

# Home Canning: The Basics

**Why learn to can?** Better quality food, lower food costs, pride and gratification. Plus, all the cool kids are doing it!

**What this series of classes will cover?** Water bath canning of jams/jellies or pickled foods.

## Core Safety Issues

#1 concern? Botulism. Only 15% of botulism cases are foodborne (65% is infant, 20% is wound). Of that 15%, most (11%) is from commercially prepared food or improperly handled normal domestic cooking. Only 4% is due to home canning. Not bad in the overall scheme of things, but we want that number to be ZERO. So...

Use the correct method for the food you are canning, for the correct amount of time.

- Water bath canning (THIS SERIES), done correctly, kills off badies and paralyze the rest with a low pH.
- Pressure canning kills 'em with extreme heat (we're not going to cover pressure canning in this series).
- A good seal means we keep out any new contaminates, giving us a minimum one year shelf life!

**Water bath canning.** Used for low pH (high acid) foods. Water bath canning kills off things like listeria and salmonella with heat. Inactivates other things, like botulism, with pH.

**Not every fruit or vegetable can be water bath canned...**unless you decrease their pH with vinegar, in which case they can be made safe (based on size of food, amount of vinegar, amount of heat, length of time in the water bath...use a tested recipe). See handout regarding pH of different fruits and vegetables.

**How to deal with canning low acid foods (above pH 4.6 – things like carrots, green beans, asparagus)?** Turn them into high acid foods (pickle/ferment them) OR pressure can them. NO other canning options!

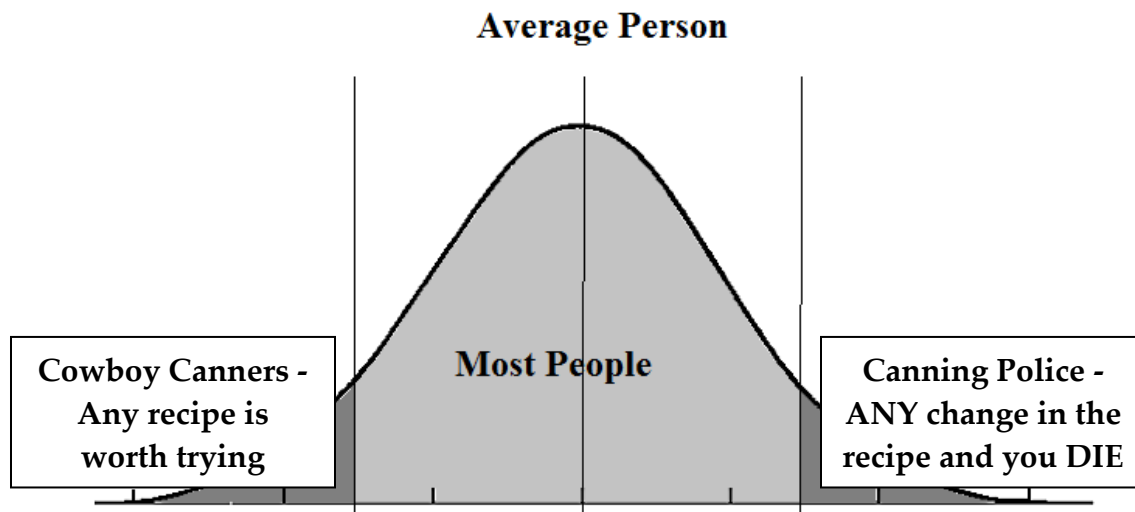
ALL canned food needs to be processed with heat after it is sealed, either with water bath canning or pressure canning. **NO** exceptions. Heat inactivates enzymes, yeasts and

other microorganisms that can thrive in unprocessed high acid foods, causing them to spoil. A seal is not an indication of safety.

### Unsafe methods:

- Using anything besides a water bath (or pressure canning) to can (oven, microwave, dishwater, crockpot, compost canning – seriously? What?) *Steam canning has recently been given the thumbs up, but I'm not personally familiar with it.*
- Not water bath canning (just putting food in jars, covering with hot liquid, and sealing – includes inversion canning).
- Using paraffin in jams. Unnecessary and pointless.

The two extremes. The **Canning Police** and the **Cowboy Cannery**. You'll find both in online groups. They fight a lot. Let's aim for an understanding of WHY we do what we do so we can make informed choices and stay out of the fight.



**Reputable recipe sources:** See attached list

### Disreputable sources:

1. Your grandma's old recipe. Anecdotal evidence ("my family has been making it this way for 50 years and no one has died") doesn't negate chemistry and science.
2. Canning books prior to 2009 (last big technique update) are out of date and should only be used with a lot of additional knowledge and comparison.
3. A recipe you found online with no source data.

**Why you shouldn't just "wing it".** Because formal testing looks at pH, heat transfer properties, food particle size, food viscosity and container size and usually has a large margin for error built in.



These are not things you can easily measure or predict in a home kitchen. **USE TESTED RECIPES!**

# Jams

## Why cooked/canned jams are shelf stable

Jams and Jellies get their preservation from 1) low pH – ie high acid and 2) sugar – which binds up the water in the mix and makes it difficult for things to grow and 3) water bath canning, which kills off any incidental microbes that may be in the air/on your equipment or fruit before it was canned. No water bath = not preserved (regardless of what your Grandma's old recipe calls for)!

### A note on water activity (*because science is cool!*)

Water activity (aw) is defined on a scale of 0 (bone dry) to 1 (pure water). *C. botulinum* generally cannot exist in an aw lower than 0.93. However, other pathogens can exist in environments with an aw of 0.86. The water activity of sugar is 0.85. What makes jams shelf stable is that the sugar and the pectin bind up a great deal of the water naturally found in the fruit. In doing so, they don't leave enough water free for any bacteria to grow.

## Natural Pectin in Fruit

Pectin is a long chain of carbohydrates called a polysaccharide. It's found in the cell walls of all land plants, helping to give structure to stems, leaves, flowers, and fruit. It's most concentrated in the skins and cores of fruit, with some types, like apples and citrus, having particularly high levels (see table of high and low pectin fruits).

When heat is applied to fruit, its cells rupture and pectin-rich fluids leak out. Once that happens, the pectin is then capable of forming that web-like structure that holds the fruit in place, forming a gel. But, without the right conditions, pectin dissolved in water is just a free-floating pectin molecules in liquid. Sugar and acid need to be added in the right amounts in order for the web-like structure to form. GREAT more in depth explanation of all of this here: [www.seriousseats.com/2014/08/jam-making-101-pectin-sugar-gel-point.html](http://www.seriousseats.com/2014/08/jam-making-101-pectin-sugar-gel-point.html)

In order to make traditional jam, you need LOTS of sugar in order to form this gel structure.

## Traditional Jam

Traditional jams and jellies, when you think about it, are basically candy. The USDA technically defines jam as consisting of 55 % (by weight) of sugar. These jams are thickened by 1) the natural pectin in the fruit 2) water evaporation while cooking and 2) the right amount of sugar and acid in the mix. This all results in a spreadable gel structure.

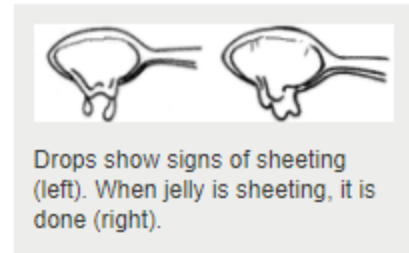
To make traditional jam, the fruit and sugar mixture is cooked down until it reaches the gel point. Jams are tested for doneness using several methods.

1. Temperature Test – Take the temperature of the jelly with a candy or jelly thermometer. When done, the temperature of the jelly should be 220°F, 8°F above the boiling point of water, if you are at sea level. NOTE: For each 1000 feet of altitude above sea level,

subtract 2 degrees F. For instance, at 1,000 feet of altitude, the jelly is done at 218°F; at 2,000 feet, 216°F, etc.

For an accurate thermometer reading, place the thermometer in a vertical position and read at eye level. The bulb of the thermometer must be completely covered with the jelly but must not touch the bottom of the saucepot. (Remember to test the accuracy of the thermometer by placing it in boiling water.)

I've personally not found this to be as accurate as one would expect.



2. Spoon or Sheet Test – Dip a cool metal spoon into the boiling jelly mixture and lift the spoon out of the steam so the syrup runs off the side. When the mixture first starts to boil, the drops will be light and syrupy. As the syrup continues to boil, the drops will become heavier and will drop off the spoon two at a time. When the two drops form together and "sheet" off the spoon, the jelling point has been reached.
3. Refrigerator/Freezer Test - Pour a small amount of boiling jelly on a plate, and put it in the freezing compartment of a refrigerator for a few minutes. If the mixture gels, it should be done. During this test, the rest of the jelly mixture should be removed from the heat.

### **Traditional Jelly**

Similar to traditional jam, but all of the fruit/pulp has been filtered out to produce a clear product. Are sometimes harder to make because some of the natural pectin in the fruit gets filtered out with the pulp. Jellies are beautiful, but they also generate a LOT of waste, as most of the fruit you start with is thrown away.

### **Fruit Butters**

Fruit pulp (think apple sauce) cooked down until it's very thick. Some sugar is usually added, but no additional pectin is needed. Usually made with apple, but can be made with any high acid fruit. Sugar, in this case, is really more to taste, as it isn't there so much to preserve the fruit – which is done by the high acid and low water content.

### **Lower Sugar Jams (what I make)**

Traditional jams and jellies have a long long shelf life. But...they generally start out with equal amounts of fruit and sugar by weight, and then that sugar is additionally concentrated by water evaporation. The fruit also tastes very "cooked", because it can take a long time to boil off enough water to reach gel stage. But there is a way to make jam with less added sugar.

Technically, according to the USDA, jams with less than 55% sugar are "fruit spreads".

Fruit spreads can be thickened by:

1. boiling them down and naturally concentrating the pectin (like a butter);
2. using added sugar and added pectin;
3. using no-sugar needed pectin.

### What is in store bought pectin? Is it natural?

The pectin found in commercial pectin is derived from fruit – usually from citrus rinds. In the case of the “low sugar” pectins, the pectin has been modified to be a low-methoxyl pectin, so that it will still create a gel with less sugar added. The boxed pectins also contain a bit of additional sugar (dextrose, sucrose) and some additional acid (citric acid, fumaric acid) and perhaps a bit of preservative (sodium citrate, calcium citrate). It comes in powder or liquid form.



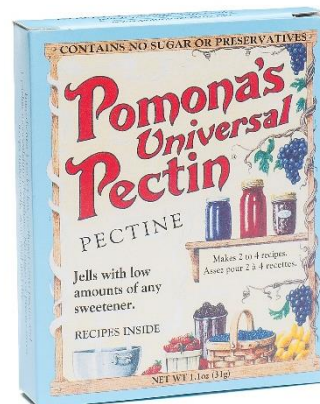
Note that Pomona's pectin works in a different way. It's a two part system, using pectin power and calcium powder to create a gel. With pomona's if you add TOO MUCH sugar, your jam won't gel.

*Note that with these low sugar pectins, you could technically make a jam out of a low acid fruit (ie something like melons). This is a BIG no no, as the high acid is what makes your jam safe. Follow package directions/recipes.*

Are boxed pectins natural the way an apple is natural? No. But then again, the sugar we use in jams is highly refined as well! For me, it's a worthy trade off to have a lower sugar fresher tasting product.

### Can I make a no sugar spread or an alternative sugar spread?

Yes, using the correct pectin product. Follow package directions (additional recipes can be found on the company websites). Know that your product will have a much shorter shelf life, as the sugar is also acting, to some extent, as a preservative.



## How I Make Jam

- Clean, rinse and process fruit (seed, hull, slice or crush into smaller pieces).
- Using a dry measuring cup, measure exact amount of prepared fruit and place into saucepan. Add any juice, zest or spices.
- Measure exact amount of sugar into large bowl
- Combine ¼ cup of measured sugar with Sure-Jell For Less or No Sugar Needed Pectin in a small bowl. Stir into fruit in saucepan.
- Bring mixture to full rolling boil, stirring constantly.
- Stir in remaining sugar. Return to full rolling boil and boil exactly 1 minute, stirring constantly. Remove from heat.
- Ladle jam immediately into prepared jars, filling to ¼ inch of tops. Wipe jar rims and threads. Cover with prepped mason jar cap. Tighten to the point when I feel the rim of the jar make contact with the sealing compound.
- Place jars on elevated rack in canner. (Water to cover jars by 1 to 2"). Cover and bring to a boil.
- Once canner reaches a boil, process 8 oz jars of jam 10 minutes.
- Remove jars from canner and let cool naturally on wire rack, checking for seal after product has cooled.

*A note on recipe size. The recipe should indicate how many jars of jam/jelly it will make. I find these estimates are almost ALWAYS off, and I have more jam than I have jars prepped. Throw in a few extra jars, just to be on the safe side.*

## Things I've Found Really Helpful

- Food Mill – great for removing pulp from peels on apples, pears, plums, tomatoes...
- Cherry pitter – will save you SO much time if you are into cherries.
- Kitchen scale – I like the Oxo brand. If you want consistency from year to year, measuring your recipe by weight rather than volume is invaluable. One cup of sugar = 7 oz.
- Food processor – makes short work of chopping
- Potato masher – great for crushing smaller berries.
- Jelly bags and stand – if you are into making jelly. I personally HATE trying to wash anything out of cheese cloth.
- 8 oz ladle – for pouring into jars
- Crock pot – for fruit butters.  
Cook down on low overnight with the lid cracked. Brilliant!





# Nuts and Bolts of Water Bath Canning

## Equipment

- Big pot with lid (tall enough to hold jars, water, and canning rack at bottom and still cover jars with water by 1" minimum). Granite Ware stinks. Rusts almost immediately. Buy aluminum or stainless
- Canning rack (or something to get jars off the bottom of the pot). Stainless if possible to avoid rust
- Jar lifter (trust me, you want one)
- Magnetic jar wand/bubble releaser
- Canning Funnel
- Jars/lids/rings

## Does and Don't

### Do:

- Follow a institutionally tested (extension, USDA) recipe
- Adjust for altitude if you are above 1,000 ft.
- Use the jar size called for in the recipe
- Substitute one vinegar for another as long as they are all 5% strength and the AMOUNT stays the same
- Adjust the amount of salt/sugar (within reason – this WILL affect flavor and storage length, but not safety)
- Substitute or decrease the type of dried seasonings (don't use fresh unless it's called for)
- Change out the variety of onions/peppers (ie bell peppers instead of hot peppers, red onions instead of white onions) but DON'T CHANGE total amount or substitute one for the other (ie don't sub all peppers if it calls for half pepper and half onion).
- Take good notes

### Don't:

- Use fat/oil unless called for
  - Interferes with proper and full heat penetration while you are processing the jar
  - Interferes with a good seal taking effect and holding
  - Goes rancid in the jar over time, whether there is a good seal or not
- Change the recipe, other than substituting spices (i.e. don't do things like double the amount of onions, or substitute one vegetable for another).

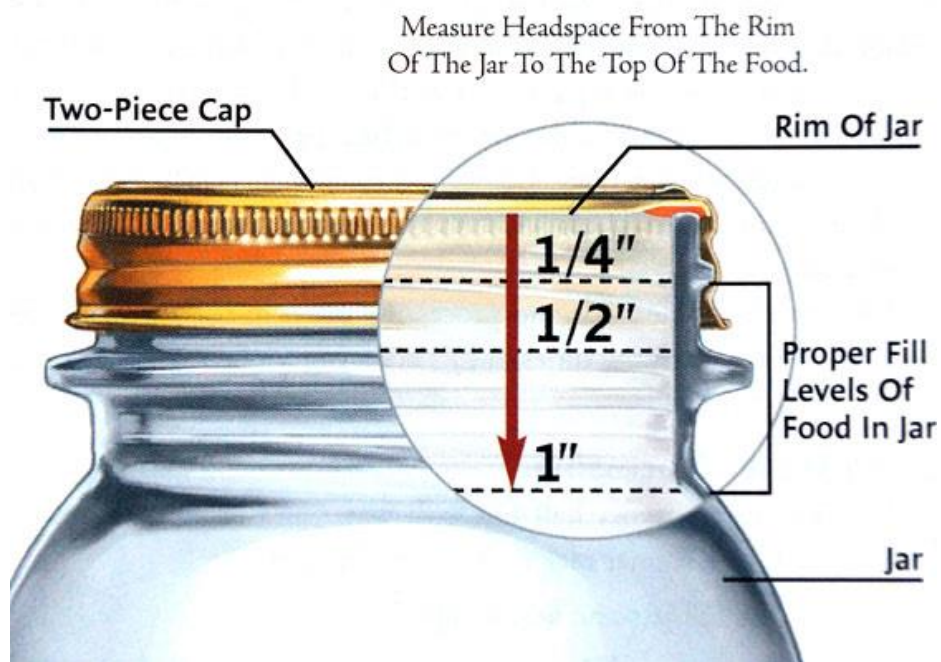


## Types of Packing: Raw or Hot

Most times, the packing method for the recipe is the one that delivered the best quality end product when it was tested. Raw pack is easy, but the food level and liquid volume of raw-packed jars will be noticeably lower after cooling, because air is exhausted during processing and the food shrinks. And, some foods, especially fruit, will float in the jars. The entrapped air in and around the food may cause discoloration within 2 to 3 months of storage. Hot pack is more work, but often has better results.

## Head Space

Fill to the level stated in the recipe



## Finger Tight Rings

Enough to hold the lid down on the lip of the jar, but loose enough to allow some air to escape. Don't crank on it, but don't be wimpy about it either. About ¼ turn past when you JUST start to feel resistance is good.

**If your time in the water bath is 10 minutes or more, you do NOT have to preheat the lids/rings.** (This is a fairly recent change so a lot of the older books will tell you to preheat. You still can if you want to, but it's no longer necessary).

**Timing**

Put your jars into water that is already almost boiling. Begin timing when your water comes back to a rolling boil. Remove jars when time is up and let cool to room temp on their own.

**Storage**

Label your jars with contents and date. Trust me on this! You won't remember a year from now what's in there or when you made it.

Remove rings! If a seal fails in storage, you won't know it if the ring is on.

## Canning Foods—the pH Factor

### What Does pH Have to Do With Canning Foods?

The acidity, or pH, of foods determines how they must be processed for canning. Acid foods such as fruits and pickles with a pH of 4.6 or lower may be canned in a water bath canner. Low-acid foods such as vegetables and meats with a pH above 4.6 must be processed in a pressure canner. *Clostridium botulinum* bacteria are the main reason why low-acid foods must be pressure canned to be safe. *Clostridium botulinum* spores can survive boiling water (212 °F) and grow in a sealed jar of low-acid food. The spores can change into the vegetative cells that produce the deadly botulinum toxin. You must use a pressure canner to raise the temperature to the desired 240–250 °F to destroy the spores during the canning of low-acid foods. Some foods, such as figs and tomatoes, may be processed as acid foods, but because they may have pH values slightly above 4.6, lemon juice or citric acid must be added before canning.

### Use a Tested Recipe

You do not need to know the pH of a food, but you must use a tested canning recipe based on the pH value of a food and other factors. In addition to pH, factors such as heat transfer properties, food particle size, food viscosity, and container size, influence the choice of an appropriate canning process. For this reason, use only tested recipes that consider all these factors. Sources of tested recipes include Clemson University's Home & Garden Information Center at <http://www.clemson.edu/hgic> and the National Center for Home Food Preservation at <http://www.uga.edu/nchfp/>.

### Approximate pH of Some Foods

Considerable variation exists between varieties, condition of growing and processing methods. The pH values shown are for the edible portion of foods in their normal and natural state, unless indicated otherwise.

#### Fruits and Vegetables—with pH values near or above 4.6—must add acid according to tested recipes to bring pH to 4.6 or below:

Figs, canned	4.92–5.00
Papaya	5.20–6.00
Tomatoes	4.30–4.90

#### Low-Acid Fruits—must pickle to lower the pH and process in a water bath canner:

Cantaloupe	6.13–6.58
Watermelon	5.18–5.60

#### Acid Fruits—may process in a water bath canner:

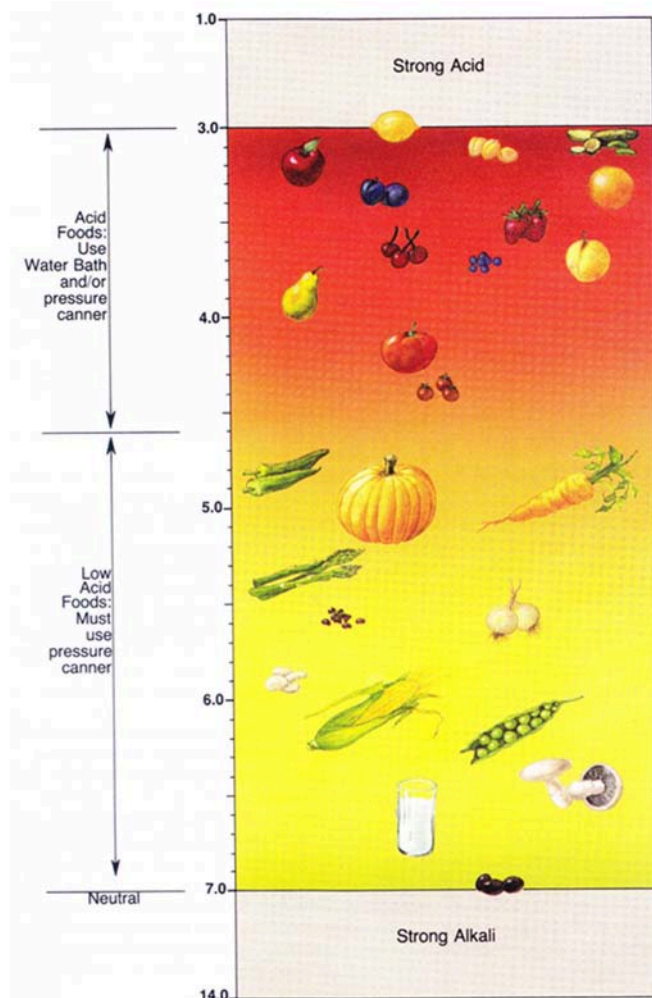
Apple	3.30–4.00
Blackberries, Washington	3.85–4.50
Blueberries, Maine	3.12–3.33
Cherries, California	4.01–4.54
Gooseberries	2.80–3.10
Muscadine grapes	3.20–3.40
Nectarines	3.92–4.18
Oranges, Florida	3.69–4.34
Peaches	3.30–4.05
Pears, Bartlett	3.50–4.60
Pineapple	3.20–4.00
Plums, Damson	2.90–3.10
Plums, Red	3.60–4.30
Raspberries	3.22–3.95
Strawberries	3.00–3.90

**Meat, Poultry and Seafood—must process in a pressure canner**

Beef (ground)	5.1–6.2
Chicken	6.2–6.4
Clams	6.0–7.1
Codfish, boiled	5.3–6.1
Crab meat	6.5–7.0
Ham	5.9–6.1
Shrimp	6.5–7.0
Veal	6.0
Oysters	5.68–6.17

**Low-Acid Vegetables—must process in a pressure canner or pickle to lower the pH:**

Artichokes, French (cooked)	5.60–6.00
Artichokes, Jerusalem (cooked)	5.93–6.00
Asparagus	6.00–6.70
Beans, Lima	6.50
Beans, String	5.60
Beans, pork & tomato sauce (canned)	5.10–5.80
Beets	5.30–6.60
Broccoli, cooked	6.30–5.52
Brussels sprouts	6.00–6.30
Cabbage	5.20–6.80
Carrots	5.88–6.40
Cauliflower	5.60
Corn	5.90–7.30
Cucumbers	5.12–5.78
Eggplant	5.50–6.50
Garlic	5.80
Hominy, cooked	6.00–7.50
Mushrooms	6.00–6.70
Okra (cooked)	5.50–6.60
Onions, yellow	5.32–5.60
Peas, Chick, Garbanzo	6.48–6.80
Peas (cooked)	6.22–6.88
Peppers	4.65–5.45
Potatoes	5.40–5.90
Pumpkin	4.90–5.50
Spinach	5.50–6.80
Squash, yellow (cooked)	5.79–6.00
Sweet Potatoes	5.30–5.60
Turnips	5.29–5.90
Turnip Greens (cooked)	5.40–6.20
Yams (cooked)	5.50–6.81



Adapted from USDA *Complete Guide to Home Canning* 2009 (Bulletin No. 539)

For more information on canning foods safely, see [HGIC 3025, Choose the Right Canner for Home Canning](#), and [HGIC 3040, Canning Foods at Home](#).

**Sources:**

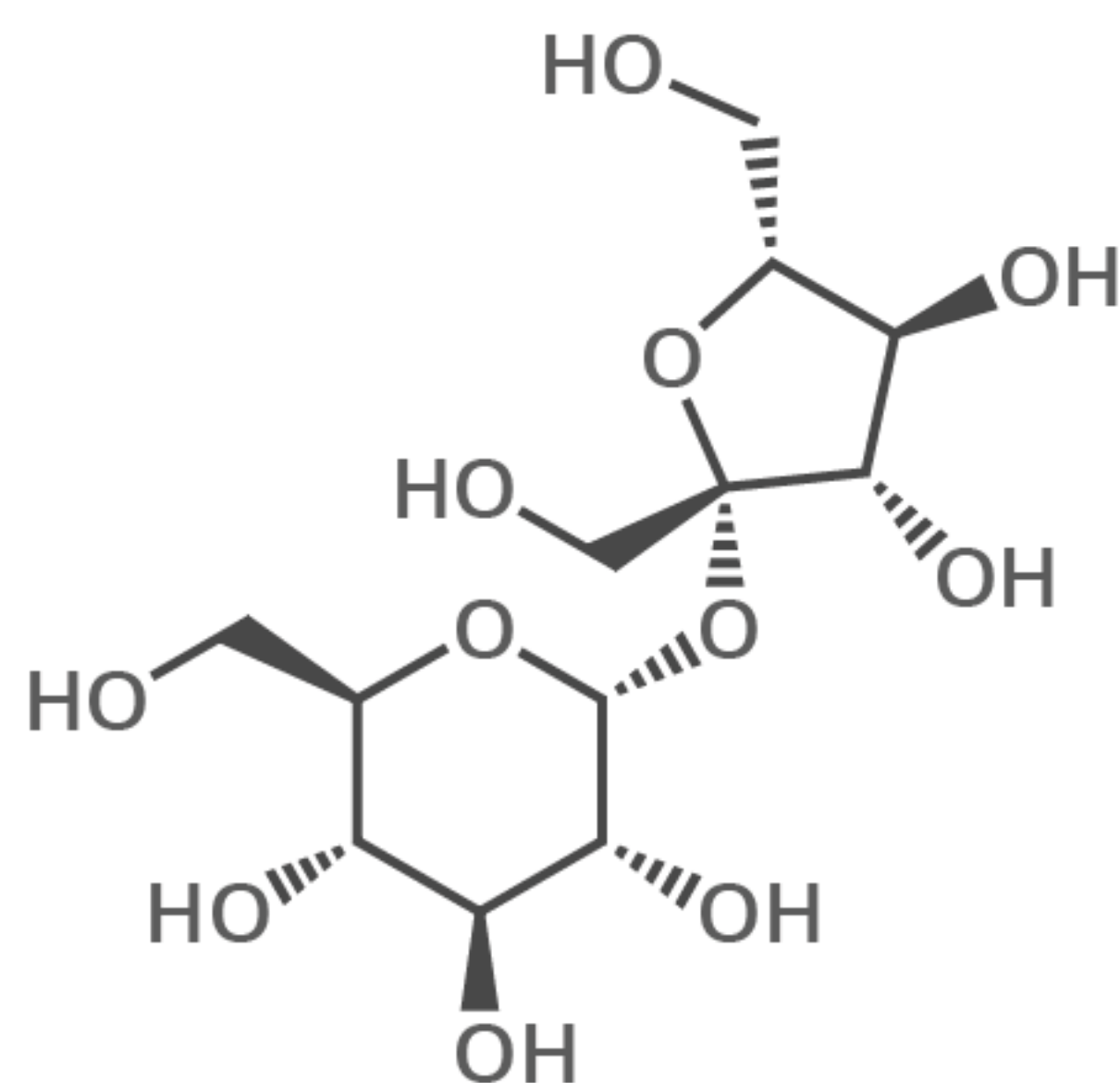
1. FDA. Evaluation & Definition of Potentially Hazardous Foods. December 2001.  
<http://www.fda.gov/Food/ScienceResearch/ResearchAreas/SafePracticesforFoodProcesses/ucm094145.htm>
2. FDA/CFSAN. Approximate pH of Foods and Food Products. April 2007.  
<http://www.foodscience.caes.uga.edu/extension/documents/FDAapproximatepHoffoodslac-phs.pdf>
3. Reynolds, Susan and Paulette Williams. So Easy to Preserve. Bulletin 989. Cooperative Extension Service, the University of Georgia. Fifth Edition revised by Elizabeth Andress and Judy Harrison. 2006.
4. USDA. Complete Guide to Home Canning. 2009. Bulletin No. 539.

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# THE CHEMISTRY OF JAM-MAKING

## SUGAR



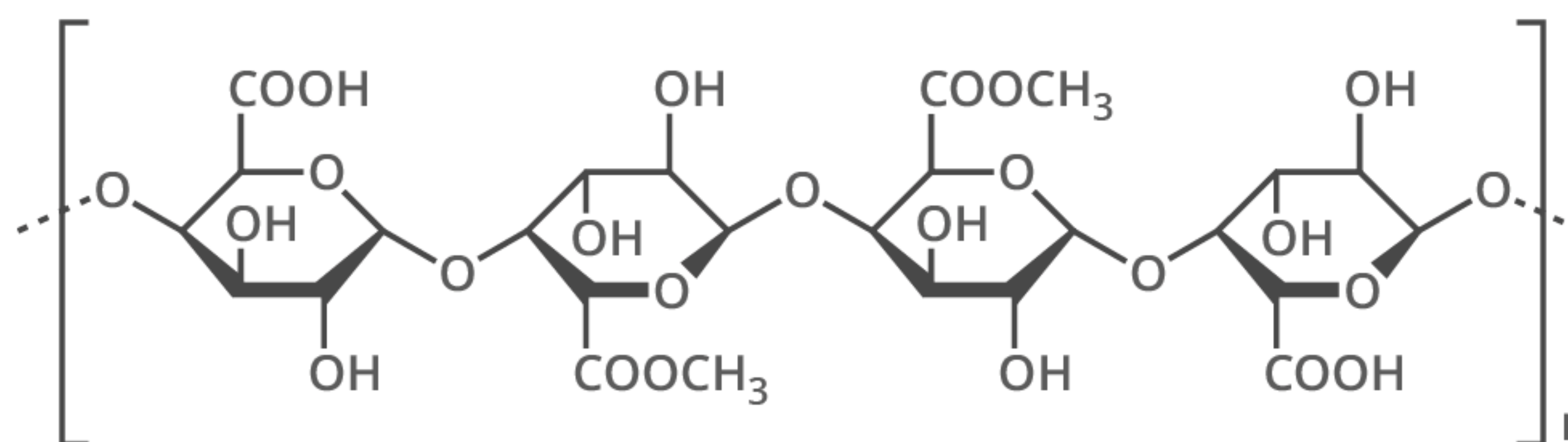
**SUCROSE**  
(table sugar)

The majority of jam-making recipes call for an equal weight of fruit and sugar. Sugar boosts the gel-forming capability of the jam by drawing water away from pectins. It binds the water, meaning that with high levels of sugar, there is no longer enough water available in the jam to support microbial growth, therefore imparting a natural preservative effect.

**65-69%**  
**REQUIRED FINAL SUGAR**  
**CONTENT OF JAM**

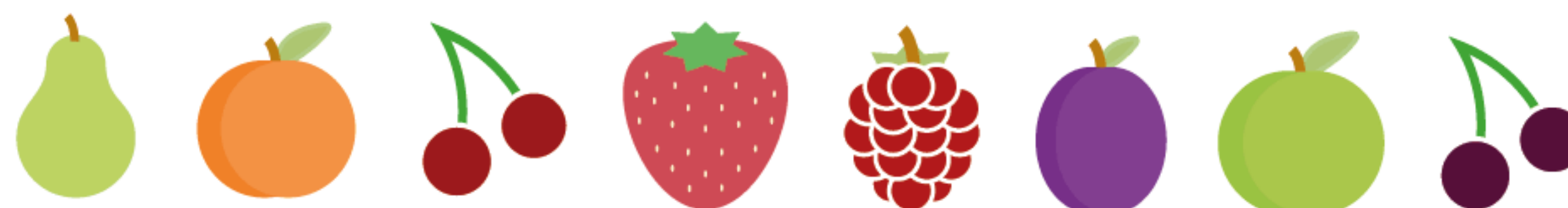


## SETTING & PECTINS



**PECTIN**  
(typical chemical structure)

Pectin is made up of a large number of sugar molecules bonded together in a long chain. The pectin content varies from fruit to fruit; fruits lower in pectin require more pectin to be added, either in the form of commercial pectin or by addition of fruit whose pectin content is higher. The 'setting point' when boiling jam is ~104°C; the pectin chain binds to itself, forming a gel network that traps liquid as the jam cools and helps it set.



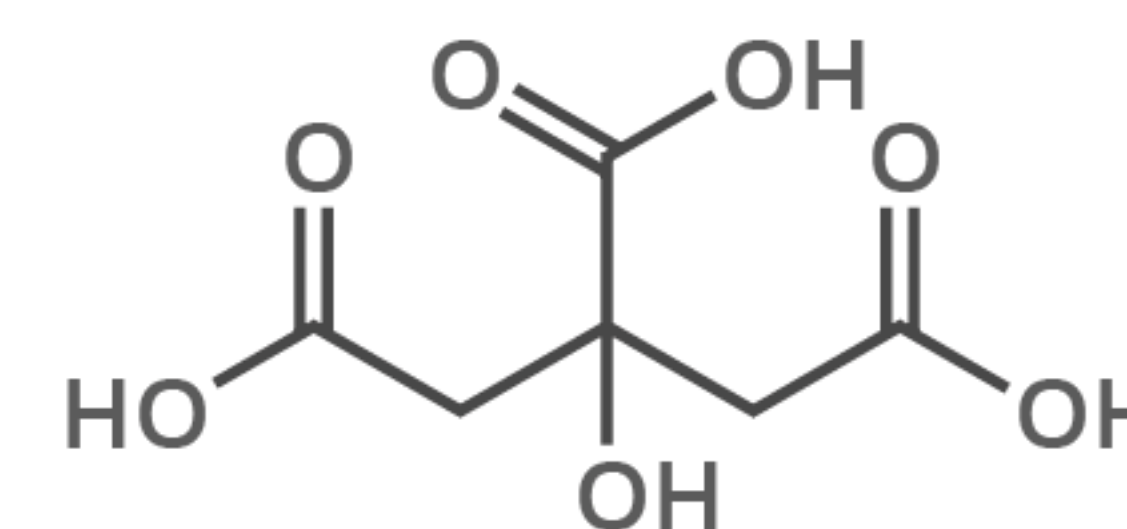
### LOW IN PECTIN

Pears, peaches, cherries, strawberries, raspberries, blackberries, sweet plums, blueberries, elderberries.

### HIGH IN PECTIN

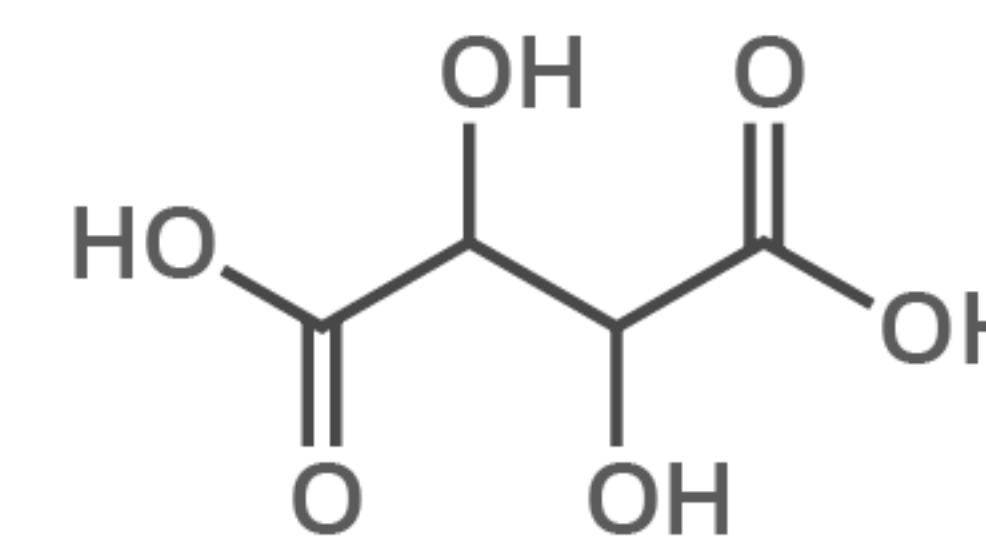
Apples, gooseberries, blackcurrants, sour plums, grapes, citrus rind.

## FRUIT ACIDS



**CITRIC ACID**  
(occurs naturally in citrus fruits)

A frequent cause of jam not setting is a lack of acidity. Fruits themselves provide some acids naturally, but often extra acid will need to be added - this is commonly in the form of citric acid, but tartaric acid can also be used. A pH of between 2.8-3.3 is needed to help the pectin form a gel and allow the jam to set properly.



**TARTARIC ACID**  
(found in grapes)

**2.8-3.3**  
**OPTIMAL pH FOR SETTING**

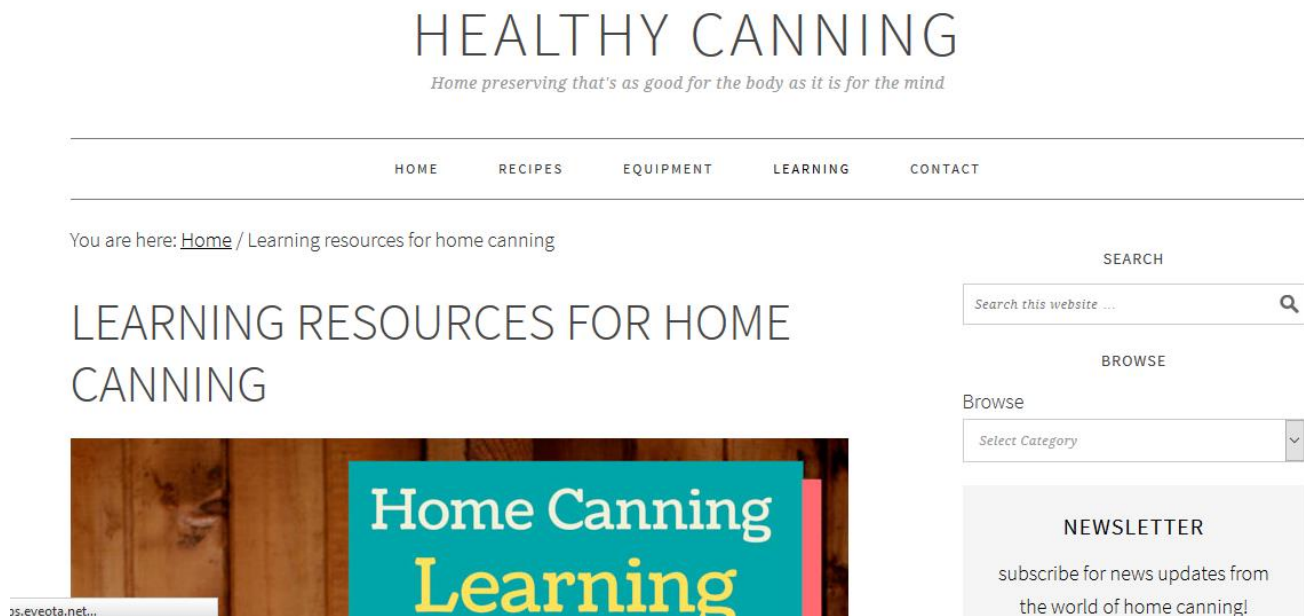




## Healthy Canning

Amazing very well researched yet practical and reasonable resource out of Canada (but almost all of the info it's based on comes out of the US). A LOT of the information from this class is based off of this website. They also have a Facebook page. Plus a ton of recipes.

<http://www.healthycanning.com/>



## Washington State Master Food Preservers Program

Note that WSU still offers a hands on “Master Food Preservers” course in two locations, one of which is in the Tri-Cities. I recently had the pleasure of meeting Lizann, and wow, this women REALLY knows her stuff. She’s an amazing resource. If you have the time, this 10 week course would be well worth doing. It covers everything from pressure canning to fermenting to drying to freezing.



<http://extension.wsu.edu/benton-franklin/health/master-food-preservers/>

## Beginning Canning Series

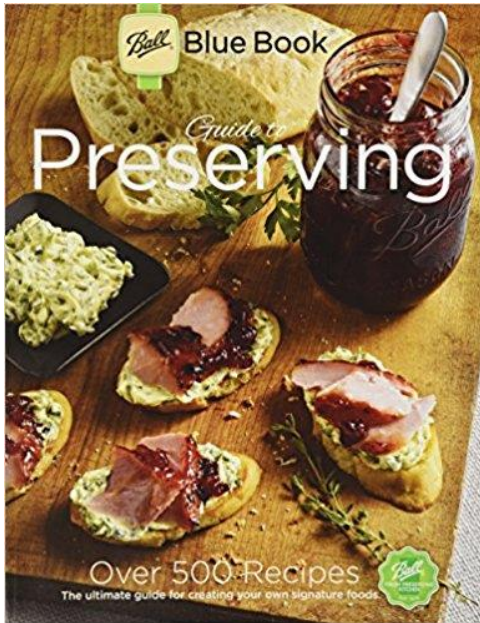
Jennifer Kleffner

2021

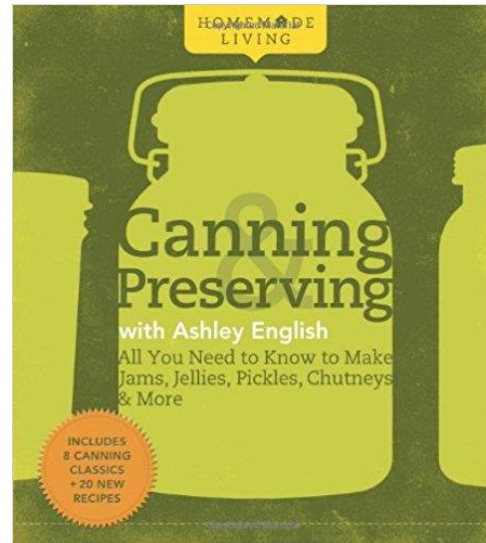
Miles Away Farm



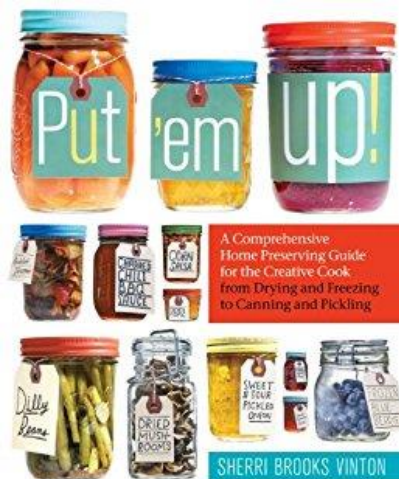
## Recommended Books



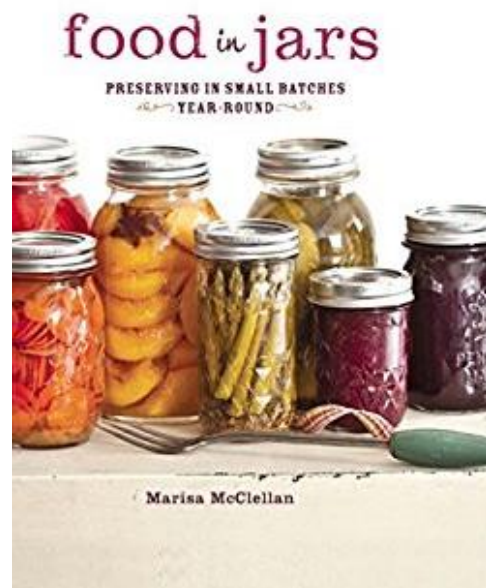
**Ball Blue Book: 37th edition (2014).** About \$7 on Amazon. Often found where canning jars are sold. Tends to have a lot of “buy this Ball product” information, but has always been an up to date resource and the price is reasonable. There are several other Ball books out there. This one is likely the most succinct.



**Canning and Preserving with Ashley English. (2010).** About \$9 on Amazon. This is the book I would have written if I had written one. Well organized, well written, solid information.



**Put-em-up (2010).** A timeless classic that gets updated when needed. About \$12 on Amazon.



**Food In Jars (2012).** Nice because it deals with small batches rather than putting up enough to feed a family of 12 for the year. Marisa has several other books on canning as well.

Enough Natural Pectin to Gel	May Need Added Pectin	May Be Watery Without Added Pectin
Granny Smith Apples	Blackberries	Apricots
Citrus Peels	Chokecherries	Blueberries
Concord Grapes	Concord Grape Juice	Figs
Crabapples	Elderberries	Guavas
Currants	Grapefruit	Nectarines
Gooseberries	Grapes	Peaches
Lemons	Oranges	Pears
Loganberries	Sour Cherries	Pomegranates
Plums		Strawberries
Raspberries		Sweet Cherries

# Jam Class – Sustainable Living Center June 15, 2021

Recipe for today's jam is literally the one on the pamphlet that comes with the box of pectin. See, easy!

Prep fruit/ingredients/heat canning water while talking (frozen raspberries). (5 minutes)

Start cooking – discuss steps plus their biggest concerns about canning while jam is cooking. (30-45 minutes – relaxed vibe)

1. Measure out fruit and sugar.
2. Add fruit and pectin to pot.
3. Heat to rolling boil.
4. Add sugar.
5. Reheat to rolling boil.
6. Ladle into jars.
7. Wipe rims.
8. Add lids (no need to sterilize jars or lids before using as long as water bath time is 10 minutes or more).
9. Put jars in canner.
10. Wait until it returns to rolling boil.
11. Start timer. 10 minutes.
12. Remove jars.
13. Let cool until lids “pop”.

# Online Canning References

## National Center for Home Food Preservation (NCHFP)

You can download a PDF of the USDA **Complete Guild to Home Canning** here. It's not pretty, but it is the definitive "bible" for home canning and is always up to date.  
<http://nchfp.uga.edu/>



## Food In Jars

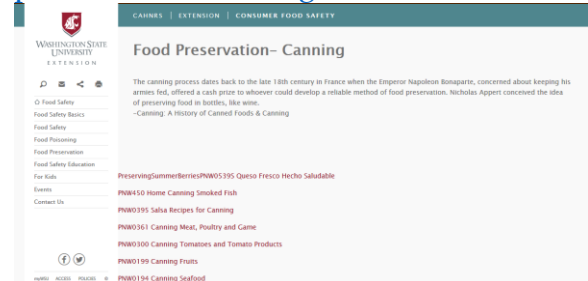
Excellent beginners section.  
<http://foodinjars.com/>



## Extension Office Home Canning Recipes and Information

Usually under "food preservation" under consumer health/nutrition/home, sometimes by county rather than state. ANY state extension recipe should be safe. WSU offers an online "master canner" course.

<http://extension.wsu.edu/foodsafety/food-preservation-canning/>



## Ball/Kerr website (owned by Jarden Home Brands)

All recipes are safe and can be trusted  
<https://www.freshpreserving.com/canning.html>

