

Jam and Jelly Principles and Other Sweet Spreads



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Welcome to

Jam and Jelly Principles Extension In-Service

If you are participating in this session as part of a group at your computer, please type the names of all attendees in the Text Chat box now.

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Objectives for Today

Participating educators will:

- ✓ Understand scientific principles related to making safe and high quality sweet spreads.
- ✓ Understand the science of pectin gels.
- ✓ Understand steps in boiling water canning.
- ✓ Know recommended Extension resources for programming/questions.
- ✓ Practice answering questions.



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Questions?

- If you have a question,
 - Select the (hand) icon 
- After your question has been answered,
 - Re-select the hand icon  to remove your name from the question queue.

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Jellied Fruit Products

- **JELLY** - firm gel from juice. 
- **JAM** - sweet spread that holds shape - crushed or chopped fruit.
- **PRESERVE** - small whole fruit (or uniform size pieces) in very thick to gelled sugar syrup. 
- **CONSERVE** - jam-like consistency - 2 or more fruits, nuts, raisins, coconut.

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Jellied Fruit Products, cont.

- **MARMALADE** - citrus base or citrus added, usually with peel and transparent jelly.
- **FRUIT BUTTER** - spreadable fruit pulp with sugar.
- **FRUIT HONEY** - consistency of honey - from juice or pulp, not as thick as butter.
- **FRUIT SYRUP** - sweet thickened juice

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The Pectin Gel

The basis for traditional jellies and jams.

fruit
sugar – pectin – acid

jar size



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Ingredients

(all 4 needed to form gel)

1. FRUIT

- Flavor.
- Provides some or all of pectin.
- 1/4 slightly under-ripe to 3/4 ripe.
- Only ripe fruits are canned and frozen.

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Ingredients

2. SUGAR




- Cane or beet sucrose the standard.
 - No dextrose.
- Preservative effect for microorganisms.
- Contributes to flavor (sweetness).
- Too much sugar for pectin = weak gel.
- Too little = tough.
- Avg concentration of solids (mainly sugar) for jelly is 65%.
- Can use corn syrup or honey, but...
 - See special instructions

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Ingredients

3. PECTIN



- Occurs naturally in fruit (heat “activates” by changing the form).
- Concentrated in skins and cores.
- Amount varies w/ fruit and maturity.
 - under-ripe has more.
- 0.5 to 1.0% pectin produces good gel.

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Ingredients

3. PECTIN continued

- Overcooking destroys.
- Commercial pectin is made from apples or citrus.
- Powdered/liquid pectins not interchangeable in recipes.
 - Nor freezer jam pectins.




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Ingredients

4. ACID



- pH of 3.2 gives good gel if ratio of pectin and sugar also just right.
- Naturally higher in under-ripe and tart fruit.
- Contributes to flavor (tartness).
- Helps control crystals during storage.
- Added with commercial pectin if needed: Lemon juice, vinegar, citric acid, lactic acid, tartaric acid.

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Pectin and Gel Formation

Optimum Pectin Concentration = 1.0%

Optimum Sugar Concentration = 67.5%


Optimum pH Value = 3.2

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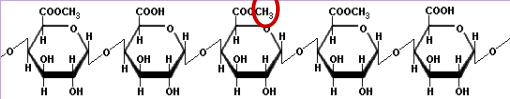
Pectin Molecule

- Threadlike carbohydrate molecule (polysaccharide) made up of galacturonic acid
 - derivative of galactose
 - with methyl groups attached.
- In water, negatively charged ions (O^-) along the molecule repel each other, keeping molecules apart.

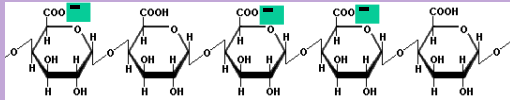


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Pectin Molecule



In water




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Forming a gel

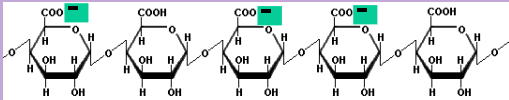
- Molecules must get close together and crossbond.
- When acid is added/present:
 - H^+ ions attach to O^- ions.
 - Molecules crossbond because no more negatively charged ions repel each other
 - Water is tied up among the bound pectin molecules.



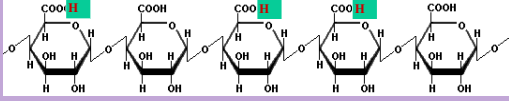
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Pectin Molecule

In water



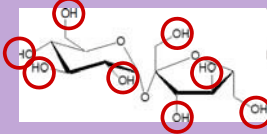
In acid



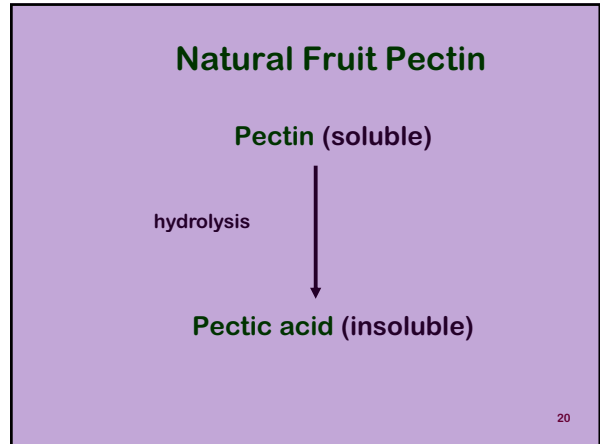
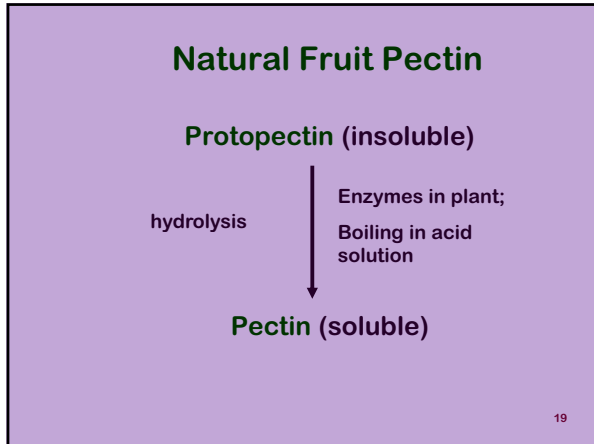
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Forming a gel

- When sugar is added:
 - Acts as a dehydrating agent, has a high attraction to water because of its chemical structure.
- Attracts additional water so less is available to pectin.



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Natural Pectin Tests




1. Cooking Test

- 1/3 cup juice
- 1/4 cup sugar
- Heat, stir, dissolve sugar.
- Boil rapidly until it sheets from spoon.
- Pour in bowl or jelly glass and cool.
- If cooled mixture is jelly-like, it will gel.

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Pectin Tests



2. Alcohol Test


- 1 tsp. juice
- 1 T. rubbing alcohol
- Gently stir or shake in closed container.
- Solid jelly-like mass forms if enough pectin to gel - can pick up with fork.

DO NOT EAT ANY OF THIS!



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Acid Test



- 1 tsp. lemon juice
- 3 T. water
- 1/2 tsp. sugar
- Mix and taste. Taste fruit juice.
- Should be equal in tartness



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Commercial Pectins



• Regular

- Available in liquid and powder forms.
- Higher yield per measure of juice.
- Can use fully ripe fruit.
- Use more sugar, flavor may be masked.
- Do not have to cook fruit to extract juice.
- Do not need to test for pectin or acid.



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Commercial Pectin

- **Regular (continued)**
 - Shorter cooking time
 - No doneness tests
 - Uniform results, quality
 - Store in cool, dry place
 - Use within 1 year or see expir. date
- Powdered and liquid pectin are not interchangeable in recipes

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Types of Jams and Jellies

- **No pectin added**
 - Also called long-boil
 - Requires "full sugar"
- **Pectin added**
 - With full sugar
 - With reduced sugar
 - With no sugar added
 - Uncooked (a/k/a freezer)
- **Gelatin**
 - Uncooked, non-pectin gel
 - With or without sugar

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With or Without?

- **Without added pectin:**
 - Long boiling time with fruit and sugar.
 - Less added sugar, but concentrated natural sugar.
 - Loss of flavor from long boiling.
- **With added pectin:**
 - Greater yield from measure of fruit.
 - Fresher fruit flavor, but some flavor may be masked.
 - Better color.
 - Less chance of failure.

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Equipment

- Measuring equipment, bowl for sugar
- Heavy, metal pot – large!
- Ladle
- Jar filler/funnel
- Jars and lids
- Boiling water canner and rack
- Jar lifter



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Other Possible Equipment

- Scales
- Sieve, food mill, fruit press
- Jelly bag
- Thermometer - jelly or candy



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Preparing the Fruit

1. Approximately 1 lb. prepared (washed, trimmed, cut) fruit = 1 cup juice.
2. Use fruit immediately. Do not refrigerate longer than one day.
3. Discard over-ripe or rotten fruit.
4. Use 1/4 under-ripe fruit and 3/4 just-ripe fruit, if no added pectin is used.





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Preparing the Fruit

5. Wash fruit, lifting out of water.
 - DO NOT SOAK.
6. Remove stems and blossoms.
7. Do NOT remove skins, cores, or pits.
 - high pectin concentration
8. Cut as recipe indicates.


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Extracting Juice



1. Place prepared fruit and cold water in saucepan (soft berries can be crushed and no water added).
2. Bring to boil on high heat.
3. Reduce heat.

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Extracting Juice

4. Cook until fruit is soft.
 - Grapes, berries: 10 minutes
 - Apples, hard fruits: 20-25 minutes
 - DO NOT overcook - destroys pectin, color and flavor

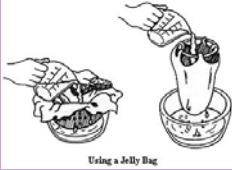



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Extracting Juice

5. Strain through damp jelly bag.
 - Can use fruit press before straining.
 - Cover jelly bag and bowl while dripping to prevent contamination.



Using a Jelly Bag

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Jelly - No Added Pectin

1. Bring extracted juice to boil (6 cups maximum).
2. Add sugar immediately; stir until dissolved (gives time for inversion* of sugar by acids in the fruit, and less danger of crystallization).

If no recipe is available, try 3/4 cup sugar per 1 cup of juice.




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Jelly, No Added Pectin, cont.

- **Inversion:**
 - splitting sucrose into fructose and glucose.
- These sugars have a different shape than sucrose and thus do not fit the slots available when the sucrose molecules begin to align to form crystals.



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Jelly - No Added Pectin

3. Cook rapidly. Long cooking destroys pectin.
4. Test for doneness.




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Tests For Doneness with no added pectin


1. Temperature
 - Cook to 220°F or 8°F above boiling point of water.
 - Test thermometer with boiling water prior to cooking jelly.

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Tests For Doneness with no added pectin

2. Sheet Test (Spoon Test)
 - Dip cold metal spoon into boiling jelly.
 - Hold spoon out of steam.
 - Drops should “sheet” together.



Spoon or Sheet Test

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Tests For Doneness with no added pectin

3. Refrigerator/Freezer Test
 - Place small amount on plate.
 - Place in freezer for a few minutes.
 - Check for gel.



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Jellies With Added Pectins


- With full sugar
 - Powdered or liquid pectin
- With reduced sugar
 - Powdered pectins
- With no sugar added
 - Powdered pectins
- Uncooked (a/k/a freezer)

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Commercial Pectins

- Kraft Foods
 
- Jarden Home Brands
 
- Mrs. Wages
 

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Jellies With Added Pectins

- **Cooking**
 - Follow instructions with pectin insert.
 - **ORDER** of adding ingredients and boiling periods matters.
 - Will be different for powdered and liquid pectins.
- **NO TESTS for doneness.**
 - Time the cooking as required.

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Cooked Jams and Sweet Spreads

- **Without Added Pectin**
 - Generally made like jelly.
 - Sheet test **NOT** recommended, but can use cold plate or ice water.
 - Cook to 220°F
 - **Softer:** shorten cooking time
 - **Firmer:** lengthen cooking time
- **With Added Pectin**
 - Follow package instructions.



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Preparing Jars

Best to use half-pint or pint jars.

Two options for “full-sugar” jams and jellies that are pectin-set:

- Pre-sterilize jars and process 5 minutes in BWC.
- Use clean, hot jars and process for 10 minutes in BWC.

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Preparing Jars

Best to use half-pint or pint jars.

To pre-sterilize jars:

- Wash jars in hot, soapy water and rinse.
- Cover jars with water, bring to a boil and boil 10 minutes.
 - The boiling water canner works well.
- Keep the jars in the hot water until ready to fill.
 - If altitude > 1,000ft: add 1 min. of boiling time for each 1,000ft

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Preparing Lids



- Follow manufacturer’s directions -- they vary.
- Most: Cover with water, bring to simmer only, keep warm until ready to use.

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Filling Jars


1. Skim foam (quickly).
2. Pour boiling product into hot, sterilized half-pint jars.
3. Leave headspace of 1/4".
4. Wipe rim.
5. Close with lid and screw band.
6. Process - to prevent mold growth.






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Processing Jars




- Place jars on rack in canner filled w/ hot (simmering) water (water should cover jars by 1 to 2").
- Cover canner.
- Bring water to a full boil; boil for 5 min. if jars are pre-sterilized; 10 minutes if not.
- At end, turn off heat. Remove lid from canner, wait 5 minutes.
- Remove jars to protected surface.




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Processing Jars



- Cool away from drafts for at least 12 hours.
- DO NOT DISTURB or move for at least 12 hours or gel may break.
- NOTE: USDA and University of Georgia DO NOT recommend inverting jars.



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Storage



- To avoid breaking gel, do not move for 12 hours.
- Check seal.
- Remove screw bands.
- Label.
- Store in cool, dry, dark place.
- Short storage time is best.

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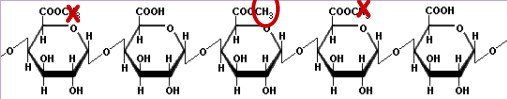
Jellied Products Without Added Sugar



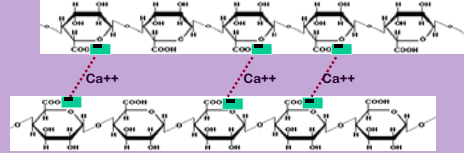
- Thickened or gelled by:
 - Special pectins
 - low methoxyl (calcium bonds)
 - Vegetable gums (powdered)
 - Gelatin
 - Long boiling to concentrate product
- Lack structural, preservative and flavor effects of sugar.

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Low-Methoxyl Pectin Molecule



Bind with divalent ion, usually Ca⁺⁺



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Jellied Products Without Added Sugar



- Low-Methoxyl Pectins
 - Metal ions required for gel.
 - Ca⁺⁺ or Mg⁺⁺
 - Some hard to dissolve.
 - May can or freeze.
 - Inconsistent results.
 - May use sugar to sweeten.
 - May use sugar substitutes to sweeten.



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Jellied Products Without Added Sugar

- Artificial sweeteners can not be interchanged for sugar in recipes.
 - Must use special recipe.
 - Read labels carefully - some lose sweetening power after heating or storage.
- Sweeteners are for flavor only in LMP.
 - Not for preservation.
- Follow processing and storage directions on box or in recipe.

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Jellied Products with Reduced Sugar

- Modified pectins for reduced sugar.
 - Sure-Jell® for Lower Sugar Recipes
- Most use 1/3 less sugar, but a few use Splenda® only.
- Have a very few options for no sugar, and Splenda® flavoring.



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Jellied Products with Reduced Sugar

- Pomona Pectin LMP
 - Separate calcium and pectin.
 - You make a calcium solution in water before beginning.
- Citrus pectin, made in Denmark.



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Gelatin

- Unstable at room temperature.
- Must refrigerate - up to 4 weeks.
- Cannot can or freeze.
- Artificial sweetener may be used.




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Gelatin

- Product of hydrolysis.
 - From bone collagen and skin stock
 - Protein
- Usual form is granulated.
- Fruit flavor:
 - Added sugar, fruit acids, flavors, and colorings

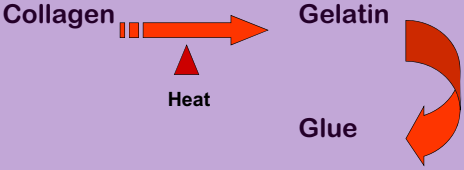
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Gelatin

Collagen $\xrightarrow{\text{Heat}}$ Gelatin

Glue $\xrightarrow{\text{Heat}}$ Gelatin



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Freezer Jams and Jellies

- Must Use:
 - Fresh or frozen fruits or juices
 - canned do not give good product.
 - Commercial pectin
 - no heat to activate naturally-present pectins.
 - Some more sugar added than cooked.
 - Fresher fruit flavor due to no cooking.

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Freezer Jams

- Newer pectins.
- Simpler instructions.
- Less sugar than some others,
- OR, no sugar.



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Uncooked Jams and Jellies: Storage

- Must be stored in refrigerator (up to 3 weeks) or freezer (up to 1 year).
- DO NOT store at room temp - will mold and ferment.
- Freezer storage best for color and flavor retention.
- Do not place in freezer until gel forms.
 - 24 hrs
- Use within a few days-few weeks after opening.

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Fruit Pulp Concentrates

- A few recipes that are not pectin based.
- Concentration of fruit pulp, with or without added fruit juice.
- Processing necessary if not refrigerated.
- 15 min BWC process.



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Microwave Jellies

- Do not always save time.
- Use recipe designed for microwave technique (best if developed for that specific microwave).
- Use deep bowl since product tends to “boil over” easily.
- May need to experiment.

WE DO NOT HAVE UGA EXTENSION RECIPES.

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Tips for Success

1. Use reliable recipes.
2. Follow boiling times explicitly.
3. Measure carefully.
4. Don't alter sugar or pectin.
5. Don't double recipes.
6. Use large enough saucepan.
7. Cool as quickly as possible after canning process (Don't force cool!).

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Question this week:

> question -> I bottled 10 jars of strawberry jellie. I doubled the recipe, 10 c. crushed strawberries, 2 packets pectin but I forgot to double the sugar so the end product is runny. I also did the inversion method of turning the jars upside down for 5 min instead of the water bath method . they all sealed. I am just wondering if the amount of sugar will affect the preservation of the jam.....

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Critical Controls

• **Sugar Concentrates**

- Selection of quality fruit ingredients.
- Preparation and color control of fresh fruits.
- Sugar concentration for pectin gels.
- Acidity or pH.
- Selection of appropriate pectin for pectin-added.
 - Pectin not expired.
- Order of adding ingredients.
- Cooking time and determination of boiling.
- Filling jars.
 - Temperature, headspace, adjusting lids.
- Processing.
- Cooling.
- Checking seals.



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Critical Controls

• **For “regular” (traditional) pectin gels**

- For non-pectin added gels:
 - Natural pectin in fruit; amount of sugar.
 - Doneness tests.
- For pectin-added gels:
 - Dry and liquid pectin not interchangeable.
 - Order of adding sugar and pectin matters.
 - Timed boilings.
- Cannot reduce sugar.



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Critical Controls

- **For reduced sugar pectin gels**
 - Only make from acid fruits or use recipe with enough acid to “preserve” without sugar.
 - Must have modified pectin.
 - Follow recipes with the pectins or tested.
 - Timed boilings.
 - Amount of sugar not important to gelling.
 - Sweetened to taste with variety of optional sweeteners.
- **Other special situations**
 - E.g., jelly from fresh grape juice:
 - Standing time and decanting to prevent tartrate crystals

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Critical Controls

- **For traditional Southern preserves**
 - Amount of sugar **MATTERS** for **SAFETY**
 - Amount of acid **MATTERS**
- If people want preserves with reduced sugar, they will need to use special pectin and make a jam-like product.



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Critical Controls

- **Canning, Jams and Jellies**
 - **Processing in Boiling Water**
 - Start water ~180F (simmering).
 - Water should cover jars by 1-2 inches.
 - Start timing when water comes to a full boil.
 - Process time at least 10 minutes unless jars were pre-sterilized.
 - Make altitude adjustments over 1,000 ft.
 - Remove jars at end of process time and 5 minute wait to air cool.
 - **Cooling jars and checking seals.**




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Jellied Product Problems

- **JELLY:**
 - Crystals
 - Bubbles
 - Too Soft
 - Syneresis or "Weeping"
 - Darkening
 - Cloudiness
 - Fermentation
 - Mold
 - Stiff or Tough



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Jellied Product Problems

- **JAM:**
 - Crystals
 - Bubbles; air
 - Too Soft
 - Stiff or Tough
 - Darkening
 - Fermentation
 - Mold
 - Syneresis or "Weeping"



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Jellied Product Problems

- **PRESERVES:**
 - Shriveled Fruit
 - Off-Flavor
 - Tough
 - Sticky, Gummy
 - Dark
 - Loss of Color
 - Fermentation or Mold

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More Bites of Information

- **Sure Jell Splenda Strawberry Jam**
 - Our group felt it wasn't sweet enough.
 - Makes only 3 half-pints.
 - **Why?**
 - Also seems to have more fruit than some other recipes.
- **Fruit floats a LOT in the cooked jams. Traps a lot of air in many fruits.**

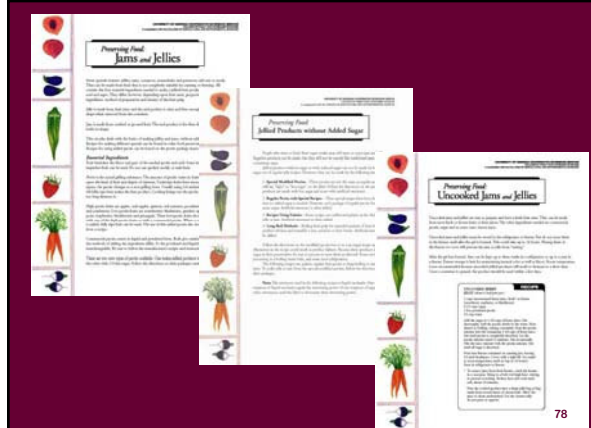
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Extension Resources

- *So Easy to Preserve*, 5th ed.
- *So Easy to Preserve* video.
- *Preserving Food* Factsheets
 - www.fcs.uga.edu/ext/pubs
 - *Jams and Jellies*
 - *Uncooked Jams and Jellies*
 - *Jellied Products Without Added Sugar*
- *Processing Jams and Jellies*
 - *Steps in Processing Jams and Jellies*

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