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# CIDERMAKING

# HOME CIDERMAKING TECHNIQUES

BY ANNE WHYTE

You might remember a time when a jug of cider that sat around in the fridge too long started to get fizzy. When you removed the cap there was a little spurt of pressure released and, sadly, the cider was deemed too old and sent down the drain. If you only knew then what you know now; that fizzy cider was starting to ferment. With an airlock and a little patience, you might have had your first taste of hard cider.

Fast forward and one of the hottest "new" beverages to create is hard cider. Craft beer has gotten most of the press in the last decade, but lots of homebrewers are looking for the next new thing. Hard cider can be made using the same equipment and brewing techniques as homebrewing and can deliver the same thrill of designing a drink to be exactly what you want. Hard cider is also probably the easiest alcoholic beverage to ferment for people who are gluten intolerant. If you are a homebrewer then you already own all the equipment you need. Basic homebrewing techniques such as sanitizing, siphoning, using a hydrometer, etc. are exactly the same for beer or cider. In this story we will explore how to make sweet cider into hard cider that you'll be proud to share with your friends and family.

## THE CIDER

In Vermont, where I live, we are lucky to have many small orchards that press cider from early September into November. The best ciders are the ones that have been treated the least. Most orchards will wash the apples and some orchards will also pasteurize the cider before it is sold to eliminate any pathogens that could make you sick. Cider producers pasteurize cider that is sold to the general public as raw cider has been linked with E. coli deaths.

If you don't want wild yeast to be a part of the fermentation you have two choices: You can use pasteurized cider, or you can heat the cider and kill the yeast yourself, however this might also have the side effect of changing the flavor and aroma of the cider. Most pasteurization techniques used for commercial cider are "high temperature, short time" and the effect on flavor and aroma is far less dramatic than batch pasteurization. If the cider has been pasteurized then there will be no wild yeast and no need to add sulfites to the cider to "knock them out," nor will there be sorbates to slow them down. If you are using unpasteurized cider you can add sulfite in the form of Campden tablets, which will neuter the yeast. If it can't reproduce, it can't ferment. Sulfite will not kill yeast and it doesn't protect your cider from acetobacter/vinegar bacteria. Typically the Campden tablets are dosed 1 per gallon (3.8 L). I crush them between two spoons, add them to the cider and wait 24 to 36 hours before pitching the yeast to let the sulfite do its thing. If the cider is very cold, as it can be fresh from the press, I wait even longer than 36 hours to allow the cider to warm up to room temperature (~60 °F/15 °C) before adding my yeast, nutrients, sugar, etc.

As for the cider itself, this is the main ingredient. As a cidermaker I want some tartness in the final cider to add more flavor and to balance the

cider. Antique cider apples are not easy to find but some orchards will have a special hard cider pressing. Varieties that are true cider apples are fairly inedible. They are so tart that you would probably spit them out if you ate them raw. The higher the percentage of tart apples, the more that character will come through in the final product. If you can't find any of the old cider varieties, some crab apples will do just fine. We sponsor a crush at Vermont Homebrew Supply every year where the apples and the proportions of sweet to tart varieties varies. For more on cider apple varieties, see below.

If you don't have access to fresh cider you can also use a cider from the grocery store if it hasn't been treated with sorbates, which should be listed on the label. Pasteurized cider is fine but sorbate is used to inhibit any naturally occuring yeast (and any that you add too) so that grocery stores don't have to take back fizzy returns. Store cider may not have the complexity of a blend from an orchard but it will make a fine hard cider.

## CIDER APPLE VARIETIES

If apple cider is something you always just bought at the grocery store when summer turns to fall, you may have never thought much about the varieties of apples that are used to make it. Variety makes a big difference when it comes to making cider, however — especially hard cider. Just as a brewer decides which grains are needed to make a specific beer style, a cidermaker must also choose his or her apples wisely. And with more than 7,500 different varieties of apples grown around the world, 2,500 varieties in the US alone (which are grown in all 50 states), there are many apple choices, indeed.

Most of the sweet (non-fermented) ciders you can get at the grocery store or local farm stand are made from a blend of all-purpose culinary apples, which will make a totally acceptable sweet or hard cider, but it won't be very complex. Unlike the Macintosh, Granny Smith and Empire varieties you might find in the grocery store produce section, true "cider" apples are not generally good eating apples. While supermarket varieties tend to be in the 12–14 °Brix (1.048–1.057 SG) range, cider varieties will often reach 15 °Brix (1.061 SG) and others can get as high as 20 °Brix (1.083 SG). Cider varieties also have different acid and tannin levels than all-purpose eating apples. What apples you choose to use for making cider are your call, however, consider this advice from Oscar Mendelsohn in his book The Earnest Drinker: A Short and Simple Account of Alcoholic Beverages for Curious Drinkers: "Cider of a sort can be made from any variety of apple juice, but for a fine beverage it is essential to use 'vintage' apples, which are distinguished by a chemical composition which make them inferior or even unusable for general purposes. Cider varieties of apples are broadly distinguished by comparatively high acidity and tannin. They are therefore somewhat sour and bitterish."

There are four generally-accepted categories of cider apples: sweets, sharps, bittersweets and bitter-sharps. Here are some suggestions of cider apple varieties to look for in your area:

**Sweet (high sugar levels, which encourages fermentation and raises alcohol levels. Low tannins and acidity.)**

- Ashmead's Kernel
- Esopus Spitzenberg
- Golden Russet
- Gravenstein
- Sweet Alford
- Sweet Coppin
- Northern Spy
- Taylor's Sweet

**Sharp (high in acidity, tend to be low in sugar and tannins.)**

- Bellflower
- Bramley's Seedling
- Brown's Apple

**Bittersweet (high in both tannins and sugar)**

- Amére de Berthecourt
- Ashton Bitter
- Beden
- Binet Rouge
- Brairtot Fuji
- Brown Snout
- Bulmer's Norman
- Chisel Jersey
- Dabinett
- Ellis Bitter
- Frequin Rouge
- Medaille d'Or
- Michelin
- Somerset Redstreak
- Stembridge Jersey
- Yarlington Mill

**Bittersharp (high tannins and acid)**

- Fox Whelp
- Herefordshire Redstreak
- Kingston Black
- Porter's Perfection
- Stoke Red
- Tremlett's Bitter
- Yarlington Mill

Cidermakers also often use other apple varieties that are sometimes as good for eating or cooking as they are for fermenting. Here are a few to try:

- Baldwin
- Black Gilliflower
- Elstar
- Gala
- Golden Delicious
- Granny Smith
- Hidden Rose
- Jonagold
- Macintosh
- Newtown Pippen
- Pomme Gris
- Wickson (a crab apple)

## YEAST

Once you have selected your cider the next decision is which yeast to use. Much as in beer brewing there are commercially manufactured liquid and dry yeast strains. You can use beer, wine or mead yeasts for cider, but you should always make sure the yeast you choose likes the temperature of your homebrewery and that it can ferment to the alcohol content you desire. I don't go out of my way to oxygenate my cider; it's already brown because it has been exposed to oxygen during pressing. I do, however, make sure to pitch enough yeast and, as stated before, make sure the yeast can do what I want it to do.

If you can get an orchard or producer to sell you some raw cider you might want to try a "spontaneous" fermentation. Most apples will have a blend of yeasts on the skins. You won't know how many strains are there or what it will taste like, and you won't know how much alcohol they can ferment or what temperatures they like. For that reason, I don't try to make cider with wild yeasts myself. I keep the alcohol content under 10% and the temperature over 60 °F (15 °C). I've enjoyed the ciders I've made this way and lots of other cidermakers agree. It can be a little stressful (that's my inner homebrewer talking) but if you've dabbled in Brettanomyces and sour beers, and if you have the right cider, go for it. One time I waited a week for the fermentation to start and I couldn't take anymore — I pitched a wine yeast and got the fermentation going. Other cidermakers with the same blend encountered the same thing, so be prepared to pitch a commercial strain if you try a wild fermentation and feel that it is taking too long. You can always try a wild fermentation again next year.

If your cider is going to be under 10% ABV you can also pitch any ale or lager brewer's yeast. Just make sure your pitching rate is sufficient. I have had some lovely ciders brewed with Belgian yeasts. Without the malt and hops getting in the way, the flavor and aroma of the yeast can really shine.

For ciders over 10% ABV I prefer to use a wine or mead yeast as they can tolerate higher gravities. I've also used liquid cider yeasts to enhance the fruitiness of the cider. German white wine yeasts will give a very aromatic nose, while Champagne yeast is the most commonly used wine yeast for cidermaking. Champagne yeast has the ability to ferment a higher alcohol cider, and tolerance to cooler temperatures make it work in a variety of recipes and temperature conditions. Champagne yeast is also used for its ability to attenuate. The final gravity of cider can be as low as 0.995. If my cider is already going to be tart due to the apple blend, then Champagne yeast might be too tart and dry for you. In a cider with no cider-specific apples, then champagne yeast will give you the crispest, driest cider.

## ADJUNCTS

Once you have your cider you will want to know its sugar density. When you take a hydrometer reading you can use the potential alcohol scale to see what you're going to get for an alcohol content. Unlike beer, cider will fully ferment out so the potential alcohol scale is very useful. Most of the time my ciders test out between 5 to 6.5% alcohol, but it can vary widely and I wouldn't want to assume anything just from how sweet it tastes. Once I know the starting gravity I can then decide if I want to fortify the cider to get more alcohol. Not only will adding more sugar increase the alcohol content, it can influence the color, flavor and aroma of your cider. Darker, more caramelized sugars are great to try. I have used Belgian amber candi sugar, dark and light brown sugars like raw, Turbinado and Demerara. A bit of molasses will darken the color and add another layer of complexity to a New England-style cider. And honey has been my go-to sugar for cidermaking for many years. It will completely ferment out so it will not add honey sweetness, and I like the smooth mouthfeel. I have used a lavender honey that added a delicate floral nose. — expensive but worth it! You can dissolve the sugar in a small amount of cider then pour it back into the fermenter. If you aren't sure how dense the sugar is then you can check the gravity then add more if you need it.

Other adjuncts could include spices, fruits and berries, oak chips/cubes, flowers, ginger . . . there really is no limit. Just remember that the cider is going to be clean, crisp and dry. Whatever you add, do so judiciously. You can't take it out but you can always add more.

When I want to oak a cider I have had the best results from using a small amount in the secondary. I have

boiled and steamed the chips and just added them to the carboy. If you don't want to risk too much oak exposure then plan on thieving out a sample and be prepared to rack into another carboy. A scale is very helpful when you are recording adjunct additions. Lately I have been soaking the oak chips in a spiced rum during the fermentation, then adding them to the secondary.

## OTHER ADDITIONS

I always add 2–3 tsp. of a yeast nutrient to a 5-gallon (19-L) batch of cider if the alcohol content is going to be over 10%. It wouldn't hurt to do it for a lighter cider either. With a tart cider you won't need to increase the acidity, but you might have to bump it up with a store-bought cider. I have added dried tart cherries and cranberries to cider that needs acidity to good effect. After fermentation is over you can add a little acid blend (much like a meadmaker), but try to let the cider clear and condition a bit before you start making adjustments.

Pectic enzyme can help you get your cider to be clear. Apples naturally contain high levels of pectins that can haze your cider. If it doesn't matter to you if it clears or not, then it's totally optional. Using sweet cider to top off can add a haze so do this only if you don't mind a cloudy cider.

## TIMELINE

The time it takes to ferment and secondary your cider has a lot to do with the alcohol content and the tartness of your cider. A 6% ABV cider could take two to three weeks to fully ferment out and another two to four months to clarify. Carbonation time is about the same as it is for beer, and your cider should be crisp and tasty for a year or two. Once you start adding sugar the process is much more like winemaking. I might give a 12% cider a year in secondary and enjoy it for the next 3–4 years. But like all homebrews, trust your palate and if you aren't sure it is ready wait a bit longer.

Since cider will tie up a secondary for a fair bit of time, you might want to invest in a cider-only carboy that isn't needed for your beer brewing. Ciders that don't get enough time to fully sediment out can have a deep layer of sediment in the bottle. That sediment can be fluffy and come up off the bottom when you open a carbonated cider.

## POST-FERMENTATION FUN

In addition to the adjuncts that you can add in secondary, you can still tweak your cider. One of the more common adjustments is to sweeten your cider. If the cider is too tart, back-sweetening can help to balance things out. If you are trying to duplicate a commercially-made cider you can de-gas and take a hydrometer reading of a sample to see how sweet it is, then adjust your cider to match. Of course, once you have added sorbate you won't be able to carbonate the cider unless you can force carbonate in a keg.

Blending ciders is also an option. If you have done more than one cider recipe, then perhaps a third version is possible from a blend.

## OTHER CONSIDERATIONS

Just like beer, you need to be sure your equipment is in good shape and well sanitized. The fermenter should have enough headspace to accommodate a little foam, but many ciders will not head up like a beer so you can get away with using a slightly smaller fermenter. Since cider will likely be in secondary longer than most beers, it is critical that there is only an inch or two of headspace to prevent oxidation. I always try to make an extra quart or two of cider in the fermenter so when I rack into my carboy I can always fill it right up. When you have extra headspace and no cider to top up, a white wine works very well in a pinch. We used sweet cider to top up a fermenter one year and that batch of cider never cleared as well as the other ciders we made that year. Oxygen in the sweet cider is what makes it brown, but in the secondary the cider will settle out and lighten to a pale yellow that can be totally transparent. If there is too much headspace/oxygen, however, then it may go back to an amber tint and develop nutty/oxidized aromas.

## BOTTLING

It's your choice whether to bottle your cider still or sparkling. A still cider can be bottled in any kind of beer or wine bottle. If you choose to carbonate your cider, however, only use thicker-walled Champagne-style bottles, and be sure that if your cider has been back sweetened that you don't overcarbonate and create bottle bombs by adding too much sugar. And of course you can keg your cider too. I prefer a fairly light level of carbonation. Since I also use liter and half-liter bottles I prime 5 gallons (19 L) with $^1/_3$–$^1/_2$ cup of dextrose/corn sugar. You can also use honey or a darker sugar to prime. I have also had success using raisins to prime ciders. One or two per bottle did a great job of lightly carbonating a spontaneously-fermented cider. I have thought about trying this with dried cranberries or cherries; I might use two or three small ones per pint bottle or just one or two if they seemed like very large raisins.

But wait, there's more! Here in the North Country winters can be dark and very cold. If you find yourself with a clear, 12% cider on a -20 °F (-29 °C) February night, try making applejack. Siphon some hard cider into a plastic bucket, cover and set it out to freeze for a day or so until it forms a layer of ice on the top, bottom and sides. Using the black knob of a racking cane, poke it through the ice, siphon and bottle. I have taken 12% ciders and after freezing they test out at just over 20%. Not hot like a distilled brandy, but nice to have on a cold night. BYO

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# BACK-SWEETENING HARD CIDER

BY BOB PEAK

Cider is hot! And I don't mean the winter-time beverage of heated apple juice with cinnamon in it. No, the cider we are discussing here is that moderately alcoholic beverage also known as hard cider to distinguish it from the product that comes in a juice box. Hobby cider making is booming as both homebrewers and home winemakers find lots of familiar territory when they ferment some apple juice. If you start with apples, you need to grind or shred the fruit, then press it to extract the juice. You can also make perfectly enjoyable cider from commercial bottled apple juice. Pasteurized or sterile juice is fine, just check to make sure it contains no preservatives, like sorbate, that might inhibit your yeast.

Cider is produced in four basic styles. It is dry or sweet, and it is still or sparkling. To make dry cider, ensure sound fermentation conditions, use healthy yeast and adequate nutrients, and you should finish the fermentation with a residual sugar level of 0.4 °Brix (1.0015) or less. Cider makers, like winemakers, tend to use the Brix scale (percent sugar by weight) more often than the Specific Gravity or Plato scales commonly used by brewers. At 0.4 °Brix or below, a cider will taste somewhere between bone-dry and slightly off-dry and has little or no risk of spontaneous refermentation. To bottle such a cider as a still (non-sparkling) beverage, add sulfite like a winemaker or mead maker and bottle your cider under a cork in a wine bottle or under a crown cap in a beer bottle. For dry sparkling cider, do not make a final sulfite addition but instead add priming sugar just as you do for priming homebrew and bottle in pressure-tolerant bottles (with thick-walled glass).

Many cider drinkers prefer a bit of sweetness in their cider. Making a sweet cider at home is a bit trickier than a dry cider and that is where this article's discussion comes in. There are some cider making techniques that preserve a fraction of the original sugar to achieve a noticeable residual sweetness. They are discussed briefly later in this story, but tend to be rather complicated and not 100% reliable. Most makers of sweet cider at home will want to use the alternate technique known as back-sweetening: The addition of a sweetener close to bottling.

Photos by Brenda Bailey Collins

## CIDER SWEETNESS

Apples naturally contain several different sugars. One academic study reported the following sugars (in g/100 mL, nearly the same as Brix or percent): glucose 0.9–3.2, fructose 6.6–9.6, sucrose .8–5.5, and total sugars 11–16. The ratio of various sugars influences the perceived sweetness. That is because human tasters do not experience these sugars equally on a gram-to-gram basis. Researchers have used tasting panels to help determine "iso-sweet" levels — the concentrations of various sugars that taste equally sweet. Using a solution of 10% sucrose as a reference, they found that an 8% solution of fructose was equally sweet. On the other hand, glucose required an 18% solution for the same effect. Sucrose is common table sugar (usually cane or beet) and glucose is readily available in homebrew supply stores as corn sugar or dextrose. Although fructose has a greater sweetness impact for its weight, it is not easily found in commercial retail sales. In a low pH beverage like cider sweetened with sucrose, over a period of weeks the sucrose will "invert" to an evenly divided combination of glucose and fructose. Since fructose is sweeter than sucrose but glucose is less sweet, the resulting effect on the flavor is not pronounced (the "inverted" result will be about 90% as sweet as a pure sucrose version).

Sucrose is the most common sugar for back-sweetening. Since it is fermentable, adding it to a finished cider risks refermentation and pushed-out corks or blown-up bottles. Cider can be also be sweetened with a non-fer-

mentable sweetener such as saccharin or stevia, which we will cover later in this article. You have three major choices to make when you sweeten a cider: Which sweetener to use, how much to add, and how to assure a stable product. Among the fermentable sweeteners, dry sucrose comes in a number of forms:

• **Cane sugar:** Refined white sugar from the juice of sugar cane. Imparts sweetness to cider with very little additional flavor.

• **Beet sugar:** From sugar beets; a direct substitute for cane sugar.

• **Brown sugar:** Cane sugar with residual molasses content. For commercial brown sugar, the molasses is added to refined white sugar. For raw sugar, some molasses is left in the sugar by only partially refining it. Brown sugar adds flavors of caramel or molasses and will influence the taste of your cider beyond sweetness.

Other fermentable sweeteners include honey, which is about 77% sugar and will impart honey flavor. Maple syrup is about 66% sugar with a distinctive aroma and flavor. Molasses is about 55% sugar and has a very distinctive brown-sugar type flavor and aroma. Agave syrup, from the same plant used for tequila, is about 70% sugar. It is high in fructose and has a stronger sweetening effect for a given addition.

Cider may also be sweetened with sweet apple juice. For your own sweetener, you can freeze some juice at harvest and then thaw it, boil it briefly to sanitize, and add. Use your starting Brix number for your sugar calculation. Commercial apple juice is usually about 12 °Brix (1.048 SG). If you wish to minimize dilution of your finished cider but want to stay with apples, you can sweeten with apple juice concentrate. The commercial product is usually about 70% sugar.

Your next decision, then, is how much to sweeten your cider. As noted earlier, below about 0.4 °Brix (1.002 SG), your cider will be perceived as dry. In cider competitions, sugar levels from that level up to about 0.9 °Brix (1.003 SG) are considered off-dry. From 1–4 °Brix (1.004–1.016 SG) is considered medium to medium-sweet, and greater than 4 °Brix (1.016 SG) is considered sweet cider. To find out what you like best, run a trial on a small amount of cider and then scale up your batch when you find a taste you like. Weigh out enough of your chosen sweetener to equal 50 g of sugar. Dissolve that in distilled water and dilute in a beaker or cylinder to 100 mL. You now have a solution that contains 0.5 g of sugar in every mL. To treat a tasting sample, measure 100 mL of your finished cider. If you add 2 mL of your test solution, that will be 1 g of sugar and you have sweetened to the 1% level. Try 4 and 6 mL in additional samples for 2% and 3%. Once you know the percent that you like, you can treat the whole batch. For instance, if you like a 2% sugar level and you have 5 gallons (19 L) of cider, convert the 19 L to mL: 19,000 mL. Multiply by your chosen decimal sweetness fraction (2% = 0.02) to determine grams to add:

19,000 mL x 0.02 = 380 g of sugar

Table 1 presents the grams of various sweeteners needed to make a trial solution that is 0.5 g/mL (50% sugar) and the amount of sweetener needed to produce a 1% sweetening in 5 gallons (19 L).

Note: With the apple juice Brix around 12 (1.048 SG), you cannot make a 50% trial solution with it. To determine the amount of juice to add directly to a 100 mL sample for a 1% addition, divide 100 by the Brix reading. For example, 100/12 = 8.3 mL of juice in a 100 mL sample.

TABLE 1

| | Dry Sugar | Honey | Molasses | Maple Syrup | Agave Syrup | Apple Juice | Apple Concentrate |
|---|---|---|---|---|---|---|---|
| 100 mL Trial Solution (at 50%) | 50 | 65 | 91 | 76 | 71 | (see Note) | 71 |
| 5 gal (19 L) of cider (at 1%) | 190 | 247 | 345 | 288 | 270 | 1577* | 270 |

*grams of 12 Brix juice for 1% sweetness. mL is close enough to grams, so 1577 mL or 1.58 L (0.42 gal) in 19 L (5 gal).

Table 2

| | Sucralose | Saccharin | Stevia Powder | Stevia Liquid |
|---|---|---|---|---|
| 100 mL trial solution | 0.08 | 0.17 | 1.0 | 1.0 |
| 5 gal (19 L) | 0.32 | 0.63 | 3.8 | 3.8 |

## NON-FERMENTABLE SWEETENERS

So far, our discussion has been all about fermentable sugars. An alternative to sweeten without the risk of refermentation is to use non-fermentable sweeteners. The ones used in cider making are the artificial sweeteners sucralose (marketed as Splenda) and saccharin, plus the natural plant extract stevia. Sucralose is about 300 to 1,000 times as sweet as sucrose and saccharin is about half that. For Figure 2, I have assumed a factor of 600 for sucralose and 300 for saccharin. Stevia is marketed as a powdered concentrate and as a liquid concentrate. Both the powder and the liquid are about 50 times as sweet as sucrose. The table presents the preparation of 100 mL of trial solution that mimics the "50% solution" in the first table. Also presented is the gram weight needed for a 1% "su-

crose equivalent" sweetness in 5 gallons (19 L). Note that these figures are for the pure artificial sweeteners and the stevia concentrates. Some commercial sweeteners are diluted with dextrins or other materials to make measuring them easier in everyday use. If you buy one of those, check with the manufacturer for the sucrose equivalent.

While very efficient, the artificial sweeteners and stevia yield mixed results in terms of flavor and mouthfeel, with some tasters finding that they dislike cider sweetened with one of these products. Since I have not used them, I turned to some colleagues who have for their experiences. Jennifer Harris, founder and director of Sonoma County's Farm to Fermentation Festival in Sonoma County, California, has had good success with stevia in ciders. She used the liquid extract and first tried 4 mL in a 5-gallon (19 L) batch. She reports that the sweetness was noticeable but some tasters (including herself) detected an objectionable stevia flavor at that level. On another batch, she used 2 mL instead and found a slight sweetness with no stevia flavor. She estimated the apparent sweetness as about like a 0.8% to 1.0% residual sugar, which correlates reasonably well with the Table on page 6.

Kimi Anderson is a former associate of mine at The Beverage People homebrew supply store in Santa Rosa, California, who now lives in Maryland. She experimented with stevia liquid concentrate in cider, adding just one drop to a 2.5 gallon (9 L) batch. At that level, none of the tasters (including me) detected any stevia flavor, but the sweetness was also very low. Anderson describes it as just enough to take the edge off of a dry cider, but suggests some other methods to improve cider flavor that will be discussed in a moment.

After you have chosen your sweetener and decided the amount to add, you may treat the batch. If you are using dry sugar, boil it with an equal amount of water to sanitize for a few minutes. For the liquid syrups, you may add sterile commercial products directly. If in doubt, add enough water to thin to a boilable consistency and boil first as for dry sugar. To make a still sweet cider, rack it into a bottling bucket and add the sugar. Stir in potassium sorbate at a rate of 0.5 to 1.0 g/L. Add sulfite to about 30 mg/L and bottle. Sparkling sweet cider is difficult to produce at home. If you are set on it, your best bet is to sweeten, add sorbate, and add sulfite as just described and then force carbonate in a stainless steel soda syrup keg as you would with homebrew. For bottles, you can use a counter-pressure filler. Some users report that sorbate-stabilized ciders produce sediment during aging. To avoid that, you could sweeten and sorbate in bulk and store for a period in a topped-up carboy, but preventing spoilage becomes a challenge once sugar is present.

*To find out what level of sweetness you like best, run a trial on a small amount of cider and then scale up your batch when you find a taste you like.*

To use an unfermentable sweetener, just add it to the cider in the bottling bucket. For still cider, sulfite as described earlier and bottle. For sparkling cider, add priming sugar to the bottling bucket along with the sweetener. Do not add any sulfite. Bottle the cider and keep it at room temperature for a week to ten days for the residual yeast to ferment the priming sugar to carbonation. Sweetness will come entirely from the added sweetener, as the priming sugar will be consumed by the yeast.

## OTHER PROCESSES

For traditional cider making, there are a couple of other processes to produce a sweet cider. One of these is called keeving, where a combination of pomace and calcium rises to the top of the cider to make a crust. Because much of the yeast is in the crust and the cider below is deprived of nutrients, the fermentation may become "stuck" and leave a naturally sweet cider. Counting on achieving a stuck

fermentation at the right sweetness is risky at home.

In another method, partly fermented cider is chilled and sterile filtered to remove any residual yeast. Sterile filtration is also difficult to achieve at home as the equipment is costly.

Some hard ciders are bottled sweet, with or without carbonation, and heat-treated to pasteurize the cider and prevent refermentation. I have seen no guidelines for this process at home.

Finally, cider may be bottled in thick-walled Champagne bottles under crown caps and allowed to carbonate. Then, the "méthode traditionnelle" for sparkling wine is employed. The way this works is that the bottles are held upside down and moved every day ("riddled") to move residual yeast into the neck. After a period of riddling, the neck is frozen in a brine bath, the cap is removed, and the block of frozen cider containing the yeast blows out. At that point, a sugar syrup can be added, the bottle topped up from another open bottle, and a Champagne cork inserted into the bottle. If all the yeast was removed, you are left with a shelf-stable sweetened sparkling cider. This process is not recommended for first-time cider makers, however, as the contents under pressure can be dangerous. If you want to try and use this method, read up about making sparkling wine, and get some advice from someone who has mastered the technique.

Along with the various sweetening alternatives, Kimi Anderson noted that many cider makers would be happy with getting more "apple" character in their hard cider or just taking the edge off of the dryness. She has experimented with yeast choice and has found some strains, like M2 from Enoferm and M02 from Mangrove Jack's, leave a slight impression of sweetness without leaving enough sugar to cause instability. She has also found that using white wine specialized yeast nutrients like OptiMum White® from Lallemand can help preserve and enhance fruit aromas. Those nutrients do not replace your usual nutrient program and are usually applied at a rate of 1 g per gallon (3.8 L) of juice. For the sometimes bland results that may result from using bottled apple juice, Anderson has added white wine tannin products to enhance mouthfeel and fill out midpalate body. She has had good results with Scott'Tan FT Blanc Soft from Scott Laboratories. At a rate of 7.5 g in 5 gallons (19 L), she found character reminiscent of the skin tannins one encounters on eating a fresh apple. It was a bit strong for her and she intends to use just 4 to 5 grams next time. For sweetness, she used sucrose at 1.5% and applied sorbate. She also added one more product that is used in winemaking to give a slight impression of sweetness and improve mouthfeel: Gum Arabic. As a 25% liquid preparation, such as Flashgum R Liquide from Scott, it is used at a rate of 1.5 to 5 mL per gallon (3.8 L) and is the last product added in the bottling bucket. Anderson reports very positive responses from a variety of cider tasters with the overall character being a slightly sweet with a very "appley" cider.

## ASK A CIDERMAKER (OR A WINEMAKER)

As you may have noticed, making and sweetening cider relies less on homebrewing techniques and more on home winemaking skills. If you want to get good at making hard cider, chances are your local homebrew shop has someone on staff who is the go-to winemaking person — find out who they are and ask for advice. You can also talk to meadmaking friends about their techniques as they also often use back sweetening methods. Give some of these techniques a try, and have some fun making cider this season! BYO

*Bob Peak has been making cider, beer, and wine for many years and is a former partner of The Beverage People Inc. in Santa Rosa, California*

# CIDER YEAST SELECTION

BY BOB PEAK

As the craft cider wave rolls across America, interest in home hard cider making is right there with it. When you decide how to turn your apples (or apple juice) into this time-honored but also trendy beverage, you are faced with more choices than ever before. Other fruits can be added, hopped ciders are becoming common, apple variety blending has long been a part of hard cider making, and then there is choosing the yeast. Older references for cidermaking often advise using Champagne yeast, but modern choices have gone far beyond that narrow focus. There are cider-specific selections from commercial yeast producers as well as a whole world of yeast strains originally selected for beer or wine that also can be applied to hard cider making. Let's explore some variables that go into the selection of a yeast strain for hard cider making, and then a range of specific alternatives.


Yeast choice for making the best hard cider requires a few considerations. Prominent among these are your specific objectives for your particular beverage. Choice is further influenced by the apples (or juice) that you will have available for the project. Finally, you are faced with whatever range of yeasts you can obtain where you live.

Cider objectives can be simple to complex. You may just have a large quantity of apples and want to turn them into a clean, straightforward adult beverage as simply as possible. In another direction, you may be a history buff and looking to re-create a historical category or style of hard cider. The character of the apples themselves may also drive your decision, if you are seeking to express specific fruit characteristics or capture the characteristics of the apples in a specific region or orchard. If that seems too basic, maybe you want to choose a yeast that contributes strongly to an exotic profile in the finished cider. Even having decided that, you still have the choice of many strains with many effects. You can even take a shot in the dark and rely on indigenous yeast and see what you get, although that's not a yeast choice that you will have much control over during fermentation.

## CIDER SOURCES

A popular way to make cider at home is to pick or purchase apples at harvest time, crush them, and press the juice. In that sequence, you may wish to add pectic enzymes to the pulp to increase juice yield and enhance the release of aromatic compounds. If you will be using a selected yeast strain (the point of this article), sulfiting the juice is advisable to retard growth of indigenous yeasts prior to the dominance of your cultivated strain.

If you do not have apple trees but live in an area with orchards, you may be able to buy freshly pressed apple cider from a commercial grower. Frozen cider is often available year-round in apple growing areas, and even store-bought bottled juice may be used if it is free of preservatives (like sorbate). After you have your cider, add yeast and nutrients to get the fermentation started.

Alternative methods for making hard cider are available and some are of historic interest. For example, fermentation can be carried out on the crushed apple pulp and the cider pressed off later. There is also a traditional method from France and England known as "keeving." To do this, calcium salts and table salt are added to the cider to coagulate the pectins. This causes a brown, gelatinous mass of the pectins to form and rise, which is known as the chapeau brun or "brown hat." Once the brown hat rises, the clear cider underneath is racked away and fermented. Because it is treated in this way, the fermentation will be very slow as most of the nutrients and indigenous yeast are left behind in the cap, making it easy to create a sweeter cider as the yeast will likely become stuck and leave behind residual sweetness. For more on keeving, check out this link: www.cider.org.uk/keeving.html

Even in a conventional fermentation, your yeast choices may change

if you decide to add other fruits to change the flavor and color of your cider or to add sugar to increase the final alcohol level. Among apples themselves, traditional fresh eating varieties or "culinary apples" are lower in tannin and acid than specific-purpose cider apples. If you are using culinary apples, you may tilt your yeast choice toward adding complexity that the apples do not have. If you have a good selection of apple varieties available, including some cider types, you may tend toward a yeast with a simpler profile and build your complexity in the juice.

Culinary (eating) apples tend to be sweet with low acid and low tannin profiles, leading to a fairly bland cider if fermented alone with a clean, neutral yeast strain. Varieties like Red Delicious, Cortland, and Rome Beauty fall into this group. Some multi-purpose apples, suitable for eating fresh as well as cooking or cider, are higher in acid and provide a bit more interest in a blend. These higher acid varieties include Jonathan, Rhode Island Greening, and Winesap. For aromatic enhancement, there are also some multi-purpose types, including Cox's Orange Pippin, Gravenstein, and McIntosh. Finally, astringent varieties that are high in tannins will usually be grown strictly for cider production. Some of these are Newtown, Lindel, and various crabapple varieties. "Wild" apples that have grown from seeds without deliberate cultivation or grafting will usually be higher in acid and tannins also. When you know what apples you will use, the predicted alcohol/acid/tannin balance can help you choose the best yeast.

## STRAIN CONSIDERATIONS

In making a yeast choice to match your apples and your objectives, consider three broad attributes of yeast strains for fermentation. Many might be described as "clean" or "neutral" in their effects, producing little in the way of added estery aromas or yeast-derived flavors. Others are specifically targeted at aromatic enhancement, often developing fruity esters reminiscent of apples and pears. Finally, there are specialty yeasts, mostly borrowed from beer brewing practice, that introduce dramatically different aromas such as the barnyard funk of *Brettanomyces* or the cloves-and-bananas of German hefeweizen.

One additional factor to consider in your yeast choice is availability. Of course, with the Internet, we can order anything from anywhere. To assure the freshest yeast and best product support, I encourage you to work with your local homebrewing or home winemaking supply store. As far as I know, no one has created an exclusively home cider making store — yet! Usually you will find yeasts available in specific cider strains, a variety of wine strains, and many beer-derived choices. Here are my most recommended choices:

## WINE YEAST

While neutral Champagne-like yeast strains were long recommended, modern cider makers are having good success with others that enhance aromas. Most are marketed primarily for white wine production, but adapt easily to cider. Here are a few examples, but feel free to experiment more widely on your own!

### NEUTRAL

**Prise de Mousse, EC1118 from Lallemand:** A very traditional choice among the Champagne-style yeasts, this one is a *bayanus* strain of *Saccharomyces* and has a high alcohol tolerance of about 18%. A level that high would not likely come about naturally from apples, but if sugar is added to make apple wine, this yeast would be a good neutral choice. The character of the apples themselves will be on display, with little contribution from the yeast. The finish is usually bone-dry with no hint of sweetness.

**Pasteur Champagne (now called Pasteur Blanc) from Red Star:** This is a similarly neutral strain with good alcohol tolerance. This is also known as UCD #595 from the UC-Davis yeast type collection. White Labs liquid yeast WLP715 and Wyeast liquid yeast 4021 will produce similar results.

**VQ 10 yeast from Enartis:** This is another *bayanus* strain and reflects the higher alcohol tolerance typical of such yeasts. It is considered neutral in character and may ferment up to 17% alcohol by volume (ABV).

### AROMATIC

**M2 from Lallemand:** I will confess to a bias right here — this is my personal first-choice yeast for cider. It reliably produces enhanced fruit aromas that intensify apple character and add other fruit notes including pear, and sometimes also cherry. It also helps develop richer mouthfeel and leaves a fruity note in the finish that may suggest a residual sweetness even when fermented effectively dry. Alcohol tolerance is plenty high for cider, topping out around 15% ABV.

**71B from Lallemand:** Favored by some cider makers, particularly when faced with a blend of apples that may be too high in acid to produce a well-balanced cider. 71B partially metabolizes malic acid (20-40%), the dominant acid of apples, reducing the sharpness and rounding out the product flavor. It is also estery, although some users report a buttery note, probably from diacetyl production. Alcohol tolerance to 14% ABV.

**Enartis Ferm WS:** This yeast was originally isolated from an indigenous yeast fermentation of late-harvest Zinfandel at Williams Selyem winery. For aromatic complexity in your cider it might be a good one to try and is very high alcohol tolerant at 18% ABV.

**Côte des Blancs from Red Star:** Also known as Epernay II, this strain has the UC-Davis type number 750. It has long been used in production of aromatic white wines and often produces similar effects in cider fermentation. It is tolerant to about 15% ABV. It is particularly easy to stop by chilling, so it would make a good choice if your objective includes an interrupted fermentation to produce a sweet beverage.

## CIDER-SPECIFIC YEAST

As cider fermentation grows in popularity, many commercial yeast producers are taking notice and making cider-specific strains.

**Mangrove Jack's Cider Yeast M02:** Produced specifically for cider

fermentation, this yeast would be among the "aromatic" strains. It produces fruity esters and has a lingering finish along the same lines as M2 wine yeast.

**Safcider from Fermentis:** This is another *bayanus* strain that is effective at fermenting cider even under difficult conditions. It has a wide fermentation temperature tolerance of 50 to 86 °F (10 to 30 °C). It is rated to 11% ABV, which should be fine for natural-sugar ciders but may not accommodate apple wines with added sugars.

**WLP775 English Cider Yeast from White Labs:** A traditional cider yeast, this liquid preparation can be used for ciders up to 12% ABV. It produces sulfur odors during fermentation, but should clear up with aging (White Labs says within two weeks). Traditional ciders made with this yeast include "West Country" styles that are usually made with bitter apples that are cultivated specifically for cider production.

**Wyeast 4766 Cider:** This yeast was selected for producing a big, fruity finish. Aromas of pears, apples, and other fruits are prominent. Alcohol tolerance is to 12% ABV.


## BEER YEAST

In this category of yeast strains we find a division between fairly neutral/somewhat fruity yeasts in lager and ale strains as compared with very character-driven specialty strains for specific exotic effects. Most beer yeasts are less alcohol tolerant than wine yeasts but bring a wide range of aromatic development.

### NEUTRAL/FRUITY

**Saflager S-23 from Fermentis:** This dry yeast was derived originally from VLB-Berlin German brewery. It produces fruity and estery lager beers in its primary role and can bring similar effects to ciders, although it may be a bit subdued as compared with fruity wine yeasts or fruity cider yeasts. As with lager fermentation, it should be used between 53 and 59 °F (12 and 15 °C). It has a lower attenuation profile than some other lager yeasts and may leave slight residual sweetness.

**WLP001 California Ale from White Labs:** This yeast is widely used among brewers for fermentation of clean, crisp ales. It will bring similar effects to cider, although some users report a beer-like note in the cider even with the neutral character. It is highly alcohol tolerant for a beer yeast, up to 15% ABV. It accentuates hop character in ales, so it could be a very good choice if you want to try a hopped cider. Wyeast 1056 will produce similar results.

### CHARACTER

**WLP565 Belgian Saison from White Labs:** A classic strain originally from the Wallonia region of Belgium. It produces spicy, earthy, and slightly funky notes in saison ales and will similarly affect a cider fermentation. It has a low attenuation level and may leave residual sweetness. It is a slow fermenter, sometimes stalling out and then restarting as much as two weeks later. A good choice if you want to make a funky, earthy farmhouse style cider.

**Wyeast 3711 French Saison:** Along with similar spicy and peppery notes as noted for WLP565, 3711 often displays a citrusy component in the aroma. It shows higher attenuation, leading to a dryer finish. This strain could be a good choice for those hobbyists who want to achieve French cider character at home. It enhances the aromas of added spices, so it might make a very interesting spiced farmhouse cider with added cinnamon and cloves.

**Wyeast 3787 Trappist High Gravity:** Typically used for strong Belgian ales, this strain produces a complex mix of fruity and phenolic esters. It has very good alcohol tolerance for a beer yeast at 12% ABV or higher. An excellent choice if you want to produce an overtly "Belgian-style" apple beverage.

**WLP300 Hefeweizen Ale from White Labs:** Traditionally employed to make cloudy, aromatic German-style wheat beers, this yeast has great aroma potential. It produces a blend of banana-like esters and phenolic clove-like aromas. Recommended fermentation temperature is 68 to 72 °F (20 to 22 °C). Fermenting at higher temperatures will produce more esters, potentially developing a strongly aromatic cider.

**Wyeast 5112 Brettanomyces bruxellensis:** This could be a good yeast choice for the very adventurous cider maker. Old-style Belgian beers like gueuze or sour brown were traditionally fermented with *Brett* as it was naturally present (it was not added by the brewers). It can produce aromas of sweaty horse blanket and possibly barnyard. For beer brewing it is often used in conjunction with a *Saccharomyces* strain to complete the alcoholic fermentation. For cider, you could either do that or let it ferment on its own, although unless properly pitched, completion might require three to six months. For more about the latest methods for brewing with *Brett*, check out Michael Tonsmeire's story "All About *Brett*" in the October issue of *BYO*.

## YEAST TRIALS

With so many choices and so much range of character, you may be hard-pressed (no pun intended) to decide what to do for your cider. One approach is to split up a large batch or make single-gallon (3.8-L) trial batches with a variety of yeasts and present them to friends and family for critiquing. A couple of years ago, my former colleague at The Beverage People, Kimi Anderson, did exactly that. She purchased locally produced Sonoma County refrigerated apple juice at an independent market and tried seven different strains of beer, cider, and wine yeast on them. She brought the resulting ciders in to work and had five of us taste them and give her written feedback (you can find her summary here: http://www.thebeveragepeople.com/pdf/webwinepdf/AppleCiderYeasts.pdf). The overall winner was M2 and this was the study that started me using that wine yeast for my ciders.

To design your experiment, or to just plunge ahead and make a full-size batch of cider, think of your yeast choice as a matrix of elements. Factor in the character, flavor, acid, and tannins of your apples (or juice); your objectives for the final beverage; and the availability of yeast strains in your area. Let your imagination run free and celebrate the result: Your own unique cider! BYO

*Bob Peak has been making cider, beer, and wine for many years and is a former partner of The Beverage People Inc. in Santa Rosa, California*

# FRUIT CIDERS

BY MICHAEL FAIRBROTHER

Cidermaking is a journey. Don't be fooled by anyone who tells you it's easy, as developing a delicious hard cider requires a lot more artistry than simply adding yeast to apple juice. Cidermaking requires you to develop, refine, and master many different skills. When you add the additional layer of fruit to your cider, it requires even more understanding of how these new flavors will fit with those from the apples. My hope is to provide some basic guidelines and inspire you to set off on a journey of becoming a cider artist. I view what I do these days as being a fermentation artist, the magic to making world-class beer, mead, or cider all require a mastery of fermentation.

Photo by Charles A. Parker/Images Plus

I started making cider in the fall of 1995 as the Brew Free or Die and Boston Wort Processors homebrew clubs had an annual cider picnic. Paul Correnty, who went on to author The Art of Cider Making, was selecting the apples that were pressed into cider, and I was fortunate enough to start my cidermaking journey among such a dedicated group of enthusiasts.

Until recently, there used to be two typical forms of hard cider — sweet varieties and dry ciders. As has happened with homebrewers and craft brewers pushing the envelope of beer, exploring new styles and using unusual ingredients has also become the norm in cidermaking. It's common when visiting a cidery to find various ciders with unique ingredients including fruits, spices, or hops, ciders fermented with different yeast strains, and ciders aged in oak barrels.

Just as varied as the styles of ciders, or the number of apple varieties and fruits that can be used to make fruited cider, so too are the methods to cider production. Before you jump into fruited cider, it's important that you understand the basics of making hard cider, which I'll cover here in addition to the nuances that come with making hard fruited ciders.

## HOW YOU LIKE THEM APPLES?

It all starts with great apples and the farmers who grow them. I recommend going to the source and talking with the farmers. Appreciate what goes into farming and the growing of apples. Understand the yield, flavors, sweetness, and acidity of the apples as they differ year to year. Farmers are critical in cider production. The orchard needs to be protected from disease, frost, and wildlife. With many orchards in danger of becoming future development properties, go out and support the local apple growers, and at the same time soak up their knowledge about their apples. Hey, it also makes for a great fall day out with the family.

Most of the sweet apples that are abundant in grocery stores and farmer's markets will work for making hard cider, but I like to get a pretty diverse blend of dessert apples and cidermaking apples (some of which are so tart you would never eat them on their own). At Moonlight Meadery (of which I am the owner as well as Meadmaker and Cidermaker), we use as many as 12 different varieties of apples, but that's because we are try-ing to maintain some consistency to our batches of hard cider. The apples we have access to in late spring have been kept cold under nitrogen all winter, are usually a little sweeter, and have dehydrated a little. Apples you've heard of, like Macintosh, Cortland, Gala, Liberty, or Northern Spy often provide the principal flavors. Lesser-known heirloom apples contribute subtle layers of flavor, acidity, and tannins.

## FRUIT OPTIONS

When it comes to fruit selection to add to a hard cider, there are no wrong answers. However, some definitely pair with apples better than others. I have had good success with fruits like black currants, cranberries, boysenberries, and raspberries. What each of these fruits have is a fair amount of acidity that builds onto what the apples bring. I normally shoot for 10-20% of the sugars coming from the non-apple fruits. This way you still get plenty of apple character with a light fruit note. Adjust the amounts as you like, but just be forewarned fruits like black currants are very assertive.

With fruited ciders you can add the fruit either before fermentation or afterwards. The flavor and aroma

will change based on when you make the additions. Fruit additions made prior to fermentation will lose some of the fresh fruit flavor and aroma, but still help create a tasty fruit cider.

When making fruited cider on a small scale, I would buy organic fruit juice from the grocery store and add it prior to fermentation. Where 2 to 4 quarts (or liters) would make up that 10 to 20%, in a 5-gallon (19-L) batch, this is an easy way to make fruit cider by blending the fruit juice with your sweet (non-fermented) cider.

When making a fruited cider with the fruit added after fermentation to back sweeten a dry cider, I use much less juice and back sweeten to taste. Keep in mind, when going this route, stabilization will be needed to ensure refermentation doesn't occur. This can be done with the addition of sorbate and sulfite. The best way to determine how much juice to add when back sweetening is to perform bench trials and then scale up your batch when you find a taste you like.

The form of the fruit you use is another question that you'll have to answer, and there are a few good options including juice, puree, and fresh or frozen fruits. If going with juice, which is by far the easiest option and results in a great, clean flavor, just make sure it contains no preservatives, like sorbate, that might inhibit your yeast. Pasteurized or sterile juice is fine.

If you go with fresh fruit, I recommend pressing the juice from the fruit vs. the option of adding bagged, crushed fruit. Having access to a press will make it easy to press softer fruits to create juice that you can use when making your fruited cider. Hard fruits need to be ground up prior to pressing (similar to how you would prepare your apples). The fruits I listed in Chart 1 (below) are all easily pressed without the need of grinding before pressing. Another option to make pressing easier is to freeze the fruit first (cutting it into chunks if using larger fruits), and then thawing them. This freezing and then thawing of the fruit will help release the juice and make pressing easier. When using stone fruits you should slice and remove the pits prior to pressing.

## SANITATION

Freshly pressed cider and fruit juice is going to be full of wild yeast, some of which can provide unwanted results. Without the step of boiling in the cidermaking process, it's extra important to sanitize all surfaces (remember you can't sanitize something that isn't clean) in your brewing area. Follow a strict protocol on cleaning and sanitation — it will only help you make better fermented beverages in the long run.

## SUGAR CONTENT & ACIDITY

I highly recommend you record every-thing you do in the cidermaking process in order to allow you to adjust/improve your skills as a cidermaker. A hydrometer is used to measure the sugar content (density) of the must. This provides a means of knowing the quantity of sugar, and the potential alcohol strength. The measurement of pH is necessary only for the dose of sulfite to the must. In addition, the total acidity (TA) will help you understand the perceived sweetness of the finished cider and can be found using an acidity test kit.

## SULFITE AND PECTINASE

Sulfur dioxide, or $SO_2$, is a chemical compound used by winemakers to help keep their wine protected from the negative effects of oxygen exposure as well as spoilage micro-organisms. $SO_2$ management is beyond the scope of this column, suffice to say it is also important to be aware of it in cidermaking. For more on the subject, please visit https://winemakermag.com/article/634-solving-the-sulfite-puzzle. This is a process that requires accurate pH level measurement.

For North American apples that are fairly sharp, you are looking for a dosage of 40 to 50 ppm of $SO_2$ — this equates to adding 1.8 grams (just less than a 1/2 teaspoon) of potassium metabisulfite that is dissolved into some juice and mixed into the must 24 hours prior to pitching the yeast. If using Campden tablets, four in a 5-gallon (19-L) batch will provide 50 ppm of $SO_2$. Please use caution and don't consume or smell the freshly sulfited juice.

The usage of pectic enzyme or pectinase breaks down some of the pectin chains in the juice, which will help the cider clear once fermentation is completed. This is an optional step, and I made cider for 20+ years without it, but have now used it for the past 3 years as a commercial cidermaker. Think of this treatment as an insurance policy, it doesn't hurt and provides increased odds that the cider will be perfectly clear when finished. For my operations, any pectin in the fermented ciders could damage our filtration system.

## FERMENTATION MANAGEMENT

This is the most critical step, and applies to beer and meadmaking as well. The yeast being kept in an

### Chart 1: Fruits, sugar contents, & tasting notes from Michael Fairbrother's ciders.

| Fruit | Gravity | Notes |
|---|---|---|
| Raspberry | 1.036 | Lightly tart, works well with sweet cider. |
| Blackberry | 1.043 | Slightly sweet, works well with drier ciders. |
| Black Currant | 1.047 | Tart, wine-like, works well from dry to sweet. |
| Boysenberry | 1.052 | Great depth, like it in a semi-sweet cider. |
| Tart Cherry | 1.036 | Well-balanced, semi-sweet to sweet. |

Photo by CShutterstock.com

ideal environment will only make for a better fermented beverage. Each yeast is different, for how much nutrients it requires, what temperature it likes to ferment at, how aggressive it is towards other microbes, and the other characteristics it creates.

I exclusively use Lalvin Narbonne 71B-1122 for all the cider that we make and follow the optimal yeast rehydration protocol from Lallemand. Ideally, you are looking to maintain a ratio of 1 part yeast to 1.25 parts yeast rehydration nutrient. For this strain, fermentation works best at 64–68 °F (18–20 °C).

Non-grape fruits are often low in nitrogen; the result is that the yeast creates hydrogen sulfide. Nutrients like Fermaid O can remedy this, and supply the yeast with the missing nitrogen. At about 1/3 of the way through fermentation, add 1 teaspoon of Fermaid O. Additionally, using the Tailored Organic Staggered Nutrient Addition (TOSNA) process like a lot of commercial meadmakers follow for their meads, would also work. The TOSNA process uses Fermaid O along with a Go-Ferm addition that is added when hydrating the yeast. Fermaid O is added in equal size increments at 24, 48, and 72 hours after pitching the yeast, and lastly at either one week or when the 2/3 sugar break is complete. The size of the Fermaid O addition is dependent on the nitrogen requirements of the yeast, original gravity of the must, and batch size. The formula to determine the total Fermaid O addition is:

Initial Sugar (g/L) x Nutrient requirement x batch size (gal.) / 50 (ppm) = Total Fermaid O (grams)

For more on the TONSA-2 method, visit www.meadmaderight.com. BYO

*Michael Fairbrother began making ciders and meads in 1995 and opened Moonlight Meadery in Londonderry, New Hampshire in 2010.*

# HOPPED CIDERS

BY GLENN BURNSILVER

To paraphrase William Shakespeare, who probably quaffed his fair share of hard cider: "To hop, or not to hop, that is the question?" At least, that's the going question for modern cidermakers looking for new methods of enhancing their ciders, while simultaneously attempting to attract craft beer drinkers to the cider fold.

"It's something a little bit different for your craft beer drinker looking for familiar flavors," says Devin Britton, Cidermaker of the Highland, New York-based Bad Seed Cider Company. "There is a huge demographic of craft beer drinkers. We needed to make something for them. It was an effort to bridge that gap."

Britton's ciders are but two of a double handful of hopped ciders now found in the United States. Some brands attempt to emulate traditional beer IPAs with big, floral-forward notes and citrus-packed aromas, while others simply highlight or add complexity to an already flavorful product. Many former beer drinkers have also discovered hopped cider as a gluten-free alternative beverage. The hops provide the essence of beer in the cider, without the prohibitive gluten.

"You've got the floral, citrusy and grapefruit notes (of an IPA), but it's missing the malt," Finnriver Farm & Cidery Cidermaker Keith Kisler says, a fact he proudly advertises on his cider. "It's the next best thing for people who can't drink beer anymore, but still want that (hoppy) flavor."

The idea of dry hopping cider originated with Salem, Oregon's Wandering Aengus Ciderworks — planted by a Washington brewery that blended its cider with an IPA. This introduced beer drinkers to the idea that hops "worked really well with the sweet apple character of the cider," explains Wandering Aengus founder Nick Gunn. When a brewer suggested adding hops to cider, Gunn initially thought it was "a little crazy," but after a few attempts, the results "really blew us away."

"When you drink a good cider, you're looking for those subtle lemon, citrus, grapefruit notes in the background," Britton explains. "Hops work naturally with cider because you're infusing those flavors into it. It enhances the key flavors you're looking for in a cider."

"We were after something unique and interesting in our cider," Kisler concurs. "It was like, well, let's put some hops in there. And we all were surprised at how much we liked it."

## HOP SELECTION

The concept of dry hopping cider works on the same principle as dry hopping beer. Once the cider has aged and is ready to be bottled, that's the time to add the hops. Hop selection is crucial to development of balance and flavor components that highlight a cider. Use the wrong hops and the apple flavors can get masked or off-flavors can compete with the central cider taste.

"We're looking for hops that would come through but also allow the apple aromas to come through, and we found that a challenge," says Citizen Cider Works Head of Product Development Bryan Holmes, who is based in Essex, Vermont. "Sometimes you get a lot of hop aroma, but that apple aroma gets masked. Finding that balance is a delicate thing for sure."

Looking at the hops and what they're traditionally used for in brewing beer is not really that helpful. Hops used in dry hopping do not impart bitterness since they are not heated and no isomerzation of alpha acids takes place. Instead, only hop aromas and flavors are imparted to the cider. So before tossing just any hops into the carboy, it's important to determine the desired hop characteristics of the finished product.

The key is lining up the right hops with the apple flavors present, which varies with apple varieties used. As many ciders tend to be floral, citrusy, lemony and crisp, popular hop choices typically fall along the lines of the fruity hops IPA beer makers gravitate towards. These include Cascade (most commonly used), Citra®, Palisade®, Amarillo®, Simcoe®, Galaxy, Sorachi Ace, Nelson Sauvin and Centennial.

"We've been playing around with some Galaxy, Simcoe®, Citra® and other designer hops," Gunn says. "They do some real knockout things to cider."

Interestingly, traditional bittering hops like Galena or Fuggle are also be utilized by cidermakers. Since isomerization does not take place, the normal bitterness attained in beer

production isn't added. Instead, these ciders benefit from the earthy or nutty tones they impart.

"That's kind of the trick. It all depends on what you want that end aroma to be," adds Marcus Robert of Tieton Cider Works in Yakima, Washington, who uses three hops — Fuggle, Cascade and Palisade® to add complex notes to his hopped cider. "If you want it be more earthy and round, you might use an older variety like Fuggle or a noble hop."

Of course, the idea is to have fun experimenting with these hops. Most cidermakers recommend breaking down a finished cider into smaller sample sizes and adding different hops to each, taking notes and then using the varieties that best suit the maker's palate. What this entails is simply pouring small samples of cider in wine glasses, adding a pellet or two of hops and covering them with a plate to allow the hops to dissolve and then smelling the headspace to evaluate the hop aroma.

"We're constantly playing around and trying new (hop varieties). Some of them we put on the paper: 'Never again,'" Britton says with a laugh.

Both pellets and whole cone hops can be used. An advantage to pellets, Gunn explains, is the increased surface area, which imparts more hop aroma. Other cidermakers swear by whole cones for the freshness and crispness they impart. Either should do the job, though one consequence of using pellets is the mess they leave behind when they dissolved.

"As long as you rack carefully," Gunn says, laughing about the mess he encounters with pellets, "you can get some amazing extraction."

## DUMP THEM IN

The next question to address is the best method for putting the hops on the cider. As with homebrewing, it's a personal choice. To avoid the mess mentioned above, Britton puts his pellet hops in a large, weighted grain bag that he floats in the middle of his tank. A lot of other cidermakers simply throw hops into the cider.

A third option is using a hop back. Tieton uses a "Torpedo-like" device, similar to what Sierra Nevada Brewing uses in its Torpedo beers, which speeds up and enhances hop oil extraction.

Gunn, however, doesn't think any fancy equipment is necessary to achieve solid results, at least not on a homebrew scale: "You can try filtering through Torpedos and all kinds of things," he says. "As far as homebrewers go, you don't need any high tech materials, just toss them in."

## HOW MUCH FOR HOW LONG?

As with hopping methods and varieties in brewing, the volume of hops used for hopped cidermaking is also subjective. Most cidermakers recommend approximately 2 ounces (57 g) per 5-gallon (19-L) batch. Hops varieties like Citra® or Simcoe® are more pungent than say, Cascade, so a little goes a long way. Again, it all comes down to final flavor.

"Cider is a little more delicate than most beers. It's like working with a Pilsner or a lager, very light, crisp and clean," Robert explains. "(Hops) can overwhelm the cider."

Once the hops are in the cider, most cidermakers agree the best thing to do it just let them sit.

"We're careful about opening the tanks," Britton says. "We're careful about oxidation because we don't want to use sulfites (like $SO_2$ used in winemaking) to combat it."

Another hopping idea is the two-step hop, which Gunn employs for some ciders. Add a portion of the hops — half or more — at the start, then add the rest for the final three days for a floral blast right out of the bottle.

The duration the hops sit on the cider also plays a key role in final flavor. Too long and the hop essence can take over, not long enough and the subtleties are lost. Yet, there is no "set time" to leave the hops on the cider. Cidermakers soak between three days and three weeks. The key is regular sampling to get the flavor you want.

## ADDING BITTERNESS

Cider doesn't carry the malt base to balance much bitterness, but it doesn't mean a little bitterness can't work in some ciders. To do this either heat a portion of the cider, or all of it, to between 170–190 °F (77–88 °C) and add some hops. There's no set time to leave the hops in — 30 minutes should be sufficient — but be careful not to boil the juice.

"Stay away from cooking because you can denature some acids and caramelize sugars during the cooking process," Robert says, which leads to burnt sugar flavors.

## GET HOPPING

In the end, hopping cider all comes down to your own preferences. If you understand how to dry hop a beer, you also understand how to dry hop a cider. From there it's a matter of experimenting with different hop varieties at different quantities until you get the desired flavor profile, then bottling the cider.

Holmes sums it up simply: "Let soak, taste, soak, taste. Just keep tasting until you hit that point to where you're like, 'this is good!'"

# ICE CIDERS

BY JEREMY OLSEN

I had my first encounter with ice cider in a seminar at the 2014 Homebrew Con and made my first batch that fall. At the time, there wasn't much information about it in the homebrewing world and I could only find one commercial example locally. Today I am consistently judging excellent examples in competitions and local cideries are starting to produce more and more ice cider. With a little work and effort, as a homebrewer you can make excellent ice cider.

A relatively new cider style, ice cider or cidre de glace originated in Quebec in the early 1990s. It has quickly developed into the provincial specialty, earning in 2014 a designated geographic protection, which regulates commercial production of ice cider.[1]

Made by freeze concentrating apple cider prior to fermentation, ice cider is the cider equivalent of ice wine — sweet and thick with complex layers of flavor. There are two different freezing methods utilized to produce the concentrated apple cider must needed for fermentation. It should not be confused with applejack, which is typically "jacked" by freeze distillation or the additional of alcohol after fermentation, lending a completely different flavor profile and mouthfeel.

Photo by Charles A. Parker/Images Plus

## CRYOCONCENTRATION VS. CRYOEXTRACTION

Cryoconcentration is the most common method of freeze concentrating the apple cider, accounting for 90–95% of all commercial production. It is also the method used for homebrewing due to its ease for anyone who does not have a cider orchard in their backyard. Through this method, apples are harvested at peak maturity and pressed just like they would be for traditional cider production. On the commercial scale, the juice is stored until winter temperatures drop below freezing, when at that time the juice is moved to outdoor tanks and allowed to freeze solid in the natural cold of winter. It can take a month or more to fully freeze, with the natural day/night temperature fluctuations creating freeze/thaw cycles that help separate the water crystals from the sugar.

Once frozen, it is moved to a warmer area and slowly thawed as the initial runnings are collected. The freezing point for apple sugars are lower than water, so upon thawing the sugar-concentrated juice will thaw first and drain off, in effect separating the sugar from the water, which remains as ice. Quebec commercial producers typically will stop the thaw process when the specific gravity of the collected run off is between 30–35 °Brix (1.129–1.154 SG) (by Quebec ice cider definitions, the starting gravity must not be any lower than 30 °Brix/1.129 SG). The regulations also stipulate that all freezing must be done by natural cold and not artificial refrigeration, the residual sugar of the final product must be at least 140 gm/L, and producers cannot add any sugars to artificially boost the gravity.[1]

Additionally, Quebec commercial producers of ice cider must cultivate at least 50% of the apples in their own orchard, and all picking, pressing, and fermentation must occur on-site.[2]

The second freeze concentration method is cryoextraction, which

involves pressing frozen apples. Cortland apples, commonly used for cryoextraction, if not picked, will hang on the tree into winter, slowly dehydrating due to the sun, wind, and cold. Once temperatures drop below 14 °F (−10 °C) for a couple of days in a row, the apples are picked, crushed, and pressed immediately. Other apples that do not stay on the tree are picked in the fall and frozen whole in large totes until it is cold enough outdoors to crush and press. Producers can control the starting gravity of their must by intentionally pressing the apples at warmer or cooler temperatures — even a change of just a few degrees will result in a different sugar-to-water ratio extracted from the apples. Colder apples will result in lower volumes with a higher sugar concentration of the must.

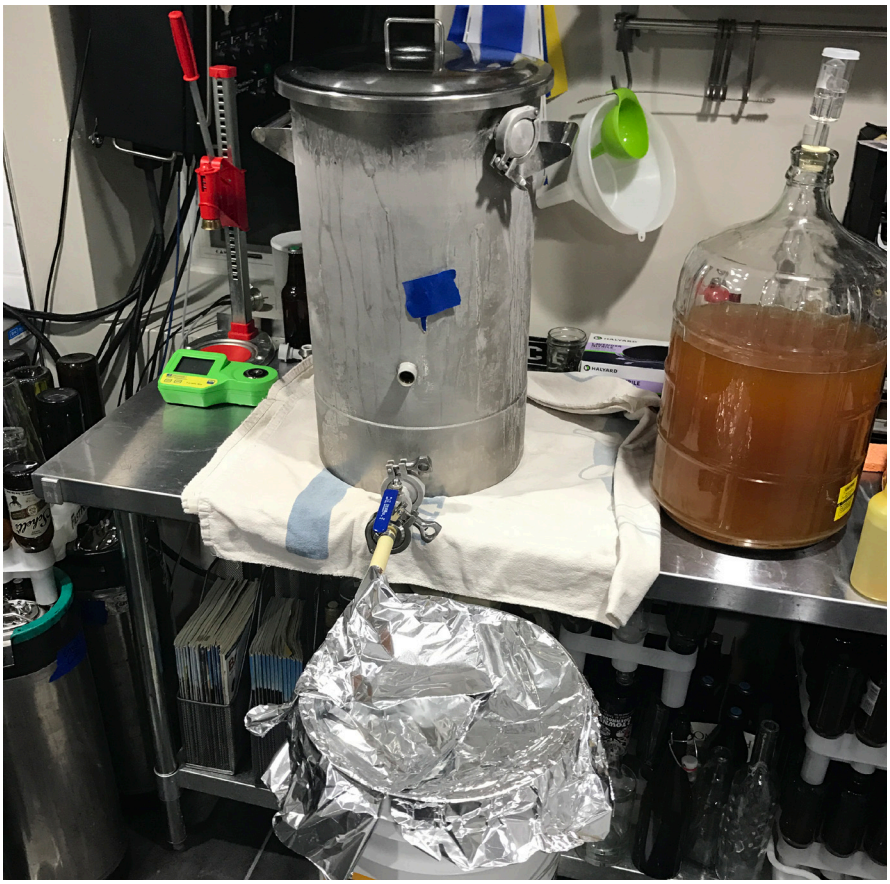
Though more time-consuming and resulting in a lower extraction percentage compared to cryoconcentration, cryoextraction produces a distinctly more complex flavor profile, with some caramel, toffee, and cooked apple flavors that develop during the extended hang time on the trees. On the other hand, ice ciders produced by cryoconcentration tend to produce ice ciders with brighter, fresh apple flavors.

While most cider styles benefit from the use of cider-specific apples, it is preferred to use table or hand apples for ice cider. The high tannin and acid levels of traditional bitter sharp and bitter sweet cider apples become even more concentrated in an ice cider, giving you a finished cider that is severely unbalanced. Cortland, Macintosh, Sparten, and Empire are common varietals used in Quebec, along with some new varietals bred specifically to hang on the tree until harvest, being ideal for cryoextraction.[3] I have had very good luck with the drinking blends produced by my local orchards — there is just enough acid and tannin to balance, but it doesn't become overwhelming when freeze concentrated.

## MAKING ICE CIDER AT HOME

Start by sourcing your fresh juice. I recommend calling local orchards to inquire about bulk purchase or

*Making ice cider requires freezing the apple juice. In my experience, it can take a week or more to freeze 10 gallons (38 L) solid. Doing this in a vessel with an outlet at the bottom makes collecting the thawed juice easier.*



*Collect the concentrated juice as it melts and check the gravity regularly so you can halt collection when the sugar concentration of the juice reaches your gravity.*

Photos by Jeremy Olsen

checking out your local farmers market in the fall. As in sourcing any fresh fruit juice, it is critical that the cider is unpasteurized — UV pasteurized cider is perfectly fine and will ferment with any commercial yeast pitch, but pasteurized juice with added potassium sorbate or sodium benzoate will not ferment. Commercially-produced shelf-stable apple juice or frozen concentrate will not give you the depth of flavor you are looking for in an ice cider — I have done trials with these in the past, but wasn't happy with the results. This would be the time to add pectic enzyme if you want, although I have not found it necessary to produce brilliantly clear ice cider. Do not sulfite the fresh cider at this point — the freeze concentration will also concentrate the sulfites into the run off, which will produce a tasty apple drink that is quite unfermentable, in my experience.

Pour the juice into a sanitized bottling bucket, carboy, or other vessel, leaving a couple of inches (~5 cm) of head space to allow for expansion during freezing. I use my 10-gallon/38-L bottom outlet mash tun from Stout Tanks and it works perfectly for this, but a bottling bucket with a spigot would work too. I recommend propping up the back to allow for rapid draining of the must as it melts. The key is draining liquid as it melts — this will give you the best extraction volume. Do not use a regular bucket and plan on intermittently pouring out the melting must as it will be very difficult to hit your target gravity by collecting the juice in larger portions like this.

After transferring the juice to your vessel, loosely cover with a lid or aluminum foil. You do not want to seal it, especially if using a glass carboy, as this may cause the vessel to break as the juice turns to ice and expands. Move it to somewhere that it will freeze and leave it until the juice is frozen solid. I find the 10 gallons (38 L) of cider in my kettle takes at least a week at 20 °F (-7 °C) in an upright freezer. The trick is to make sure the center is frozen solid — if it isn't, you will quickly have run-off of unconcentrated juice. Sanitize your collection container and slowly begin the thaw process. If using a carboy, place upside down over a collection bucket, making sure there is clearance for it to drip down and collect without filling up over the mouth of the carboy. Additionally, I have found wrapping my tank in blankets helps insulate and slow the thaw. My best extractions have taken between 18–24 hours.

Photo by Jeremy Olsen

*What remains after thawing is nearly all ice with very little sugar.*

Under ideal conditions, at a maximum you will collect 20% of the thawed volume you began with. Start checking the gravity with a refractometer once you get close to this volume, making sure to stir well prior to your measurement to prevent stratification of the must causing false gravity readings. A refractometer is key here given the overall low volumes of the concentrated must making it difficult to use a hydrometer. Stop the collection based on the original gravity (OG) of your must (note that the actual volume will vary based on the gravity of your starting cider and efficiency of the cryoconcentration process). If you overshoot, no worries, just freeze and thaw a second time. What remains behind is nearly all ice with very little sugar. It is not worth the effort to melt and refreeze this, you will get an extremely small amount of additional concentrated must.

Shoot for a starting gravity between 1.129–1.154. It is possible to go up to 1.180 and still be able to ferment with the right yeasts. Ice ciders with starting gravities above 1.154 can benefit from barrel aging as the wood-derived tannins will help balance the higher residual sweetness. Once the run off is complete, measure the pH and sulfite to 50 ppm. I would recommend waiting

until you are done with the run off to sulfite as you don't want to over-sulfite based on an expected volume that wasn't achieved. Given the cold temperatures of the run off and high gravities, I have never had any issues with wild yeasts starting to ferment during the collection phase.

Once collection of the concentrated juice is finished, oxygenate and add yeast nutrients. I prefer Fermaid O and generally shoot for a slightly lower amount than would be added to a mead of a similar gravity. Apples are naturally low in yeast assimilable nitrogen (YAN) so you need some yeast nutrient, but you don't want to encourage too rapid or vigorous of a fermentation.

White wine yeasts work well for ice cider and I have had good luck with 71b, D21, D47, and Wyeast 4184 (Sweet Mead) yeast. Many Quebec producers also use Champagne yeast, although on a home level Champagne yeast will be more challenging to use and get the fermentation to stop at the desired time.

Warm the must to fermentation temperature and temper the rehydrated yeast with small amounts of the must before pitching. Ferment at the low end of the selected yeast's temperature range. I ferment in my basement, which is around 60 °F (16 °C) in the winter. If you do not have a naturally cool location, then a temperature-controlled fridge/freezer will be required. The fermentation of ice cider is cool and slow. For commercial producers, a 6–8 month fermentation is typical, while on the homebrewing scale, I have found my fermentations are complete within a month or two.

There may be a lag period of several days before you start to see signs of active fermentation. A good rate of fermentation would be a drop of two gravity points a day. As ice cider should have a residual sugar of at least 140 g/L and ABV of 9–13%, this cool fermentation is key to stopping it when it has reached the desired gravity. The best way to control your fermentation speed is to carefully manage the temperature — you can always drop the temperature of your fermentation a couple of degrees if it is going faster than desired. Patrick Fournier at Vignoble Et Cidrerie Coteau Rougemont in Rougemont, Quebec, shared with me another method he uses to slow fast ferments if cooling doesn't work, which is to rack off the lees during fermentation. This effectively removes nutrients from the must and will slow the fermentation.

Start checking your gravity daily once you are about 10 points higher than your desired finishing gravity (a residual sugar of 140 g/L equates to a FG of 1.056). I have found that final gravities 1.060–1.070 are ideal for what I am looking for in my own ice ciders. Don't fear the high final gravity — you're not making a saison. Given the relatively small volumes of fermenting ice cider on the homebrew scale, I recommend using a refractometer to limit volume loss during gravity checks. I use the EasyDens by Anton Paar that only requites a few milliliters per reading. I think this would be a very good application for a floating hydrometer, such as a Tilt hydrometer. I have never had enough volume to leave a standard glass hydrometer in my fermenter.

Crash cooling to 25 °F (-4 °C) and adding sulfite should stop your fermentation. I have had good luck with my ice cider dropping clear in 2–3 weeks at 25 °F (-4 °C). You may need to rack 2–3 times or add a clarifying agent of your choice if not brilliantly clear. Due to the nature of the slow fermentation, the yeast and haze proteins will drop, resulting in a brilliantly clear product. Commercial producers often sterile filter, but I have not found a need for filtration or other clearing agents in home production. If you end up with a stuck fermentation that is a little sweet, or you miss your desired final gravity and it ends up too dry, save this for blending. It makes the perfect back-sweetener for other ciders or cyser. Or save to blend with other batches of ice cider. I often make several batches every fall, and definitely notice some differences between early and late season batches. Blending is your friend and will really help get the acidity and sweetness just right.

Once brilliantly clear, sulfite one more time to 50 ppm, bottle, and let age for a couple of months to help the flavor and acidity mature and mellow. If you have them, 375 mL clear Bordeaux or Bellissima bottles are perfect for showcasing the rich, dark golden color of your ice cider.

Ice cider has its own Beer Judge Certification Program (BJCP) category, C2D and I refer you to those guidelines for the BJCP style description. At the time of writing, the BJCP guidelines require the entrant to specify the starting gravity, the final gravity or residual sugar, and alcohol level. Ice cider is the only cider category to require such entry specifications, although this may change with future guideline updates.

Ice cider has quickly become my favorite bottle to pull out at tasting events or when having friends over for dinner. It is sweet, with just enough acidity and tannin to balance the sweetness and not come across as cloying. It pairs well with desserts, blue cheeses, or standing alone as an after-dinner aperitif.

In my conversation with Fournier, his recommendation for crafting an excellent ice cider is to "balance the sugar and acidity. Alcohol should be the third wheel." I couldn't agree more. Ice cider is an exercise in balance — sweet but not cloying, a perception of alcohol but not a booze bomb. BYO

## REFERENCES


[1] https://cidreduquebec.com/en/the-cider/quebec-ice-cider-designation/

[2] https://corridorcanada.ca/resource/le-cidre-de-glace-delectable-fusion-du-terroir-et-de-lhistoire/?lang=en

[3] https://goodfruit.com/ice-cider/



*Jeremy Olsen has been homebrewing since 2008, with a focus in recent years on ciders and meads. He is known for his ice ciders, wining several Best of Shows and a NHC final round gold medal.*

# BUILD AN APPLE SCRATTER

BY GRANT BRADDISH

Fall in New England conjures up images of brilliant orange and red foliage, arts and crafts fairs, and anticipation of the first frost. While most homebrewers are starting to think about pumpkin ales and holiday cheer recipes, cidermakers are focusing on what apples are coming into harvest. Whether heading out in late August for Paula Reds or Galas, or waiting until a crisp mid-October morning to pick Macoun or Liberty apples, there are dozens of varieties to choose from to make a fresh pressed cider. Personally, I prefer a good mix of apples for my cider. Some tart and some sweet fruit seems to add all the right flavors when drinking fresh juice or fermented cider.

For years I would head to orchards, pick from my backyard trees and even shake apples loose from the wild trees in the woods. I borrowed a friend's old fashioned, single-tub press with a hand-cranked grinder or "scratter" to pulp the fruit and squeeze out the juice using a long screw pressing down into a bucket. Every year I would notice how the scratter would create large chunks of apple in the tub that would remain moist even after turning the pressing screw and a using "persuader" (often an old wooden baseball bat) for extra leverage. I figured there had to be a better way. This is the point when tradition was aided by modern technology.

I started researching how production cideries grind their apples and found that it usually doesn't involve some old-timer hand cranking a cylinder with small teeth to break up the apples. In fact, most large-volume cidermakers use an industrially designed, motorized pulverizer. This led me to a small-scale, innovative farmer based in upstate New York who fashioned a 1 horsepower electric farm motor to a disassembled garbage disposal to grind up apples for cider pressing. I first became aware of Herrick Kimball through his home-designed chicken plucker, as I raise broiler chickens every summer. After building a plucker based on his plans, I knew that he was onto something. When I found that he was also a backyard cidermaker, I was pleased to see he had re-thought the old fashioned grinder into a modern version to produce higher yields and with less effort. While Mr. Kimball re-powered his disposal with a separate motor and connected them by a belt, I figured that after spending approximately $100 on a new disposal, why would I remove the built-in motor?

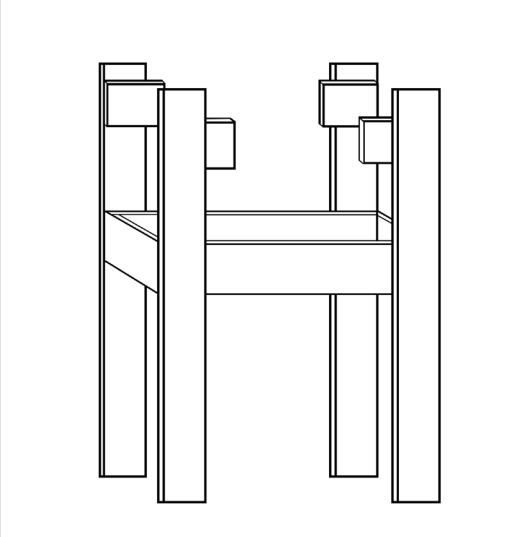
Luckily it has worked for many years and I am able to produce an almost applesauce consistency for pressing in my homemade rack and cloth cider press. In fact, compared to the old days of hand cranking, I'm able to produce almost twice the amount of cider from the same weight of apples.

**Materials and Tools:**

- ~ 20 feet (6 m) 2x4 lumber
- ~ 18-inch by 18-inch (45-cm by 45-cm) piece of countertop (or ply wood)
- Garbage disposal
- Light switch
- Weatherproof light switch housing
- Potable water plumbing pipe with friction fitting for outlet
- 6-8 inches of 1x1 wood trim
- 6 inches of 1/4-inch round stock
- 12 feet (3.7 m) 14-gauge out door rated extension cord
- Power drill
- Jigsaw

## 1. COLLECT MATERIALS & BUILD THE FRAME

I wanted to keep my costs to a minimum, so I searched the rafters of my garage for scrap lumber to build the frame. You could head to your local lumberyard and choose clear oak or other hardwood, but I just grabbed some pine 2x4s to screw and nail together as a frame. I also had a small piece of inexpensive countertop that I cut to house the disposal. Finally, because I would be consuming what came through the disposal, I was more comfortable buying a new stainless steel model.

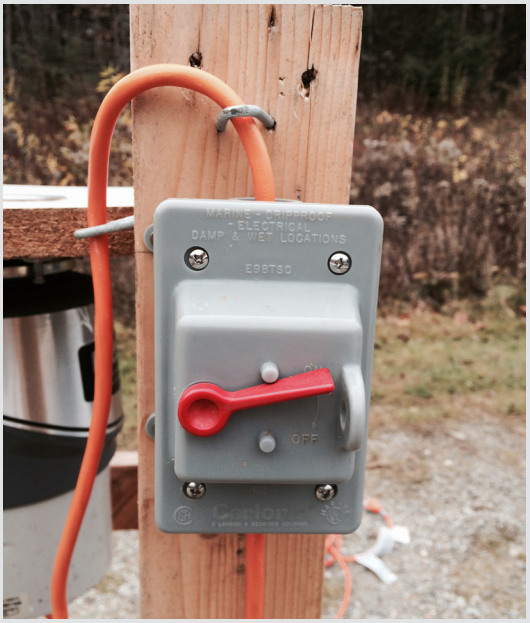


## 2. CUT TO FIT THE DISPOSAL AND INSTALL

Follow the instructions that come with the disposal to disassemble the mounting flange. Mark and measure your countertop for the proper hole size. I used a jigsaw to cut the countertop and assembled the motor just like it would be in a sink. In fact, if you have a sink and would prefer it to making a countertop, this would work just as well.


## 3. WIRING & POWERING THE DISPOSAL

To allow the grinder to be mobile, I power it using a 14-gauge extension cord rated for outdoor use. By cutting off the female power head and stripping back the wires, I was able to connect it directly to the disposal. To allow more control of turning the scratter on and off, I installed a simple in-line light switch in a weather proof housing that I mounted to the frame. NOTE: Electricity and liquid do not mix. I highly recommend using a ground fault circuit interrupter (GFCI) cord connector at the male end to plug into the wall. This ensures that if there is any short due to moisture or juice that the power will stop immediately. In the alternative, only plug your grinder into a GFCI outlet, like those found in kitchens and bathrooms.



## 4. CREATE AN APPLE "FENCE" TO CORRAL THE FRUIT WHILE PREPARING

While preparing apples for the scratter, I find that cutting them in half allows them to fit in the opening easier. This also provides a flat surface for the shredder teeth to grab hold of so the apples don't just spin around in the grinder. Having a "fence" to ensure that apples tossed on the counter don't fall off saves a lot of time and frustration. I used some scrap 1x4 molding I had and screwed it together at the corners to create the frame. You can screw this to the legs above the countertop or leave it so that it can be removed.

## 5. ADD A SPOUT FROM FOOD GRADE PLUMBING PIPE

Cider is acidic and you are planning on ingesting it, so locate pipe that is meant for potable water or marked as "food grade." You can add any length, a downspout, or any configuration that works for you. My spout is at a height that a 5-gallon (19-L) pail fits easily underneath for collecting the pomace.

## 6. USING AND MAINTAINING

I made a 6-inch (15-cm) persuader out of 1x1 stock with a cross guard made of 1/4-inch (~0.5 cm) round stock so that I can't drop it all the way into the grinder. The 1x1 allows you to push apples into the flange without risking your fingers! Never put your fingers near the garbage disposal!

I recommend rinsing your apples before pressing. I soak them in a half-barrel of sanitizing solution to kill off most wild yeast and wash off any other microbes. Then I cut the apples in half or quarters so that the teeth have a flat surface to "bite" into the fruit.

Be sure to thoroughly wash the grinder before and after each use. Cover the drainpipe and pour a light soap solution into the grinder. Turn it on for 15–30 seconds and then uncover the outlet to let it drain. Provide a good rinse (or even repeat with sanitizer) to wash away any soap.

If you are storing the grinder where mice or other rodents may want to explore, be sure to cover the inlet and drain during storage. My disposal came with a plastic stopper for the inlet and you can cover the drainpipe with a PVC cap or even a few layers of aluminum foil secured with a rubber band. BYO

# BUILD A CIDER PRESS

BY PAUL BRANNAN

A small cider press can cost hundreds of dollars. It is not difficult, however, to build your own press using inexpensive materials. The design of the press is flexible, to take into account the variation in the materials you can find. To get an idea of the trade-offs you can make, it is useful to look at what the press has to do.


## POMACE

After you gather and wash your apples, the first step is to crush or mill them into a kind of pulp, known as pomace. Some juice will be released in the crushing process — and the rest must be extracted by pressing.

The pomace must be held in a container when being pressed, and traditionally this was done by wrapping it in a cloth square to make a "cheese." Each cheese is assembled in the cheese former, a simple frame (as shown in photo 1). A number of such cheeses are stacked vertically in the press. Underneath, a tray (shown in photo 2) collects the juice and directs it to a container. Above the cheese levels is a flat plate which applies pressure. It is possible to place slatted wooden separators between each cheese during pressing to provide flow channels for the juice, but this is not essential. Around the tray, cheeses and top plate is a strong frame, and between this frame and the top plate is a device which exerts the pressure — such as a screw jack or hydraulic jack.

Once the maximum amount of juice is extracted, the pressure is released and the pressed pomace discarded. The apple juice can then be made into cider — or in the case of juice made from eating apples, drunk directly.

## THE PARTS OF THE PRESS

### The juice tray

This is a good place to start your design, as the dimensions of the juice tray determine nearly all of the other component dimensions. The base of the tray must be fairly strong, and have a surface that will not contaminate the apple juice or be damaged by its acidity. An offcut of laminate countertop is a cheap solution. A standard kitchen countertop is 25–26 inches (64–66 cm) deep, and the ones based on MDF/particle board with a thickness of around 1 1/4 inches (~3.2 cm) will be fine. The tray can be square or slightly rectangular, although it shouldn't be too wide as this increases the deformation of the horizontal frame beams when the press is used.

Next, glue and screw a softwood lip on each of the four sides (as shown in photo 3); 4 inch x 3/4 inch lumber is about right for this. Bore a hole in one of these sides to take a length of plastic water pipe; the hole must be level with, or fractionally lower than, the bottom of the tray. A pipe with an internal diameter of around 1 inch (2.5 cm) makes cleaning easier. Seal and varnish the softwood lipping using polyurethane varnish.

There needs to be some kind of locating arrangement on the underside of the juice tray to prevent it from slipping sideways in the press frame. This could either be a tongue that fits between the lower frame members,

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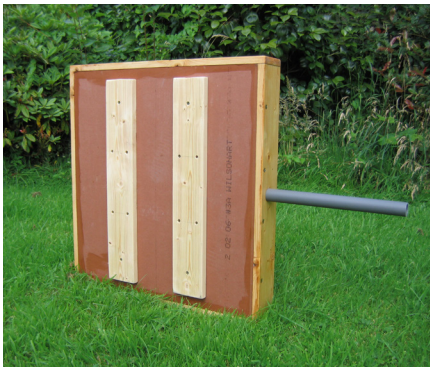

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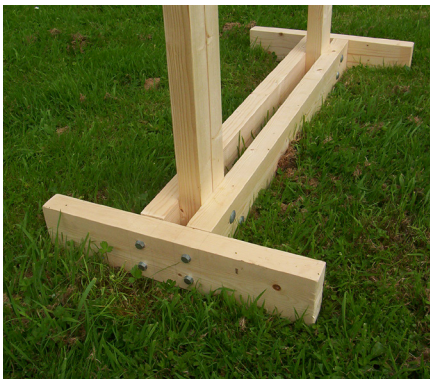

or slats which fit on either side of the frame (as shown in photo 4).

**The "cheese" former and cloths**

Traditionally, a cloth made from natural fibers was used for wrapping the cheeses of pomace. A better solution now is either plain nylon sheer curtain fabric or maybe shade cloth. Allowing for the cheese to be completely wrapped with some overlap, each cheese cloth would ideally have a minimum dimension of twice the interior size of the cheese former, plus a couple of extra feet.

To make a cheese, you place the cloth centrally over a rectangular (or square) frame — as shown in photo 1 — to give the cheese its form. As the cheeses must be a bit narrower than the juice tray, and allowing for the fact that they tend to spread slightly under pressure, it's a good idea to make the interior dimensions of the cheese former about four or five inches smaller than those of the tray, say 20–21 inches (51–53 cm).

For the first cheese, the former is placed directly on the tray. For the later cheeses, you will need a couple of wooden slats to support the former on top of the cheese underneath, to stop it sliding down. The dimensions of these slats are not critical, provided that they are longer than the width of the cheese former. Again, these slats should be coated with polyurethane varnish. Once the cheese has been folded, slide the slats out and place them on top of the cheese ready for the next layer. (Photo 9 shows the cheese former and slat, resting in the tray.)

**The Press Frame**

The rectangular press frame is built from planed softwood lumber, roughly 2" x 4" (5.1 x 10 cm) in section, although it might be better to increase the upper cross beams to 2" x 6" (5.1 x 15 cm) to resist bending forces. (Photos 5, 6 and 7 show the important details of the frame. The parts list gives the parts you would need to build the press as shown.) There is no real benefit to building a stronger frame than this with a view to increasing the pressure of the press, unless you also reinforce the juice tray and top plate. In any case, the extra pressure isn't going to make a big difference to the volume of juice extracted. The top and bottom horizontal beams are double, both to resist bending forces and to provide a more stable base for the juice tray.

The width of the frame needs to be very slightly larger than the juice tray. The height depends on the number of cheeses and the minimum height of the jack which applies the pressure. The frame members are attached to each other using carriage bolts with washers under the nuts. Mark the wood with a pencil where the drill holes will go. Double check your measurements carefully before drilling the holes.

For stability, short cross beams are attached to the ends of the lower frame members using hex lag screws. When using the press, it is easier to place it on a table or workbench to have a convenient working height, and also so that the apple juice can be poured directly into a container. The length of the juice outlet pipe depends on the size and shape of the table supporting the press, and where you can position the collecting container.

**Other Components**

Once the stack of cheeses is in place, you need to add a top plate to spread the load of the jack across them. This can be a pine board or an offcut of a table top, with about the same dimensions as the juice tray. This should be varnished on both sides. Make sure that there are no sharp edges or corners on any part of the press which could damage the cheese cloths. (The fully-assembled press is shown in photo 8.)

The easiest way to apply pressure to the cheese stack is with a car jack; a hydraulic bottle jack is probably the simplest type to use. As the head of these jacks is usually quite narrow, there needs to be a hardwood board — or better still, a steel plate — between the two upper cross beams of the press frame against which to push.

Whatever type of jack you use, it will usually have limited travel, so as the cheeses are compressed, you will need to add wooden blocks to fill the gap between the top plate and the jack. At first, this is fairly easy; later

6

7

8

9

on, the cheeses tend to spring back as the pressure is released, making it difficult — if impossible — to add further blocks. A variety of block thicknesses could help.

## MILLING THE FRUIT

If you don't have a fruit mill, there are other ways to crush or pulp the apples. You could put them in a strong plastic tub and crush them using a length of 4" x 4" lumber fitted with a cross piece to act as a handle. Alternatively, you can buy simple rotating blades that attach to an electric drill. For safety — and to reduce mess — these are used in a pail with a lid; the shaft of the blade passes through a hole in the lid. For large volumes, though, you may want to buy or build a fruit mill.

## OPERATING THE PRESS

Assemble the press and clean the parts which will come in contact with the apple juice — tray, cheese former, top plate. You can crush the apples in advance and keep the pulp in sealed containers for a day or two, if necessary. Position a collecting container under the juice tray outlet pipe. If this is going to be the fermenting vessel, it's best to sanitize it first using sodium metabisulfite. Six-gallon (23-L) fermenting barrels work well.

Make the first cheese of apple pulp by filling a cloth laid over the former frame. Fold over the ends of the cloth to close the cheese. Next, remove the cheese former, lay the slats on top of the first cheese. Then, place the cheese former on top of the slats and prepare the next cheese. Repeat until you have a stack of five or six cheeses. Remember that you can add slats between cheeses, to serve as juice channels, as you go.

Place the top plate on the cheese stack, and position the hydraulic jack between the top plate and the press frame. Add extra pieces of lumber as spacers if necessary.

Start applying pressure to the cheese stack with the jack. Once the jack reaches the end of its travel, release the pressure and add more spacing lumber before pressing again. Continue until the amount of juice produced tails off. After the press is used, it should be cleaned before being put away.

## STEPS

1. Every "cheese" is assembled in the cheese former, a simple wood frame.
2. At the bottom of the cheese former is a tray that will collect the juice.

3. The next step is attaching a softwood lip on each of the four sides with glue and screws.

4. The base of the frame needs to have a locating arrangement, such as slats, that fit on either side.

5. The press frame is built from planed softwood lumber.

6. It would be best to use 2" x 6" (5.1 x 15 cm) wood for the upper cross beams to resist bending forces.

7. The width of the frame needs to be slightly larger than the juice tray.

## PARTS AND MATERIALS

**Frame:**

Lower horizontal beams: 3 ft 4 in x 2 in x 4 in (2)
Upper horizontal beams: 3 ft x 2 in x 6 in (2)
Uprights: 4 ft x 2 in x 4 in (2)
Supports: 20 in x 2 in x 4 in (2)
Carriage bolts: 5/16 in or 3/8 in x 7 in (8)
Hex nuts: 5/16 in or 3/8 in (8)
Flat washers 5/16 in or 3/8 in (16)
Hex lag screws: 5/16 in or 3/8 in in x 5 in (8)

**Juice tray:**

Laminated countertop: 25 in x 25 in x 1 1/4 in (1)
Tray sides: 25 in x 4 in x 3/4 in (2) 25-3/4 in x 4 in x 3/4 in (2)
Bottom slats: 20 in x 4 in x 3/4 in (2)
Flat head wood screws: No.8 1 3/4 in (40)
Juice outlet pipe: 1 in diameter plastic water pipe, length variable

**Cheese former:**

Sides: 21 in x 4 in x 3/4 in (2) 21 3/4 in x 4 in x 3/4 in (2)
Flat head wood screws: No.8 2 in (8)
Support slats: 32 in x 4 in x 3/4 in (2)
Waterproof PVA glue
Polyurethane varnish

# HARD CIDER RECIPES

## BASIC HARD CIDER

(5 gallons, 19 L)
Estimated OG = 1.060
Estimated FG = 1.000
ABV = 7–9%

*Use this base recipe to play around with different strains of yeast. Try making a large batch of this as a base and splitting it into five 1-gallon (3.8-L) carboys and fermenting with five different yeast strains to see what you can get.*

### INGREDIENTS

2 bushels assorted fresh apples
5 Campden tablets
½ oz. (14 g) pectinase powder
table sugar (optional)
tartaric acid (optional)
2.5 Campden tablets (secondary)
Yeast (of cider maker's choosing)

### STEP BY STEP

If starting with fresh apples, use a mix of sweet and tannic/bitter apples. Before you begin, sort out any spoiled fruit. Then crush the good fruit. If starting with pre-pressed or store-bought cider, skip ahead to pitching the yeast.

Remove a sample of the juice to test for total acidity (TA). You can do this using an acid testing kit (available at homebrew retailers). Follow the instructions in your acid testing kit. If the acidity is less than 0.65%, add tartaric acid to bring it to this level. If you cannot do the test right away, refrigerate the juice and run the test later. Now test the sugar content of the juice with a hydrometer. Correct any deficiencies by adding enough sugar to bring the reading up to 14–15 °Brix (1.057–1.061 SG).

When these tests and corrections have been completed, add one Campden tablet per gallon of crushed fruit right away (65 parts per million $SO_2$). Stir in the pectinase powder. Wait 2-4 hours before pressing the pulp in the cider press for the pectinase to break down the pulp, which increases the amount of juice that can be extracted. It will also aid in clarifying the cider to achieve a clear, bright cider.

Press the pulp to separate the juice from the skins and other solids. Funnel the juice into sanitized fermenters that can accept an airlock. Only fill them three-quarters full. Wait a total of 8–12 hours after crushing and adding the Campden tablets for the sulfite to dissipate.

Pitch your yeast. For recommendations, see the list starting on page 9. Attach an airlock to your fermenter and allow fermentation to proceed. After a day or two of fermentation, sprinkle in 1 tsp. of yeast food or yeast nutrient. Agitate to disperse.

Allow the cider to ferment to dryness, usually less than a month. When visible signs of fermentation end the cider should be removed from the sediment. Use a siphon to transfer the cider to a secondary fermenter. Fill your container all the way into the narrow part of the neck without touching the stopper (no airspace). Close the top with a stopper and replace the airlock. During the racking at the end of fermentation, add ½ Campden tablet per gallon (3.8 L) (32 parts per million $SO_2$).

Store for two or three months. Carefully rack the cider away from the sediment, making an effort to avoid exposure to oxygen. If your cider is going into extended bottle storage, add another half Campden tablet per gallon (32 parts per million $SO_2$). Beverages such as this may often be enjoyed within two months of bottling. If you plan to drink some that soon, don't add additional sulfite to that portion at bottling time.

Siphon into bottles, cork or cap them, and set them aside for whatever bottle aging is needed. If you wish to sweeten, add to taste, a syrup made by boiling two parts sugar with one part water, and add ½ tsp. Potassium sorbate per gallon to prevent re-fermentation in the bottles.

**Tips for Success:** If your first attempt at cider tastes flat, add a teaspoon of tannin per 5 gallons (19 L); you can find tannin at homebrew and home winemaking suppliers. You can also raise the total acidity, as needed, with a small amount of tartaric acid.

To raise the alcohol of the cider, add sugar prior to fermentation, to raise the sugar content to 17–18 °Brix (1.070–1.074 SG), a customary level for traditional New England-style ciders. Small amounts of brown sugar or molasses may be used for part of the sugar.

## RED FLANNEL CIDER

(5 gallons/19 L)
OG = 1.095 FG = 0.998
ABV = ~12%

*A classic New England barrel-style hard cider.*

### INGREDIENTS

5.5 gallons (20 L) of fresh apple cider, pasteurized or not*
5 lbs. (2.3 kg) sugar: a combination of white sugar, brown sugar, a bit of molasses, honey, raw sugar
2.5 tsp. yeast nutrient
2.5 tsp. pectic enzyme
2 packages of dry wine yeast or Wyeast 4767 (Port Wine™) yeast
1 oz. toasted or untoasted oak chips (optional: soak in rum, bourbon, calvados, etc.)
1 lb. (0.45 kg) raisins

*If your cider is not pasteurized you might want to add one Campden tablet per gallon (3.8 L) to the cider, wait 24–36 hours, then add the sugars, other additives and yeast. Do not try to ferment cider that has been treated with sorbates.

### STEP BY STEP

Dissolve the sugars in a small part of the cider and then mix that back into the main volume of cider. Stir well. Add the yeast nutrient and pectic enzyme and stir again. Record the starting gravity. Add the yeast and keep the fermenter sealed with an airlock at 60–75 °F (15–24 °C) until fermentation is complete. Siphon the cider into a 5-gallon (19-L) carboy. Keep the cider under an airlock until it clears. Add the raisins. When the raisins have settled out, cover the oak chips with boiling water, strain off the water and add the chips to the carboy. A typi-

cal fermentation can last three to six weeks depending on the temperature in your homebrewery and another two to six months to clarify. Once the cider is clear you can bottle it with or without carbonation. If you want to carbonate the cider you can add a scant teaspoon of corn sugar (dextrose) per 22-ounce bottle or add two or three organic raisins per bottle. For 5 gallons (19 L) of hard cider you can also boil ½ cup of dextrose in some water and add it to the cider before bottling.

1 gallon (3.8-L) option: Scale down to 1.25 gallons of fresh apple cider, 1 lb. (0.45 kg) sugar (combination listed in ingredients above), 0.5 tsp. each of yeast nutrient and pectic enzyme, 1 package of dry wine yeast or Wyeast 4767 (Port Wine™) yeast, 0.25 oz. (7 g) toasted or untoasted oak chips (optional: soak in rum, bourbon, calvados, etc.), 4 oz. (113 g) organic raisins (brown or red flame).

## KRIEKY CHERRY CIDER

(5 gallons/19 L)
Estimated OG = 1.070
Estimated FG = 1.000
ABV = 8–9%

*If you have unpasteurized apple juice, you can also let this cider ferment on its own with whatever wild yeast strains are present in the juice. Skip sanitizing the cider with Campden tablets and do not add the Belgian yeast; add Lactobacillus culture during secondary fermentation if a stronger sour-tart flavor is desired.*

### INGREDIENTS

5 gal. (19 L) apple juice blend
3.1 lbs. (1.4 kg) Vintner's Harvest cherry purée (more if needed)
5 Campden tablets (if juice is unpasteurized)
2.5 tsp. pectic enzyme powder
Yeast nutrient, added according to manufacturer's instructions
2.5–5 tsp. acid blend (if needed)
0.75–2.5 tsp. tannin (if needed)
Safbrew S-33 or a favorite Belgian ale yeast
White Labs WLP653 (Brettanomyces lambicus) or Wyeast 5526 (Brettanomyces lambicus) yeast
Wyeast 5335 (Lactobacillus) or White Labs WLP677 (Lactobacillus delbrueckii) culture
1 cup corn sugar (if priming)
Champagne yeast (if priming)

### STEP BY STEP

Pour the juice into a sanitized fermentation bucket. If using unpasteurized juice, crush the Campden tablets and whisk into the juice. Seal the lid, attach an airlock, and wait 24 hours for the juice to sanitize. If using pasteurized juice or if you prefer not to use sulfites, skip this step.

Add one 49 oz. (1.5 L) can of the cherry purée, the pectic enzyme, yeast nutrient, and Belgian yeast to the juice. Whisk vigorously until the ingredients are dissolved and the juice is frothy. Seal the fermenter, attach the water-filled airlock, and place somewhere away from direct sunlight and at room temperature, 70–75 °F (21–24 °C) for primary fermentation.

Primary fermentation will take 1 to 2 weeks. When active fermentation seems complete, transfer the cider to a carboy and add the Brettanomyces yeast and the Lactobacillus. Continue aging the cider for another 3 months (or even up to a few years) to develop the flavor, occasionally transferring off the lees. Add acid blend, tannin, or additional cherry purée for a stronger cherry flavor at any point during secondary fermentation.

Bottle with priming sugar and Champagne yeast, or keg and set to 3 volumes $CO_2$.

## BOYS N BERRIES

4 gallons (15 L) sweet apple cider
1 gallon (4 L) boysenberry puree
4 Campden tablets
1 packet Lalvin Narbonne 71B-1122 yeast
1.5 tsp. Go-Ferm

## CRIMES OF PASSION

4.5 gallons (17 L) sweet apple cider
0.5 gallon (2 L) black currant juice
4 Campden tablets
1 packet Lalvin Narbonne 71B-1122 yeast
1.5 tsp. Go-Ferm

## RAZZ WHAT SHE SAID

3.5 gallons (13 L) sweet apple cider
1.5 gallon (6 L) raspberry juice
4 Campden tablets.
1 packet Lalvin Narbonne 71B-1122 yeast
1.5 tsp. Go-Ferm

### STEP BY STEP

These steps are for the three recipes above. Add juices and Campden tablets to a sanitized fermenter. Place sanitized airlock onto fermenter and wait 24 hours. After the 24 hours, prepare yeast by adding the 1.5 tsp. of Go-Ferm to ½ cup of hot water and mix. Let the mixture cool to 104 °F (40 °C) and then add the active dried yeast. After 15 minutes (yeast should begin to foam), stir well to mix the yeast into a slurry. Pour the yeast slurry into the fermenter. Seal fermenter with a sanitized airlock and put fermenter in an area that is 65 °F (18 °C).

When fermentation stops and the specific gravity as measured by a hydrometer is stable (has not changed over the course of several days), it is ready to transfer the cider into a secondary fermenter. Sanitize your secondary fermenter and siphoning equipment. Carefully siphon the fruited cider into the secondary fermenter. Leave as much sediment as possible in the primary fermenter. Let the cider clarify in the secondary fermenter. You may wish to add a fining agent such as isinglass to facilitate clearing, and/or potassium sorbate to prevent further fermentation.

At this point in the process you're going to want to taste your cider and see what final adjustments need to be made. This is where your skills really will shine as you need to balance the acidity, and sweetness.

I recommend using sanitized siphoning equipment to pull a small amount of cider to sample, and if needed, then back sweeten to taste and stabilize. Options for back sweeting are limitless — you could use fruit juice, sugar, honey, etc. The challenge is not to ruin what you have worked so hard at. The fermentation process causes particular matter to drop, and when you rack off the sediment it results in your clear finished product. If you were to add juice to back sweeten, you should expect that this will leave some sediment in the fruited cider. However, you can get a rather amazing fruit note by adding juice to the finished fruited cider.

If you wish to bottle condition your

stabilized cider, wait 24 hours and then add priming sugar. Use a bottle-conditioning calculator to get the right carbonation level. Bottle conditioning will produce a dry cider and cannot be used if sorbate has been added to stabilize a sweet cider.

You can bottle or keg your fruited cider the same way you would your homebrew. Hard fruit ciders can be consumed after two weeks of bottling and aged for six months or more to achieve superior flavor.

## DRY-HOPPED HARD CIDER

(5 gallons/19 L)
OG = 1.060 FG = 0.998 ABV = ~8%

### INGREDIENTS

5.5 gallons (20 L) sweet apple cider
1.5–2 lbs. (0.7–0.9 kg) sugar
1 package dry Champagne yeast
Fermentation nutrients
(e.g. Fermaid K, DAP)
Yeast rehydration nutrient
(e.g. Fermaid Protect)
Potassium metabisulfate (KMS) or Campden tablets
Pectinase
Cascade Hops (whole or pellets)
Potassium sorbate (optional)

### STEP BY STEP

Sanitize your equipment using a product such as Star San. Do not use halogen-based sanitizers such as Iodophor. As soon as the cider is pressed and in the sanitized carboy, stir in 0.6 grams (0.12 grams per gallon) of potassium metabisulfite (KMS) for a target of 30 ppm free sulfites. Alternatively, you can use crushed Campden tablets to achieve 30 ppm free sulfites in 5 gallons (19 L).

To remove pectin and clarify the juice, add pectinase enzyme. Leave overnight and rack the juice into a sanitized carboy, leaving the sediment at the bottom of the first carboy.

Using your thermometer, rehydrate the dry yeast in 104 °F (40 °C) water with the yeast rehydration nutrient, following your yeast rehydration nutrient manufacturer's instructions. You do not want to add the yeast to your cool cider if the difference in temperatures of the yeast and the cider exceed 15 °F (8 °C). To avoid temperature shock, you should acclimate your yeast by taking about 10 mL of the cider and adding it to the yeast suspension. Wait 15 minutes and measure the temperature again. Do this until you are within the specified temperature range. Do not let the yeast sit in the original water suspension for longer than 20 minutes. Now pitch the yeast/nutrient/cider combination into the main volume of cider.

At the beginning of the fermentation, add a nitrogen source, such as Diammonium Phosphate (DAP) or Fermaid K. Follow the directions on the package. Often cidermakers will add half of the total needed nitrogen at the beginning of the fermentation and the second half after ⅓ of the sugars have been depleted. Use your hydrometer before the yeast is added to determine the initial sugar concentration and make measurements daily to know when to make the second nitrogen addition. A 10% sugar. Give the carboy a stir daily to rouse the sediment off of the bottom. Once the airlock has stopped bubbling and your hydrometer readings have stabilized just below 0.000 units, the fermentation has finished. Using a siphon, rack the dry cider into a clean, sanitized carboy. Add KMS or Campden tablets to bring the free sulfites up to 0.5–0.8 ppm molecular $SO_2$. 0.8 ppm will give you about 99% protection against spoilage where 0.5 ppm is the minimum for protection. The trade off is that sulfur aromas (matchstick) may be detectable at the higher molecular $SO_2$ levels. The amount of KMS or Campden tablets you need to add is based on the pH of the dry cider, so you have to measure the pH using a pH meter or with test strips. Alternatively, you could ask a local cidermaker, winemaker or brewer to make the measurement for you. Use an online sulfite calculator to calculate how many grams of KMS or Campden tablets you will need to reach your target $SO_2$ level (http://www.winemakermag.com/guide/sulfite). Initially, multiple additions may need to be made to get the target level. Do not make more than one KMS or Campden addition per day.

Allow the cider to age, settle and clarify. After it clarifies, rack the dry cider into a clean, sanitized carboy. Aging time can be two or more months. Maintain free/molecular $SO_2$ levels by using $SO_2$ test kits (e.g. Accuvin) every few weeks and adding KMS or Campden tablets as necessary.

### DRY HOPPING

After the cider has sufficiently aged, add around 1.4 oz. (40 grams) of Cascade hop cones or pellets to the carboy. Sparge the carboy with an inert gas to displace the oxygen in the fermenter. Carbon dioxide is a good choice if you already have it in your homebrewery for kegging.

After four to seven days, rack the cider off of the settled hops and bottle or keg. Continually taste the cider until you've reached the desired aroma/flavors/ Since hop compounds are especially sensitive to oxidation, keeping oxygen at a minimum by sparging for a few minutes with $CO_2$ will increase the shelf life and preserve aroma. To carbonate, shake the keg under about 30–40 PSI of head pressure for about 5 to 10 minutes while the keg is at refrigerator temperature.

For an off-dry or sweet cider, add about 50 to 400 grams (1.5 to 14 oz.) of sugar to the cider in a Corny keg. This should be done to taste. For off-dry, it is recommended here to start around 15 grams (~5 oz.) To prevent refermentation, add 3.5 grams (0.05 oz.) of potassium sorbate to the cider and refrigerate it at around 35 °F (2 °C) or below overnight. This cooling step must be done since the yeast must be dormant to prevent refermentation. To carbonate, shake the keg under about 30–40 PSI of head pressure for about five to ten minutes while the keg is at refrigerator temperature (between 35-38 °F/1.7-3.3 °C).

## SORACHI INDIA PALE CIDER

(5 gallons/19 L)
Estimated OG = 1.060
Estimated FG = 1.000
ABV = 7–8%

*Swap the Sorachi Ace hops for any other favorite hop. Citrusy, piney, and fruity hops all work well with cider.*

### INGREDIENTS

5 gal. (19 L) apple juice blend
0.35 oz (10 g) Sorachi Ace pellet hops (dry hop)
5 Campden tablets (if juice is unpasteurized)

2.5 tsp. pectic enzyme powder
Yeast nutrient, added according to manufacturer's instructions
2.5–5 tsp. acid blend (if needed)
0.75–2.5 tsp. tannin (if needed)
Safale US-05 or a favorite American ale yeast
1 cup corn sugar (if priming)

### STEP BY STEP

Pour the juice into a sanitized fermentation bucket. If using unpasteurized juice, crush the Campden tablets and whisk into the juice. Snap on the lid, attach an airlock, and wait 24 hours for the juice to sanitize. If using pasteurized juice or if you prefer not to use sulfites, skip this step.

Add the pectic enzyme, yeast nutrient, and yeast. Whisk vigorously until the ingredients are dissolved and the juice is frothy. Seal the bucket, attach the airlock, and place somewhere away from direct sunlight and at room temperature, 70–75 °F (21–24 °C) for primary fermentation.

Primary fermentation will take 1–2 weeks. Wait at least another 2 weeks (or up to 3 months) before bottling or kegging to give the cider time to clear and complete any remaining fermentation. If aging longer than 1 month, transfer the cider off the lees to a carboy.

One week before bottling or kegging, taste the cider; add the Sorachi Ace hops for dry-hopping, and add acid blend or tannin if needed. Taste periodically and adjust if needed.

Bottle with priming sugar or keg and set to 3 volumes $CO_2$.

## ICE CIDER

(5 gallons/19 L)
OG = 1.144 FG = 1.061
ABV = 10.9%

### INGREDIENTS

10 gallons (38 L) fresh-pressed, unpasteurized apple cider
7.5 grams Go-Ferm
6 grams Fermaid O
6 grams Lalvin 71B yeast
Sulfite

### STEP BY STEP

Pour the juice into a sanitized bucket or carboy and freeze until the juice is completely frozen solid. Once frozen, move the juice to a warmer location that will result in a slow thaw. Sanitize a collection container and collect the concentrated juice, checking the gravity with a refractometer once close to 20% of the juice has thawed and been collected. When the gravity of the collected juice reaches about 1.144, stop collecting the juice (should be about 2 gallons/7.6 L in my experience). You can continue thawing juice and checking the gravity to see if you can collect enough to make a small batch of a more sessionable ice cider as well.

Making sure to give the juice a good mixing, measure the pH and sulfite to 50 ppm accordingly. Oxygenate and add Fermaid O, shooting for a slightly lower amount than would be added to a similar gravity mead.

Warm the must to fermentation temperature and temper the rehydrated yeast with small amounts of the must before pitching. Ferment cool at the low end of the yeast temperature range. A good rate of fermentation would be a drop of two gravity points a day. Start checking your gravity daily once you are about 10 points higher than your desired finishing gravity.

Crash cooling to 25 °F (-4 °C) and adding sulfite should stop your fermentation. The cider should drop clear in 2–3 weeks, but if not you may need to rack 2–3 times or add a clarifying agent of your choice.

Once brilliantly clear, sulfite one more time to 50 ppm, bottle, and let age for a couple of months to help the flavor and acidity mature and mellow. BYO