14 Farm Marketing IV: Bakery/Process Session

Where: Ballroom A
Moderator: Joyce McGarry, Michigan State University

2:00 PM **Bakery Operations and Homemade Pies at Seaquist Orchards**
- Laura Seaquist, Seaquist Orchards

2:30 PM **From Formula to Market**
- Timothy Young, Food For Thought

3:00 PM **The Science of Pectin: Will it Gel or Not?**
- Elizabeth Andress, University of Georgia

3:30 PM **Tough Times Never Last - Tough Farm Families Do!**
- Andy Junkin, Agriculture Strategy

4:00 PM **Session Ends**

Outline: Seaquist Orchards Bakery Operations and Homemade Pies

Wednesday, December 5th – 2:00pm

There is no way around it, bakeries are hard work. We have found success through simple improvements that allow for efficient and effective work. Join us as we dive into the equipment and information that we find pertinent to our success at Seaquist Orchards Farm Market.

Equipment placement can drive or hinder success

I. Look up! Storage space is on your walls

II. Sturdy, immobile counters are not always what you need

III. Purchase more than what you need and have a plan of where to store it

Standardization is the best way to move forward

I. Formulas

II. Procedures

III. Production Supervisor

Pies, Pies, Pies!

I. Pie production and the changes we have faced

II. Current pie process

III. Pie storage and packaging

Will It Gel or Not? The Science of Pectin

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December 5, 2018

College of Family and Consumer Sciences
UNIVERSITY OF GEORGIA

Session Objectives

- Survey types of spreads considered as "jams"
- Understand how pectin thickens and preserves food
- Understand formulation factors that affect pectin chemistry

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Types of Pectin Spreads

- **Jelly** - firm gel made from juice.
- **Jam** - sweet spread that holds shape, made with crushed or chopped fruit.

- **Marmalades** – citrus base or citrus added, usually with peel and a transparent jelly
- **Conserves** – jam-like consistency, two or more fruits, with nuts, commonly with raisins, coconut

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Types of Pectin Spreads

- **Preserves?**
  - **Traditional (Southern) -** small whole fruits or uniform pieces in thick, slightly gelled syrup
  - For others, more generic term covering all kinds of spreads and preserved products.

- **Fruit butters?**
  - **Traditionally,** fruit pulp, sugar and spices cooked to a consistency that mounds on a spoon (spreadable)
  - Now some commercial pectin companies incorporating "butter" into the name of products that are made like jam.

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The Pectin Gel

- For a "canned" product, allows for the short boiling water process recommended or the hot-fill-seal only method.
- Cannot automatically apply this same philosophy to reduced sugar products, or non-pectin gelled spreadable products.

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Key Preservation Points

- Jellies, Jams, Other Spreads
- Sweetening and Acidifying

  - Acidity
    - ➢ of fruit, or added
  - Less available water
    - ➢ Pectin and/or sugar ties up water present
  - Removal of oxygen
    - ➢ sealed jar if canned
  - Heat if cooked, canned
    - ➢ water bath processed

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The Pectin Gel

The basis for traditional jellies and jams.

fruit
pectin – sugar – acid

(jar size)

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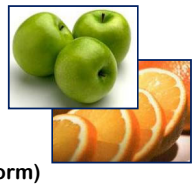
Pectin



- Occurs naturally in fruit
- Actually variety of molecules (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
- Needs acidic solution to gel
  - pH ideal at 2.8-3.5

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Pectin

- Overcooking destroys gelation
  - (See next slides)
- Commercial pectin is made from apples or citrus
- Not all brands the same even within type
- Powdered/liquid pectins not interchangeable in recipes.
  - Nor freezer jam pectins.

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Natural Fruit Pectin

Protopectin (insoluble)

hydrolysis ↓

Enzymes in plant;

Boiling in acid solution

Pectin (soluble)

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Natural Fruit Pectin

Pectin (soluble)

hydrolysis ↓

Pectic acid (insoluble)

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Pectin Molecule

- Why boil in acid mixture?
- In water, the molecules naturally repel each other (from negative charges along the molecule).
- So those certainly won't form a gel!

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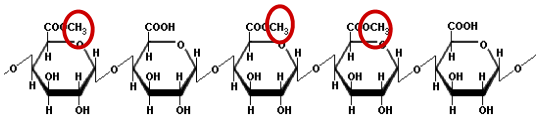
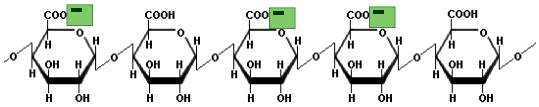
Pectin Molecule



In water



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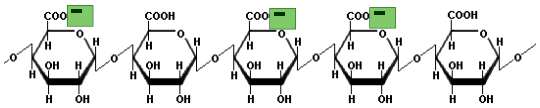
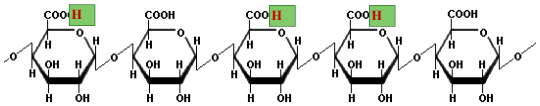
Pectin Molecule

In water



In acid



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Sugar

- Cane or beet sucrose the standard.
  - No dextrose.
- Preservative effect for microorganisms.
  - Dehydrates bacteria, molds and yeasts.
  - Draws water from fruit cells and binds it.
    - That water unavailable for microorganisms
    - Lowered "water activity"
- Contributes to flavor (sweetness).
- Sugar must be present in the proper ratio with pectin and acid for a gel to form.
- Sugar helps define allowable labeling of commercial spreads.

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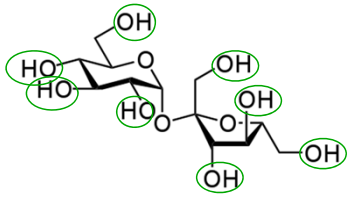
Sucrose Molecule



High affinity for water due to many bonding sites.

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Sugar

- In cooked jams and jellies, the sucrose also undergoes INVERSION
- This is a change to glucose and fructose components
- Important to prevent crystallization
  - Too much sucrose will cause precipitation

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Acid

- Necessary for gelation
- Comes from fruit or added as ingredient
- Low pH (high acidity) necessary for typical treatment as low-risk shelf stable food

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Types of Pectin Jams and Jellies

- No pectin added
  - Also called long-boil
  - Requires "full sugar" and fruits high enough in natural pectin
- Pectin added
  - With full sugar
  - With reduced sugar*
  - With no sugar added*
  - Uncooked (a/k/a freezer or "instant")

* require modified pectins that gel without sugar

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With or Without Purchased Pectin?

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.
Brighter colors (less cooking time) .
Less chance of failure.

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Purchased Pectins

- "Full" Sugar; regular
  - Powdered or liquid
- Reduced Sugar
  - Powdered
- No sugar
  - Powdered
- Uncooked – Freezer or "instant"
  - Powdered if special purpose
  - Liquid or powdered if "full sugar" pectins

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Methods of Making

- If natural pectin:
- Cook to invert and concentrate sugar and remove water
- Tests for "doneness" or gelling point
  - Temperature (220F or 8F above boiling point of water)

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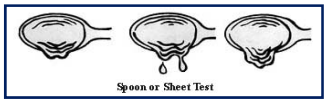
Methods of Making

- If natural pectin:
  - Tests for "doneness" or gelling point
    - Sheet Test (Spoon Test)



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Methods of Making

- If natural pectin:
  - Tests for "doneness" or gelling point
    - Cold plate

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Methods of Making

- If added purchased pectin:
- Combine ingredients in order listed.
  - Will be different for powdered and liquid pectins.
- Cook as pectin manufacturer describes and stop.
  - Usually will not thicken in pan as with natural pectin gels
  - NO TESTS for doneness; cooking is specifically timed.

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Making Jams/Jellies Shelf Stable

- Processing vs. Hot-Fill
  - Size of container influences gel strength as well as the chemistry.
  - Shelf stability requires a vacuum seal.
    - Minimal vacuums can produce hermetic seal.
    - Not all vacuums are the same; the better the vacuum, the more oxygen removed and the better product quality in storage.
  - If not processing, hot fill requires minimum fill temperature. Headspace and fill temperature affect vacuum obtained.

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Making Jams/Jellies Shelf Stable

- Processing vs. Hot-Fill
  - With true pectin gelled acid product, can process in boiling water
  - The typical 5-10 minute process time in boiling water, however, is dependent on formulation for traditional pectin-sugar gel
  - Other spreads may require longer process.
  - Boiling water only acceptable for acid (pH < 4.6) products
    - Actual pH can determine which microorganisms can still function, however.

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Spreads Without Added Sugar

- Thickened or gelled by:
  - Special pectins
    - low methoxyl (calcium bonds) (LMP)
  - Vegetable gums (powdered)
  - Gelatin
  - Long boiling to concentrate product; these are spreads and not really pectin jams
- Lack structural, preservative and flavor effects of sugar

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Spreads Without Added Sugar

- Artificial sweeteners can not be interchanged for sugar in traditional pectin recipes
  - Must use special recipe and pectin
  - 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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So I want a product with less sugar. What should I do?

- Purchase a special pectin product made to be used with less or no sugar.
- Look for “light” or “no sugar needed” on the package label.
- Follow the recipes or formulas for THAT pectin, for the type of jelly or jam you are making.
- Or count on needing a canning process vs. hot fill, and a longer process than traditional jam or jelly.
  - Treat more like a fruit puree or non-gelled product.
  - Sales approval will depend on finished product.

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But I want a product that's not made with acid fruit? What do I do?

- To create a pectin gel, you will have to add an acid ingredient to obtain a pH for pectin gelling.
- You will also need to add commercial pectin to get a pectin gel. (will not have the natural fruit pectin)
- Or, you will be making a spread that is not a pectin gel, just a thickened mixture.
- You may need special process approval to sell.
- If making for own use, be wary of safety in following any preservation instructions that look like acid gels.
  - Most likely need to refrigerate.

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What else?

- Cooking time can influence gel formation.
  - Batch size matters
    - Longer boiling temps can change pectin structure
    - As you size up, may need to change recipe
  - Pan size matters.
  - Using natural pectin: If making jelly with extracted juice and no added pectin, do not OVERCOOK or you will change the pectin structure and it may not gel.

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What else?

- For larger batches, may work with pectin supplier for different types of pectins.
  - Grades of pectin change # parts of sugar that one part of pectin will gel.
  - Household pectins have some other ingredients that commercial pectins will not, so recipes can vary.

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If selling…

- Regulatory definitions of jams and jellies
- States vary in requirements for approvals
- Even if no regulatory recipe approval, use best practices for your customer

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Quick Summary

- Acidity, sugar and pectin concentration and form all affect gelling
- Pectin gelling without sugar (sucrose) requires modified commercially purchased pectins
- Size of batches will influence gelling through influence of cooking on pectin molecular structure
- Size of container will influence gelling

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Thank you

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