25°C (77°F). Use whole packet quickly once opened, as potency will decrease after opening.

**Conversion Chart**

<table>
<thead>
<tr>
<th>SO₂ Dose</th>
<th>1 L</th>
<th>1 gal</th>
<th>60 gal</th>
<th>100 gal</th>
<th>500 gal</th>
</tr>
</thead>
<tbody>
<tr>
<td>g</td>
<td>g/100</td>
<td>g/60 gal</td>
<td>g/100 gal</td>
<td>g/500 gal</td>
<td></td>
</tr>
<tr>
<td>2 g</td>
<td>0.002</td>
<td>0.017</td>
<td>0.34</td>
<td>0.34</td>
<td></td>
</tr>
<tr>
<td>5 g</td>
<td>0.005</td>
<td>0.083</td>
<td>1.73</td>
<td>1.73</td>
<td></td>
</tr>
<tr>
<td>500 g</td>
<td>5 g/60 gal</td>
<td>5.06</td>
<td>101.3</td>
<td>101.3</td>
<td></td>
</tr>
</tbody>
</table>

Note: The SO₂ products contribute 2 g, 5 g, 100 g or 400 g of pure SO₂ when added to the cider. Because they are blends of KMB and potassium bicarbonate, the tablets and granules actually weigh more than what they contribute in SO₂.

**Bactiless**

Acetic acid and lactic acid bacteria control

Bactiless™ is a 100% natural, non-allergenic source made of potassium metabisulfite and potassium bicarbonate. As they dissolve into cider or juice, the granules release a precise dose of SO₂ cells/mL.

- During transport of juice.
- To inhibit indigenous yeast and bacteria.
- In tanks before fermentation and directly into barrels after fermentation.
- To make sulfite additions to barrels.

**Storage**

Store in a dry, well ventilated environment at temperatures below 25°C (77°F). Use whole packet quickly once opened, as potency will decrease after opening.

**Usage**

- Suspend Bactiless in 5–10 times its weight in cool water or cider (Bactiless is insoluble, so it will not go into solution). Bactiless should be mixed to obtain a homogenous addition. Leave Bactiless in contact with the cider for 10 days and then conduct a clean raking.
- Bactiless Enhances its effectiveness, a period of 20–30 days post-raking should be respected before microbial analysis. This is regardless of method used: traditional plating, microscopic observations or RT-PCR.

**Dosage**

*No Brett Inside* should be added post-ML.

**Moldex**

Chitosan that was introduced by Lallemand and is distributed exclusively in the North American market by Scott Laboratories.

**No Brett Inside** is a commercial preparation of chitosan.

**Chitosan** is a polyelectrolyte composed of repeating disaccharide units of N-acetyl glucosamine and glucosamine that is produced by fungal chitinases.

**Storage**

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

**Bactiless Efficacy Trials as conducted by ETS Laboratories, St. Helena, California.**

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Control</th>
<th>Bactiless 20 g/L</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetic acid bacteria</td>
<td>200,000</td>
<td>100,000</td>
</tr>
<tr>
<td>Lactobacillus brevis group</td>
<td>30,000</td>
<td>1,000</td>
</tr>
<tr>
<td>Lactobacillus plantarum group</td>
<td>9,000</td>
<td>3,000</td>
</tr>
<tr>
<td>Lactobacillus hansenii</td>
<td>1,000</td>
<td>0.34</td>
</tr>
<tr>
<td>Dermatococcus</td>
<td>1,000</td>
<td>0.34</td>
</tr>
<tr>
<td>Pediococcus sp.</td>
<td>1,000</td>
<td>0.34</td>
</tr>
</tbody>
</table>

**Recommended dosage**

200–500 ppm. 1.6–4.16 lb/1000 gal 45–113 g/60 gallon barrel

**Usage**

- Suspend Bactiless in 5–10 times its weight in cool water or cider (Bactiless is insoluble, so it will not go into solution). Bactiless should be mixed to obtain a homogenous addition. Leave Bactiless in contact with the cider for 10 days and then conduct a clean raking.
- To determine the effectiveness, a period of 20–30 days post-raking should be respected before microbial analysis.
- This is regardless of method used: traditional plating, microscopic observations or RT-PCR.

**Storage**

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

**No Brett Inside** is a commercial preparation of chitosan.

**Chitosan** is a polyelectrolyte composed of repeating disaccharide units of N-acetyl glucosamine and glucosamine that is produced by fungal chitinases.

**Storage**

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

To help prevent refermentation in finished ciders.

Ciders containing residual sugar are susceptible to fermentation in the bottle or keg, which can lead to haze, off-odors, off-flavors and effervescence. Adding Velcorin to cider during bottling or kegging can help prevent refermentation. Also, Velcorin can be used to replace or decrease the amount of sorbate which is sometimes used in ciders containing residual sugar.

To control spoilage yeast such as *Brettanomyces*. *Brettanomyces* is a spoilage yeast that can produce 4-ethylphenol and other undesirable sensory attributes. *Brettanomyces* can be difficult to control in cider production environments. In this application, Velcorin can be used either in the cellar or at the time of bottling.

To decrease the amount of sulfur dioxide used in ciders.

Sulfur dioxide used in combination with Velcorin has been shown to achieve microbial stability at lower overall sulfur dioxide levels. Velcorin does not provide anti-oxidant protection.

To accommodate for a wider range of packaging options and provide energy savings over pasteurization.

Packaging options are more diverse because the product, Velcorin (DMDC), is used with cold filling technology. Velcorin (DMDC) can be used with all known packaging types, including plastics (such as PET, PVC or HDPE), cans, glass, bag-in-box, and others.

**Velcorin**

**Yeast inhibitor; microbial control agent**

Conditions of Use

Velcorin must be used with an approved dosing system. Scott Laboratories will only sell Velcorin to those using a LANXESS approved dosing machine. Velcorin is a chemical and must be handled with respect. Therefore, all Velcorin handlers must undergo annual safety training (provided at no charge by Scott Laboratories, Inc.). The current cost of a Velcorin dosing machine starts at approximately $74,000.

For more information on Velcorin and dosing machines, please contact Scott Laboratories, Inc.
A clean cellar is one of the basic keys to producing and maintaining quality cider. AIRD products achieve hygiene goals while saving time, water and energy.

**CHOOSING THE RIGHT CLEANING AGENT**

- **Destainex**
  - Multi-purpose oxidizing cleaner for organic soils and molds.
  - Oak surfaces, tanks, lines, equipment.
  - Recommended dosage: 0.5–1.5% w/v.
  - Water temperature for use: 40–60°C (104–140°F).
  - pH (1% solution) ~10.5–10.9.
  - Recommended usage:
    - Barrel cleaning: 0.5–2% w/v.
    - Stainless steel, galvanized metals, concrete, polyethylene (low and high density), polypropylene, plastics, flexible hoses, glass and powder-coated surfaces.
  - Enhances antimicrobial activity.
  - General purpose cleaning.

- **Oak Restorer**
  - Hot water
  - Recommended dosage: 0.5–2.0% w/v.
  - Water temperature for use: 40–60°C (104–140°F).
  - pH (1% solution) ~10.65.
  - Recommended usage:
    - Bottling systems and difficult to rinse systems.
    - Cider contact surfaces such as: stainless steel, galvanized metals, concrete, polyethylene (low and high density), polypropylene, plastics, flexible hoses, glass and powder-coated surfaces.
  - Leaves your wooden surfaces refreshed, odorless and pH neutral.

**WATER SAVINGS WITH AIRD PRODUCTS**

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

- **Classic Method**
  - Water Used: 10 gallons.
  - AIRD Process: 5 gallons.
  - Water Saved: 5 gallons.

- **Oak Restorer**
  - Water Used: 100 gallons.
  - AIRD Product: 200 gallons.
  - Total: 300 gallons.

- **Destainex**
  - Water Used: 200 gallons.
  - AIRD Product: 200 gallons.
  - Total: 400 gallons.

- **Rinse**
  - Water Used: 100 gallons.
  - AIRD Product: 100 gallons.
  - Total: 200 gallons.

---

*Not including potential reuse of AIRD solutions. Actual water savings may be greater.

**DOCUMENTATION + SAFETY CONSIDERATIONS**

- It is essential to maintain records and incorporate cleaning and sanitation protocols into every stage of your quality assurance program. In addition, all products used in this sanitation program must be approved for use, including the concentration that you intend to use them at. Do not dispose of unlabelled containers and do not deviate from the prescribed use. Personal Protective Equipment (PPE) should be used at all times. For details on PPE, please refer to the Material Safety Data Sheet (MSDS).

**BENEFITS OF AIRD PRODUCTS**

- Specially formulated for the beverage industries.
- Significant water savings since no citric rinse is required.
- Innovative MULTI FORMULA for more effective cleaning.
- Effective at low doses over wide temperature ranges.
- Non-dusting product.
- No chlorine, other halogens, phosphates, silicates or fillers.
- Does not require hazardous shipping.
- Safer and less environmental impact than bulk chemical cleaners.
The goal of stability is to retain clarity and aromatics in the finished cider. We can separate stability into three distinct areas:

- microbiological stability
- chemical stability
- macromolecular stability

Assessing stability can sometimes be challenging. Thankfully, there are many tools available to help determine and alleviate risk.

**BASICS**

In order to obtain microbiological stability, we need to reduce the potential for microbial contamination, microbial growth, and the production of microbial metabolites (e.g., 4-ethylphenols). Microbial stability can be achieved by either physical or chemical means. For microbial stability options, please review our Microbial Control, Cleaning, and Filtration sections.

Macromolecular (or physical) instabilities can be problematic and unsightly. This type of instability is the result of interactions between proteins, polysaccharides, and polyphenolics, and can lead to hazes in the final cider.

Chemical instabilities can be caused by metal ions, or polyphenolic precipitation. Until recently, we have had limited tools to deal with such issues. There has, however, been much research done leading to recent developments with regard to stability products. We are pleased to now offer a range of options to assist with polyphenolic precipitation.

**CHOOSING THE RIGHT STABILIZING AGENT**

<table>
<thead>
<tr>
<th>Gum Arabic</th>
<th>Gum Arabic/Mannoprotein Blends</th>
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<tbody>
<tr>
<td>Promote stability</td>
<td>Highly Recommended</td>
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<tr>
<td>Diminish bitterness</td>
<td>Highly Recommended</td>
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<tr>
<td>Diminish browns and turbidity</td>
<td>Recommended</td>
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<tr>
<td>Add perception of sweetness and softness</td>
<td>Recommended</td>
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<tr>
<td>Colloidal stability</td>
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<tr>
<td>Aromatic stability</td>
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**STABILITY**
Flashgum R Liquide
Gum arabic for colloidal protection
Flashgum R Liquide is a 25% gum arabic derived from Acacia seyal. This preparation offers both colloidal protection and the perception of sweet and soft characters on the palate. Gum arabic products can help reduce the risk of colloidal deposits in the bottle. Flashgum R Liquide can provide color protection in fruit ciders.

Recommended Dosage
400-1200 ppm  40-120 mL/L  1.5-4.5 L/1000 gal*

*Bench trials recommended

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

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

Inogum 300
Gum arabic for colloidal stabilization
Inogum 300 is a clear, 25% solution of purified liquid gum arabic derived from Acacia verek. Gum arabic products help reduce the risk of colloidal deposits collecting in the bottle. Its colloidal protection helps prevent precipitation of unstable color while preserving flavor and structure.

Recommended Dosage
400-700 ppm  40-70 mL/L  1.5-2.65 L/1000 gal*

*Bench trials recommended

Usage
Inogum 300 should be the last commercial product added to a cider. Ideally it should be added to cider using a dosing pump. If the cider is to be filtered it is recommended that the additions be done 24-72 hours prior to the membrane filtration and that filterability trials be conducted. If the cider is not to be filtered Inogum 300 may be used immediately prior to bottling.

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

UltiMA Fresh
Mannoprotein/gum arabic with positive impact on stability and perceived volume
UltiMA Fresh is the result of a three year research and development program at the IOC. UltiMA Fresh is a proprietary blend of specific mannoproteins together with gum arabics. It has been shown to have a volume enhancing effect on ciders, while also reducing perceptions of bitterness and acidity. Bench trials are highly recommended and allow the cidermaker to fine tune use of UltiMA Fresh for optimal results. It is a fully solu-ble product. If the cider is not to be filtered, it may be used immediately prior to bottling. Gum arabic and mannoproteins both have some stabilizing effects on cider, though the addition of this product is not a replacement for good cidermaking practice and thorough analysis.

#17010  1 kg  $132.45

UltiMA Soft
Mannoprotein/gum arabic with positive impact on stability and perceived softness and volume
UltiMA Soft is a result of a three year research and development program at the IOC. On ciders it can soften, enhance body, add to length, and lower astringency. If the cider is not to be filtered, this fully solu-ble product can be added immediately prior to bott-ling. Bench trials are recommended. Gum arabic and mannoproteins both have some stabilizing effects on cider, though the addition of this product is not a replacement for good cidermaking practice and thorough analysis.

#17012  1 kg  $132.45

UltiMA Fresh + UltiMA Soft
Recommended Dosage
15-30 g/L  (1.2-2.4 lbs/1000 gal)*

*Bench trials recommended

Usage
UltiMA Fresh or UltiMA Soft can be the last commercial product added to the cider. Before adding, dissolve product in 10 times its weight in water or cider (ideally, it should be added to the cider using a dosing pump. If the cider is to be filtered, it is recommended that the addition be done 24-72 hours before the membrane filtration and that filterability trials be conducted prior to that.

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

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

CLARIFICATION + IMPROVE FILTERABILITY

Fining to clarify and improve filterability may involve the use of reactive components and/or settling agents to eliminate undesirable substances. Fining can also be used to complement and potentially reduce the need for mechanical clarification by centrifugation or filtration.

IMPROVEMENT OF AROMA AND FLAVORS

Fining to improve aroma and flavors may involve issues like removing bitterness, reducing perceived oxidation and eliminating “moldy” or sulfur off-flavors.

Notes

Always prepare fining agents in water (not cider or diluted cider).

Addition by pumping using the Venturi effect is a very efficient way of dispersal. A Mazzei injector is a particularly effective tool for this purpose. Closed circulation after addition is also beneficial. Consult the manufacturer’s recommendations prior to use.

Though most fining agents react rapidly when contact is made, varying tank sizes and addition methods mean that it is always prudent to give products time to work. Recommended minimum and maximum contact times for some of the most common fining products are shown on the right.

OVERVIEW

Fining agents can be used on juice or cider to deal with a variety of issues. These include enhancement of stability and clarity, improved filterability and removal of undesirable characters and components. Fining can also unmask hidden flavors and aromas and reduce the risk of microbial spoilage. Some fining agents are single function while others can perform multiple tasks. Sometimes a combination of products is required to resolve a single problem.

Bench trials are always recommended prior to product use. Samples of fining agents for bench trials are available on request. Dosage for all fining agents, regardless of intended purpose, should be determined by such trials. Protocols should be carefully observed for bench trials and cellar additions should be prepared and used the same way.

Visit our website at www.scottlab.com for specific product bench trial data sheets.

Table

<table>
<thead>
<tr>
<th>Product</th>
<th>Contact Time</th>
<th>Notes</th>
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<tbody>
<tr>
<td>Bentolact S</td>
<td>1 week</td>
<td>Highly Recommended</td>
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<tr>
<td>Bentostab</td>
<td>1 week</td>
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<tr>
<td>Caséinate de potassium</td>
<td>2 days</td>
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<td>Colle Perle</td>
<td>1 week</td>
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<td>Inocolle</td>
<td>2 weeks</td>
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<tr>
<td>Sparkolloid, Hot and Cold Mix</td>
<td>2–7 days</td>
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<tr>
<td>Gelocolle</td>
<td>10 days</td>
<td>Highly Recommended</td>
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<tr>
<td>Polyacel</td>
<td>7 days</td>
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<td>Polyxate</td>
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<tr>
<td>Redless</td>
<td>4 days</td>
<td>Highly Recommended</td>
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<tr>
<td>Sparkollad, Hot and Cold Mix</td>
<td>7–10 days</td>
<td>Highly Recommended</td>
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* A larger vessel requires a longer contact time. Above times are estimates only. Contact times may vary depending upon the product, as well as the size and shape of container being used.

CHOOSING THE RIGHT FINING AGENT

FINING AGENTS

| Casein and/or Bentonite Formulations | Gelatin | PVPP | Spirulina | Degel | Racidol |Natural
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<td>* Hot Mix is for cider only.</td>
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Bentolact S @NC
Formulated for the preventative treatment of juice prone to oxidation; helps prevent formation of undesirable off-flavors.
Bentolact S is a proprietary IOC blend of soluble calcium and bentonite. It is most effective when used early (e.g., during cold settling of juice). Bentolact S can help reduce bitterness associated with heavy press fractions. The negative charge of bentonite attracts and precipitates positively charged colloidal and proteinaceous materials which can contribute to off-flavors and haze. At the same time the casein will help remove phenolic compounds associated with bitterness and oxidation. Higher dosages may be used for poor quality juice. Bentolact S is supplied in dry form which is soluble in water. For best results, it should be mixed in the juice or cider during a tank mixing.

**Recommended Dosage**
- Juice: 30–100 g/hL (2.5–8.4 lb/1000 gal)
- Cider: 100–2000 ppm (100–200 g/L)

**Usage**
- Stir slowly until all of the translucent globules of clarifier have been dissolved and the mixture is smooth and creamy. Add to the tank. Juice generally separates and forms a clear supernatant within 48 hours. Once mixed and chilled (if the juice has been heated), juice should be left undisturbed without further mixing if natural settling is going to be the only separation method.
- Storage: Dated expiration. Store in a dry, odor-free environment below 25°C (77°F).

#15787 1 kg $25.65
#15788 5 kg $126.45
#15789 25 kg $579.65

**Bentostab @NC**
Deproteinizing bentonite for cider clarification.
Bentostab is a bentonite for clarification and protein precipitation. Montmorillonite particles allow for good colloidal adsorption.

**Recommended Dosage**
- Juice: 0.83–5.8 lb/1000 gal
- Cider: 10–70 g/L

**Usage**
- Dissolve Bentostab in approximately 20 times its volume of cold water and mix vigorously to avoid any lumps. Allow the mixture to stand for 3 hours. Add to the juice or cider during a good mixing. Depending upon the color, a Bentostab addition may take up to 7 days to settle.
- Storage: Dated expiration. Store in a dry, well-ventilated environment at a temperature between 5–20°C (41–68°F). Once hydrated, Bentostab should not be stored for more than 24 hours.

#15766 5 kg $26.10

**Caséinate de potassium @NC**
To help prevent oxidation and for the removal of oxidized compounds.
Caséinate de potassium is used in both juice and cider for the treatment of oxidized phenolics and bitter compounds. In juice it can be used preventative, while in cider it can diminish and remove off-compounds. Further, Caséinate de potassium can help remove yellow color from oxidized ciders.

**Recommended Dosage**
- Juice: 4.2–8.4 lb/1000 gal
- Cider: 1.7–8.4 lb/1000 gal

**Usage**
- Mix the Caséinate de potassium solution before settling or at the start of alcoholic fermentation. For cider, add the Caséinate de potassium solution gradually during a tank mixing or via fining connection. Mix slowly during a tank mixing or via fining connection. Mix 1-2 gallons of water per pound of Cold Mix Sparkolloid NF into the water. Agitate the blend with a high-speed mixer until all of the translucent globules of clarifier have been dissolved and the mixture is smooth and creamy. Add the mixture slowly to the juice and thoroughly combine. Let it settle one week or more, depending on the volume of juice involved. Afterwards, filter preferably from the top of the tank. Juice generally separates and forms a clear supernatant within 48 hours. Once mixed and chilled (if the juice has been heated), juice should be left undisturbed without further mixing if natural settling is going to be the only separation method.
- Storage: Dated expiration. Store in a dry, odor-free environment below 25°C (77°F). Once hydrated, Caséinate de potassium will not keep for more than 48 hours.

#15807 1 kg $46.95
#15808 5 kg $205.95

**Cold Mix Sparkolloid NF @NC**
For superior clarification of juice.
Cold Mix Sparkolloid NF was developed by Scott Laboratories to clarify and free juice. It is a blend of polyacrylamides with a carrier and has a strong positive charge. This positive charge neutralizes the repelling charge of particulate matter, allowing agglomeration and formation of compact juice lees. Cold Mix Sparkolloid NF does not remove desirable color constituents and works well with proteinaceous enzymes.

**Recommended Dosage**
- Juice: 125–250 ppm
- Cider: 10–20 lb/1000 gal

**Usage**
- Mix 1-2 gallons of water per pound of Cold Mix Sparkolloid NF into the water. Agitate the blend with a high-speed mixer until all of the translucent globules of clarifier have been dissolved and the mixture is smooth and creamy. Add the mixture slowly to the juice and thoroughly combine. Let it settle one week or more, depending on the volume of juice involved. Afterwards, filter preferably from the top of the tank. Juice generally separates and forms a clear supernatant within 48 hours. Once mixed and chilled (if the juice has been heated), juice should be left undisturbed without further mixing if natural settling is going to be the only separation method.

#15034 25 L $193.75

**Colle Perle @NC**
Gelatin for treatment of astringent ciders.
Colle Perle is a hydrophilic gelatin solution at a concentration of 150 g/L. Primary uses are clarification and the removal of bitter tannins and phenolics. Colle Perle flocculates and settles well. Desirable aromas and flavors are retained while harsh characters are removed. It is particularly useful to optimize potential of hard pressed product. It can also be used in conjunction with bentonite to compact lees.

**Recommended Dosage**
- Juice: 800–1500 ppm
- Cider: 10–20 lb/1000 gal

**Usage**
- Add gradually to the cider during a tank mixing or via fining connection. Mix slowly during a tank mixing or via fining connection. Mix the Caséinate de potassium solution before settling or at the start of alcoholic fermentation. For cider, add the Caséinate de potassium solution gradually during a tank mixing or via fining connection. Mix slowly during a tank mixing or via fining connection. Mix 1-2 gallons of water per pound of Cold Mix Sparkolloid NF into the water. Agitate the blend with a high-speed mixer until all of the translucent globules of clarifier have been dissolved and the mixture is smooth and creamy. Add the mixture slowly to the juice and thoroughly combine. Let it settle one week or more, depending on the volume of juice involved. Afterwards, filter preferably from the top of the tank. Juice generally separates and forms a clear supernatant within 48 hours. Once mixed and chilled (if the juice has been heated), juice should be left undisturbed without further mixing if natural settling is going to be the only separation method.

#15770 100 g $15.95
#15771 1 kg $140.60

**Cristalline Plus @NC**
Isinglass clarification treatment.
Cristalline Plus is a blend of isinglass and citric acid stabilized with potassium metabisulfite. It has a high positive charge and can improve clarity and fermentability even in very difficult ciders. Cristalline Plus is not sensitive to cold temperatures and may be slow to complete settling.

**Recommended Dosage**
- Juice: 3–10 ppm
- Cider: 0.1–0.25 lb/1000 gal

**Usage**
- Mix 1–2 gallons of water per pound of Cold Mix Sparkolloid NF. Slowly stir the Cold Mix Sparkolloid NF into the water. Agitate the blend with a high-speed mixer until all of the translucent globules of clarifier have been dissolved and the mixture is smooth and creamy. Add the mixture slowly to the juice and thoroughly combine. Let it settle one week or more, depending on the volume of juice involved. Afterwards, filter preferably from the top of the tank. Juice generally separates and forms a clear supernatant within 48 hours. Once mixed and chilled (if the juice has been heated), juice should be left undisturbed without further mixing if natural settling is going to be the only separation method.

#15788 1 kg $25.65
#15789 25 kg $579.65

**Recommended Dosage**
- Juice: 800–1500 ppm
- Cider: 10–20 lb/1000 gal

**Usage**
- Add gradually to the cider during a tank mixing or via fining connection. Mix slowly during a tank mixing or via fining connection. Mix 1-2 gallons of water per pound of Cold Mix Sparkolloid NF into the water. Agitate the blend with a high-speed mixer until all of the translucent globules of clarifier have been dissolved and the mixture is smooth and creamy. Add the mixture slowly to the juice and thoroughly combine. Let it settle one week or more, depending on the volume of juice involved. Afterwards, filter preferably from the top of the tank. Juice generally separates and forms a clear supernatant within 48 hours. Once mixed and chilled (if the juice has been heated), juice should be left undisturbed without further mixing if natural settling is going to be the only separation method.

#15799 1 L $21.50
#15799 5 L $72.95
#15800 20 L $277.70

**Note:** Maximum clarification is achieved after one week. This is when filtration is most productive. It is not recommended to leave gelatin in cider for more than 30 days.

#15798 1 kg $25.65
#15799 5 kg $126.45
#15799 25 kg $579.65

#15787 1 kg $25.65
#15788 5 kg $126.45
#15789 25 kg $579.65

**Recommended Dosage**
- Juice: 125–250 ppm
- Cider: 10–20 lb/1000 gal

**Usage**
- Add at the beginning of cold settling and mix evenly and completely throughout the juice. When used in juice Colle Perle should be used in conjunction with bentonite or Gelocolle to improve settling. Racking should be done after 1 week.

**Cider in Tanks**
- Add gradually to the cider during a tank mixing or mix rigorously to ensure even distribution. Alternatively add through a racking valve while using a tank agitator for even distribution. Racking should be done after 1 week. Filtration is possible 48-72 hours after racking with Colle Perle.

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

#15770 100 g $15.95
#15771 1 kg $140.60

**Note:** Maximum clarification is achieved after one week. This is when filtration is most productive. It is not recommended to leave gelatin in cider for more than 30 days.

**Storage**
- Dated expiration. Store in a dry, well-ventilated environment below 25°C (77°F).

#15787 1 kg $25.65
#15788 5 kg $126.45
#15789 25 kg $579.65
**Freshprotect**

PVPP blend for treatment of oxygen sensitive juice and cider.

**Polycel**

Polycel is a proprietary IOC blend of polyvinyl-poly-pyrrolidone (PVPP) and bentonite. It is specifically formulated to help minimize problems associated with the oxidation of polyphenols including color, bitterness and herbaceousness in oxygen sensitive juice. These characteristics are significantly mitigated with the use of Freshprotect. PVPP is intended as a preserving aid. Colors made with it must be racked or filtered afterwards. Freshprotect has also been known to help correct sensory off-aromas.

**Recommended Dosages**

- Juice
  - 200-1000 ppm
  - 200-1000 mL/L
  - 1.7-8.3 lb/1000 gal
  - *Bench trials recommended*

**Hot Mix Sparkolloid NF**

For superior clarification of cider

**Recommended Dosages**

- Juice
  - 125-500 ppm
  - 12-48 mL/L
  - 1.0-4.0 lb/1000 gal
  - *Bench trials recommended*

**Gelocolle**

Suitable for improved settling

Gelocolle is an aqueous solution of suspended cellulose commonly used in conjunction with gelatins, ungels and other organic fining agents. It helps compact lees and reduces the risk of flotation. It is also useful for hard-to-filter ciders where it helps chelate proteins and other compounds.

**Recommended Dosage**

- 200-1000 ppm
- 200-1000 mL/L
- 0.75-3.8 L/1000 gal
- *Bench trials recommended*

**Inocelle**

Gelatine to enhance the bouquet of finished ciders or for the treatment of modest browning

**Recommended Dosages**

- Ciders
  - 300-600 ppm
  - 30-60 mL/L
  - 11-22 L/1000 gal
  - *Bench trials recommended*

**Polyacel**

PVPP and casein for treatment of oxidized juice or cider

**Recommended Dosages**

- Ciders
  - 150-300 ppm
  - 15-30 mL/L
  - 1.25-2.5 lb/1000 gal
  - *Bench trials recommended*

**Polyceol**

PVPP for treatment of browning

**Recommended Dosages**

- For Oxidized Juice
  - 500-800 ppm
  - 50-80 mL/L
  - 1.75-3.8 L/1000 gal
  - *Bench trials recommended*

**Reduless**

Reduces sulfur off aromas

Reduces is a proprietary fining product from Lallemand for the reduction of sulfur off aromas such as H2S and dimethyl sulfide. Its formulation includes bentonite together with other natural elements which are rich in copper. Reduless can naturally enhance roundness while treating sulfur problems. It has also been shown to reduce phenol related defects.

**Recommended Dosage**

- Juice
  - 100-150 ppm
  - 10-15 mL/L
  - 0.8-1.2 lb/1000 gal

**Usage**

Mix Reduless into 10 times its weight in water (do not mix in juice or cider). Allow to soak for 1 hour. Then add the mixture into the tank slowly, making sure the solution is thoroughly blended into the juice. It is intended as a processing aid. Ciders made with it must be racked or filtered afterwards. 

- *Bench trials recommended*

**Storage**

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

- #15790: 1 kg $34.40
- #15791: 5 kg $165.60
- #15792: 20 kg $478.55

**Recommended Dosage**

- Juice
  - 125-500 ppm
  - 12-48 mL/L
  - 1.0-4.0 lb/1000 gal
  - *Bench trials recommended*

**Recommended Dosages**

- Juice
  - 150-300 ppm
  - 15-30 mL/L
  - 1.25-2.5 lb/1000 gal
  - *Bench trials recommended*

**Recommended Dosage**

- Juice
  - 300-500 ppm
  - 30-50 mL/L
  - 2.5-6.2 lb/1000 gal
  - *Bench trials recommended*

**Recommended Dosages**

- Juice
  - 500-800 ppm
  - 50-80 mL/L
  - 1.75-3.8 L/1000 gal
  - *Bench trials recommended*

**Recommended Dosages**

**Tea**

Recommended Dosage

- 500 ppm
  - 50 mL/L
  - 1.75 L/1000 gal

**Recommended Dosages**

- Juice
  - 150-300 ppm
  - 15-30 mL/L
  - 1.25-2.5 lb/1000 gal
  - *Bench trials recommended*

**Recommended Dosages**

- Juice
  - 500-800 ppm
  - 50-80 mL/L
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  - 1.25-2.5 lb/1000 gal
  - *Bench trials recommended*
Custom Cages
- Unlimited disc color options
- Lithograph printed per customer artwork
- 14 wire color choices
- Minimum order 10,000
- Lead time is 12–14 weeks
- NEW! Laser disc printing is available (for orders less than 10,000 pieces)
- Lead time is 3–4 weeks

Micro-Agglo Corks
- Suitable for most cork and cage finish bottles
- 25.5 mm x 44 mm
- Minimum order is 1000
- Lead time is 3 days

Custom Corks
- Relvas champagne style corks
- Sized per customer specification
- Side & end fire branding available at no charge
- Minimum order 10,000
- Lead time is 12–14 weeks
- NEW! Laser branding is available (for orders less than 10,000 pieces)
- Lead time is 2 weeks

Stock Cages
- 38CL for cider and beer; gold disc silver wire, finished disc size 26.5 mm
- 38CL for cider and beer; black disc black wire, finished disc size 26.5 mm
- Packed 2,700 per box
- Minimum order is one box
- For additional color options see “Custom Cages” below
- Lead time is 3 days

CORKS & PACKAGING

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- 25.5 mm x 44 mm
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INJECTING DEVICES

Mazzei Injector
A highly efficient, low-cost device for energizing fermentations by automatically injecting air (thus oxygen) during pump-over. Engineered by the world’s leading manufacturer of high-performance venturi-type injectors that transfer or mix liquid or gas additives into solutions.

Made from cast stainless steel, the model SS-2081 has 2” triclamp connections and a 1½” suction connection. Cider pumped through the injector creates a vacuum after the throat of the device, in turn creating suction through the lateral port. A simple valve can be added to the suction port to allow throttling of the suction.

Features and Benefits
- No moving parts.
- Not an electrical device.
- Internal vanes are cast into the injector and angled to intensify the mixing of the air with the cider.
- Fining agents and other additives can be introduced at the suction port. With the addition of a ball valve and hose, the operator can control the rate at which the liquid is drawn from a convenient vessel.
- No need for air hoses, automated systems, or dangerous and expensive oxygen tanks.
- Can be used during racking or mixing.
- Easy to clean.
Scott Plate Filters

Scott plate filters are designed specifically for North American needs. Efficiency, economy and sanitary construction are paramount. Plate filters can be used for clarification and microbe-reducing filtrations. Available in both a 40x40 and 60x60 cm with chassis sizes ranging from a 20 plate capacity up to a 200 plate capacity. Sanitary features include DIN connector fittings, diaphragm gauges and sanitary valves.

Velo Acciai Lees-Stop Filter

This crossflow filter specifically designed for the treatment of tank bottom lees is equipped with stainless steel membranes which 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 pressures 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.

Cider & Lees Filter

Velo Acciai Unico Filter

The all-in-one filtering solution for small and medium producers. The Unico filter is designed for small medium manufacturers needing to filter their products (wines, ciders, meads and lees) with a "single" solution, obtaining a filtered product of excellent quality with a turbidity below 1NTU. The Unico filter from Velo Acciai delivers a single pass solution utilizing organic membranes to filter product from the tank and sintered stainless steel membrane material to filter the tank bottom lees of the same tank. A finished product from both settled cider and lees filtration is brilliant, bright and filtered to 0.2µm.

Scott Cartridge Filter Housings

Scott Laboratories sanitary cartridge filter housings are made of electropolished 316L stainless steel, which ensures strength, corrosion resistance, improved cleanliness and excellent chemical compatibility. Housings can be loaded with as few as one module, and modules can be backflushed and reused multiple times if using Pall SupraDisc II modules.

Willmes SIGMA

Due to the combination of patented double-membrane technology with vertical Flexidrain® juice channels and the Parkett-Flow mesh, the SIGMA offers a unique press system that yields results of the highest quality and efficiency. Advantages include shorter pressing times, larger filling quantities, lower mechanical loads on the material to be pressed, and significantly higher premium-quality juice yields. The SIGMA can be hermetically sealed allowing for treatment options such as maceration, micro-oxygenation, or inert gas. Pressing is done in the filling position, allowing the optimal filling volume to be achieved without any rotation of the drum, and a series of intelligent pressing programs specific to apples are pre-programmed. The SIGMA series is available in sizes from 3,000L–34,000L.
One of the most important problematic colloids in cider is pectin. There is so much pectin in cider that just adding a good pectinase on your fruit or juice, for clarification pre-fermentation, to improve pressability. Yes, you guessed it. Pectin loves to come out of solution at about the time when you are considering filtration. Pectin can wreak havoc on even the coarsest filter media so having a relatively clear cider with a low turbidity isn’t a guarantee that you won’t gum those filters up instantly.

Not only will a good filterability enzyme like Seitz® K Series SuperDisc II regrouping into long chains. Turbidity analysis can be measured at a lab or with your own nephelometer, which is available in handheld and bigger benchtop models. The measurement that turbidity is taken in, NTU, stands for Nephelometric Turbidity Units. Some cider producers, who just want a polish and to their packaging. These type of products are either 72 73

### ScottCart PreMembrane PP

Depth filter cartridge

Maximum production efficiency

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

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

### ScottCart Membrane PES

Final filter cartridge (membrane)

Maximum security

The ScottCart Membrane PES filter cartridges are pleated membrane filter cartridges with a single layer asymmetrical polyethersulfone membrane inside. The Membrane PES has been especially designed for the filtration of cider, wine, and sparkling wine, prior to bottling. The ScottCart Membrane PES comes in 0.45 and 0.65 micron porosities with the highest retention ratings and total throughput.

### ScottPad Depth Filter Sheets

Scott series depth filter sheets were developed to meet the entire range of removal requirements in the beverage industry. From the selection and quality control of raw materials to application of the latest production technologies, the Scott® filter sheets meet the highest quality standards. Scott sheets are available in multiple grades suitable for microbial reduction and applications requiring fine, clarifying and coarse filtration.

Filter pads are one of the most popular options for cidermakers, brewers and distillers to filter their products. Pads are easy to use and offer repeatable and reliable filtration ranging from tough to-polish to pre-bottling. Filter pads are available from Scott Laboratories in various grades and dimensions. Most modern sheet filter units accommodate 40x40 cm or 60x60 cm pads. Scott Laboratories stocks significant inventory of all these sizes in grades ranging from 0.2 μm–55 μm.

### Seitz® K Series SupraDisc II

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

### ARTICLE

**FILTER GRADE SELECTION BY MEASURING TURBIDITY**

Maria Peterson

Filtration Specialist, Scott Laboratories

Choosing a nominal depth filter media like filter sheets or tertiary modules to start your filtration, and probing the subsequent step-down grades, can be challenging. One way to choose the proper grade is by taking meticulous notes during every filtration. This will help improve your instance and anecdotal experience.

With time and experience—you might be drawn to certain grades, for example a K700 to a K200 to an EK. Another popular step-down is a K800 to a K250 to a KS50. If you choose to have more than three passes, a K900 to a K300 to a K100 and then the EK is a also a well-known path. Whenever possible, avoid skipping more than three grades per pass. For example, going from a K900 to a K200 or a K700 to a K300 is too big a jump and throughput on the tighter grade will be less than optimal.

It’s important to keep in mind that using your trusted sequence every time might not be the right fit for every product, or even the same product over different vintages or batches.

Other tips:

- A good pre-clarification program that is not limited to multiple rackings, using a smart fining program (which doesn’t have to change your product, only clarify it) or just plain old time and gravity, can all help to minimize the passes through filter media. This is also applicable to other filtration media like crossflow.

The more scientific approach in choosing a porosity is to measure the turbidity of the product to get an idea what the percentage of suspended solids are, and then use the guide below to choose the proper grade. Starting too light may strip your product of color, mouthfeel and flavor. In addition, throughput would be less than stellar. Starting too coarse could result in very little change in turbidity and wasteful passes in filtration when fewer couldn’t done the job.

Although turbidity is a good indicator of clarity, it doesn’t provide much information about the types of colloids you are dealing with. It also is not the silver bullet to guaranteeing that you will not plug the filter grade you chose.

Colloids make up and contribute to most of the things we love in our cider like color, flavor, mouthfeel and weight but they can sometimes be problematic.

One of the most important problematic colloids in cider is pectin. There is so much pectin in cider that just adding a good pectinase on your fruit or juice, for clarification pre-fermentation, to improve pressability and to extract more free-run juice from your fruit, is not enough to keep the pectin from coming out of solution later.

Yes, you guessed it. Pectin loves to come out of solution in the presence of alcohol and at low temperatures at about the time when you are considering filtration. Pectin can wreak havoc on even the coarsest filter media so having a relatively clear cider with a low turbidity isn’t a guarantee that you won’t gum those filters up instantly.

If you are planning on following your depth filter media up by an absolute membrane cartridge filtration, it is best to precede this final filtration with a depth filter of 0.45 or 0.5 micron at the coarsest within 24 hours of going through your membrane cartridges on the bottling line. After 12-24 hours, colloids like to regroup themselves into long chains which can slow down filtration and decrease your throughput.

Not only will a good filterability enzyme like Seitz® Spectrum or Scottzyme KS improve your throughput dramatically, it will prevent you from stripping the color of cider, flavor and mouthfeel during a filtration and it will slow down the colloidal drama of regrouping into long chains. Turbidity analysis can be measured at a lab or with your own nephelometer, which is available in handheld and bigger benchtop models. The measurement that turbidity is taken in, NTU, stands for Nephelometric Turbidity Units.

Some cider producers, who just want a polish and to their packaging. These type of products are either 72 73
**Troubleshooting Cider Filtration**

**Frequently Asked Questions**

**What grade filter media should I use?**

Filtration is primarily used in cidermaking to achieve clarity and microbial stability.

- **Depth filtration** (sheets, lenticular, DE, etc.) can manage large colloidal proteins much more effectively and help prepare the cider for membrane filtration. If not done within this time frame, the colloidal material in the filtrate begins to regroup and can cause surface clogging on your membrane. If you must wait longer than 24 hours, you can alternatively repeat the filtration through the same grade depth filtration media before filtering through the membrane. You may also consider the use of enzymes to mitigate other clogging factors (i.e., pectin and gums).

**Disaster! I just plugged up my filters prematurely with finished hard cider and I stripped so much color! The cider looks like water.**

- **The following porosity ranges can be considered a guideline:**
  - >5 micron = rough
  - 1-5 micron = polish
  - <1 micron = sanitizing

**How cold is your cider? Colloids like to come out of solution at low temperatures.**

- **My cider filtered easily through my EK filters, but when I started bottling the next week, my membrane clogged immediately. Why?**
  - Depth filtration (sheets, lenticular, DE, etc.) can manage large colloidal proteins much more effectively and help prepare the cider for membrane filtration. The assistance of depth filtration is optimally effective if done within a 24-hour window of membrane filtration. If not done within this time frame, the colloidal material in the filtrate begins to regroup and can cause surface clogging on your membrane. If you must wait longer than 24 hours, you can alternatively repeat the filtration through the same grade depth filtration media before filtering through the membrane. You may also consider the use of enzymes to mitigate other clogging factors (i.e., pectin and gums).

**PORTFOLIO**

**Filtration is primarily used in cidermaking to achieve clarity and microbial stability.**
SUPRADISC II FILTER MODULE REGENERATION PROCEDURE

FILTER MODULE BACKFLUSH PROCEDURE

The backflush is a mechanical means used to clean and regenerate filters in order to improve operational economics and minimize production downtime. This type of cleaning cycle is most effective for the removal of hard, non-deformable contaminants that cake well on the fiber surface. Our recommendation is to set the “plugged” (initiate cleaning) differential pressure at half the recommended final change out differential pressure. These cleaning cycles have significant practical and economic value. Experience has shown as much as a five fold increase in filter life.

• To initiate a regeneration, drain or push residual product out of filtration vessel. Backflush the modules for 5–10 minutes with ambient water or until discharge water is clear and free of solids.
• Do not exceed 7 psi (0.5 bar), but do try to get to 5 psi, even if just for a few seconds, for efficiency.
• Now forward flush with ambient water at 2–3 times the product filtration flow rate.
• Gradually increase temperature to 140°F (60°C). Continue at high flow rate (or reduced flow rate if hot water is limited), for 5 minutes.
• Maintain this temperature for 5 minutes by switching off the pump and letting the modules soak. Gradually reduce temperature back to ambient water and resume high speed flow until the temperature is back down.
• When complete, filtration can resume after draining or pushing water.

Note: The regeneration procedure is best done before you reach a differential pressure of 17 psi. If you wait until you reach 20 psi to do a regeneration, the subsequent backflush and forward flow won’t decrease the differential pressure and the module would be plugged permanently.

REGENERATION PROCEDURE (FORWARD FLOW)

A forward flow can provide the most effective means of reducing fouling in the depth of the fiber media. Regeneration should be performed well before terminal dP.

1. Clear housing of product by drain or outlet valve.
2. Commence a forward flow of ambient water and slowly increase the temperature to 120–140°F.
3. Flow of water can be set to equal flow rate of the product.
4. Record pressure.
5. After 5–10 minutes of flow, hold in a soak phase for 10 minutes.
6. Commence forward flow for another 5–10 minutes, then drain.
7. After regeneration, clear housing of water and recommence filtration.

NOTE: ALL PRESSURE SHOULD ALWAYS BE RELEASED THROUGH DRAINS OR VENTS PRIOR TO REMOVING THE VESSEL LID.

CALCULATIONS + CONVERSIONS
### Volume Conversions

| 1 mL | = 0.035 fl oz |
| 1 fl oz | = 30 mL |
| 1 L | = 1000 mL |
| 1 gal | = 3.785 L |
| 1 hL | = 0.001 L |

### Mass Conversions

| 1 kg | = 1000 g |
| 1 g | = 1000 mg |
| 1 lb | = 453.6 g |
| 1 metric ton | = 2205 lb |

### Other Conversions

| 1 L/hL = 1000 g/hL | = 10,000 mg/L |

### Temperature Conversions

| 1°F = (C° x 9/5) + 32 |
| 1°C = (F° – 32) x (5/9) |

### Bench Trial Calculator

We recommend performing bench trials with many of our products including lysozyme, tannins, enzymes and fining agents. The calculator will help determine the amount of any given stock solution to achieve a range of concentrations in various-sized sample bottles.

#### For Powdered Products (Lysovin, Tannins, Fining Agents, etc.)

\[
\text{mg mL solution to add per sample bottle} = \frac{(\text{sample size in mLs}) \times (\text{desired concentration in ppm}) \times (0.0001)}{\text{% concentration (w/v) of stock solution}}
\]

#### For Liquid Products (Scottzymes, Gelatins, etc.)

\[
\text{mg mL solution to add per sample bottle} = \frac{(\text{sample size in mLs}) \times (\text{desired concentration in mLs/1000 gal}) \times (0.000026)}{\text{% concentration (w/v) of stock solution}}
\]

For example:

If you have a 10% stock solution of KS and wish to create a 150 mL/1000 gal dose in a 375 mL sample bottle, you would calculate:

\[
\text{mg mL solution to add per sample bottle} = \frac{(375) \times (150) \times (0.000026)}{10} = 0.146 \text{ mg}
\]

Therefore, you would need to add 0.146 mL of a 10% KS stock solution to a 375 mL bottle to represent a concentration of 150 mL/1000 gal.

### 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 color is a natural product. Circumstances such as fruit quality 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 cider-making practices or ongoing vigilance.

### Please Note

Trade of cider 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 prescription 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 (other than lysozyme products) described in this Handbook are legal for cider made and sold in the United States and Canada. Conditions of trade with other nations and trade blocs are subject to ongoing change beyond the control of Scott Laboratories, Inc., or Scott Laboratories, Ltd. It is the responsibility of users of our products to be informed of current restrictions of other countries or trade blocs to which they wish to export and to use only products and product levels which conform to those restrictions.

### Contact Information

**Scott Laboratories, Inc.**
Petaluma, CA 707 765 6666
www.scottlab.com
info@scottlab.com

**Scott Laboratories Canada**
Pickering, Ontario 905 839 9463
www.scottlabsltd.com
info@scottlabsltd.com

**CONTACT INFORMATION**

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| hL to L | = 0.001 |

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Pepper
Cinnamon
Hops
Blueberry
Sorrel
Birch
Juniper
Rose Hips
Anise Seed
Rosemary
Elderflower
Hibiscus
Lavender
Ginger
Rooibos
Mint
Basil
Turmeric
Fern
ORDER FORM 2018

Please Note
- All pricing for sale within United States is FOB Petaluma.
- For large orders, please call for a price quotation and order early to ensure product availability.
- We accept Visa, Mastercard and American Express.
- Credit application available online at www.scottlab.com.

Return Policy
Return Policy for Fermentation and Filtration Products
We offer credits if products are returned within 15 days of shipment. Please call Scott Laboratories prior to return for authorization. Once we receive your returned items we will issue a credit to your account. Please note that we are not responsible for perishable items that have not been stored properly by the customer. If you are returning items for any reason, the following conditions apply:
- Sealed units must be unopened and undamaged upon return.
- Goods that have been marked or labeled will not be accepted and no credit will be issued.
- Damage claims must be reported within 5 working days of receipt of your order.
- Original packing must be retained for shipping company inspection of shipping damage claims.
- Sorry, but we do not accept returns on malolactic bacteria.
- A 20% restocking fee will be applied to all returns.
- Customer to pay return freight costs.
Note: To avoid problems, all packages should be opened immediately upon receipt and contents should be checked against the packing slip. Scott Laboratories should be informed immediately of any discrepancies.

Submit Orders
Scott Laboratories Inc. (U.S.A.)
Call 707 765 6666
Fax 707 765 6674
Mail P.O. Box 4559, Petaluma, CA 94955-4559
E-Mail fermentation@scottlab.com

Scott Laboratories Ltd. (Canada)
Call 905 839 9463
Fax 905 839 0738
Mail 950 Brock Rd. South, Unit 1, Pickering, Ontario L1W 2A1
E-Mail info@scottlabsltd.com

Online ordering for Scott Labs (USA) will be available by Fall 2018. Please visit our website for updates.

Customer Information

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| Bill to Address | 
| Ship to Address | 

| Telephone Number | E-Mail Address |
| Purchase Order Number | Credit Card Number |
| Expiration Date (mm/yy) | Name on Card |
| Signature | 

Ship Via

- [ ] UPS
- [ ] FedEx
- [ ] 1 Day
- [ ] 2 Day
- [ ] Saver
- [ ] Most Economical

Malolactic bacteria, encapsulated yeast, ionys\textsuperscript{w}, Biodiva and Gaia all have greater temperature sensitivity and will be processed with expedited shipping.

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**Natural Yeast Derivative Nutrients**

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**Fermentation + Cellaring Tannins**

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