



## Welcome to Principles of Home Canning

In-Service  
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## Objectives for Today

Participating educators will:

- + Understand scientific principles related to home canning recommendations.
- + Understand recommended home canning jars and canner systems.
- + Understand steps in boiling water and pressure canning.
- + Know recommended Extension resources for programming/questions.
- + Practice answering questions.

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## Preserving Foods...

- \* Retard/delay spoilage
  - Shorter term
- \* Prevent spoilage
  - More permanent
- \* Distribution
  - Includes economy
- \* Convenience
  - Consumer
  - Wholesalers/retailers

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## Major Causes of Food Spoilage

- \* Microorganisms
- \* Enzymes
- \* Moisture Loss
- \* Non-enzymatic reactions
  - Oxidation
  - Drying
- \* Mechanical damage
- \* Damage from insects and rodents

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## Physical Changes

- \* Bruising and punctures
- \* Water loss
- \* Insect/rodent infestation

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## Chemical Changes

- \* Enzymes - proteins found naturally in plants and animals that can initiate or speed-up certain reactions necessary for life.
  - Browning of fruits.
  - Flavor, color, and texture changes in vegetables.
- \* Oxidation of fats.
  - Autoxidation.

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## Basics of Home Canning

- ★ Food is placed in a jar or can and is heated to a temperature that destroys microorganisms that would be a concern in storage.
- ★ The heat also inactivates enzymes that lead to spoilage.
- ★ With jars, air is driven from the jar during heating. As the jar cools a vacuum seal is formed.

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## Vacuum Seal

- ★ Holds the lid on the jar.
- ★ Prevents recontamination of the food.
- ★ Prevents air from drying out the food.

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## Commercial Sterility

- ★ All pathogens are killed.
- ★ Some bacteria survive even a proper process.
  - Those that survive are spoilers but won't make someone sick.
  - Some produce gases.
  - Some produce bad odors.
    - putrefactive anaerobes (PA)
- ★ Is important how jars are stored.

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## Process Times

### Affected By:

- ★ Acidity of the food.
- ★ Preparation style of the food.
- ★ Composition of the food.
  - Viscosity
  - Tightness of pack
  - Convection vs. conduction transfer of heat
  - Starches, fats, bones
- ★ Initial temperature of food as it's filled into jar or can.
- ★ Temperature of processing.
- ★ Size of jar or can.
- ★ Shape of jar or can

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## Acid Foods

pH  $\leq$  4.6

- Generally all fruits
- Tomatoes and figs are borderline
- Sauerkraut
- Rhubarb
- Foods to which large amounts of acid are added (pickles).

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## Low Acid Foods

pH  $>$  4.6

- Generally all vegetables
- Meats
- Poultry
- Seafood
- Soups
- Mixed canned foods (low acid + acid)
  - However, if pH  $<$  4.6 = acidified foods

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## Two Methods of Canning

- \* **Boiling Water Bath Canning**
  - Used for acid foods
- \* **Pressure Canning**
  - Used for low acid foods (and some acid foods)

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## Why Two Methods of Canning?

### *Clostridium botulinum!*

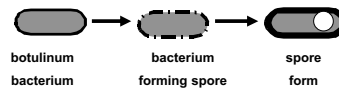
- \* Yeasts, molds and most bacteria are destroyed at boiling temperatures (212°F at sea level).
- \* *C. botulinum* forms spores that require higher temperatures for destruction in a reasonable period of time (usually 240°F or above at sea level).

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## Scenario for Botulism Food Poisoning

- \* *Clostridium botulinum* bacteria are found naturally in soil and water.
- \* 7 known types, but only A, B, E & F cause illness in humans.
- \* This bacterium can produce heat-resistant spores.

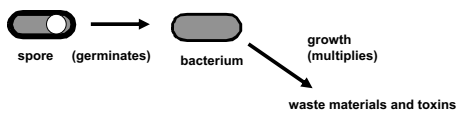


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## Botulism Food Poisoning

- \* To germinate, the spores need the following conditions:
  - Anaerobic
  - Low acid (pH > 4.6)
  - 40°F to 120°F
  - Relatively high moisture



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## Botulism Food Poisoning

- \* These conditions may be found in:
  - Home canned foods
  - Smoked fish and sausage
  - Foil-wrapped baked potatoes
  - Packaged mushrooms
  - Pot pies

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### Botulism Food Poisoning

- \* The botulinum toxin, one of deadliest known, causes botulism food poisoning.
- \* 1 mg can kill 655 tons of mice 
- \* Food can contain toxin without showing signs.
- \* Antitoxin is available, but there is slow recovery. Permanent nerve damage possible.



### Botulism Food Poisoning

- \* Symptoms usually appear within 12 to 72 hours:
  - Digestive upset (in some cases)
  - Blurred, double vision
  - Difficulty swallowing, speaking and breathing
  - Possible death from suffocation
  - 10-35% mortality rate



### Preventing Botulism

- \* Home Canned Foods
  - Spores won't germinate in acid foods (pH less than 4.6).
  - Spores killed when heated long enough at a specific temperature.
  - USDA usually recommends 240°F at sea level.
  - Pressure canner must be used for all low acid foods to reach that processing temperature.



### Preventing Botulism, cont.

- \* Food must be properly prepared and processed correct time.
- \* Canner must be accurate and operated correctly.
- \* Foods must be checked carefully when opening jars.
- \* Note: If presence of toxin is suspected, opened food should be de-toxified prior to discarding. The toxin is destroyed by boiling even though these bacteria are not.



### Significance of Heat Penetration

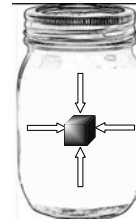
- \* Process time is affected by whether food heats by convection, conduction, or a combination of both.
- \* Heat penetration studies are used to scientifically determine safe processing times.
- \* The "cold spot" in the food must reach the correct temperature for the correct length of time to destroy target pathogens.

### Heating Patterns in Jars

Convection



Conduction





## Heat penetration, cont.

### \* Follow recipe exactly.

The following slow down heat penetration:

- Extra sugar or fat
- Oversize food pieces
- Added thickeners

### \* Use recommended canners.

Heat-up and cool-down times in pressure canners are counted toward sterilizing value of the process. Don't rush them.

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## Methods of Pack

### \* Raw Pack

- For foods that lose shape when cooked.
- Place raw food directly in jars. Boiling hot liquid is then poured over the food.
- Pack firmly, don't crush.
- Add jars carefully to warm canner to avoid breakage from heat shock.

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### \* Hot Pack

- Preferred method for most foods.
- Food is cooked in liquid before packing. Cooking liquid poured over food in jar.
- Fewer jars are needed.
- Less floating of food pieces in the jar.
- Better food color and flavor.
- Easier to pack, foods more pliable.
- Heat in preparing kills some microorganisms.

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## Headspace

\* This is the space in the jar between the inside of the lid and the top of the food or its liquid.

\* Check directions for the correct headspace for each food.

\* Usually:

- 1/4" jellied fruit products
- 1/2" fruits, tomatoes and pickles
- 1" to 1 1/4" low acid foods

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## Headspace

- \* **Too little**
  - Food may bubble out during processing.
  - Deposit on rim may prevent proper sealing.
- \* **Too much**
  - Food at the top is likely to discolor.
  - Jar may not seal properly, because processing time not long enough to drive all air from jar.

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## Closing the Jars

- \* **Remove air bubbles.**
- \* **Re-adjust headspace if necessary.**
- \* **Wipe jar rims.**
- \* **Adjust two-piece lids, fingertip-tight.**

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## Boiling Water Canner Canning

- \* **Have water simmering or hot in canner, high enough to cover jars when filled (about 6 inches for most loads).**
  - **Hot packed jars - simmering water**
  - **Raw packed jars - warm to hot water**
- \* **Place jars on rack in canner.**

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## Boiling Water Canning, cont.

- \* **Add more *hot* water if necessary, once jars are in canner.**  
(Don't pour hot water directly on raw-packed jars.)
- \* **Start counting process time after water returns to a full boil.**
- \* **Adjust process times for altitudes over 1000 ft.**

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## Boiling Water Canning, cont.

- \* At end of process time, turn off heat and remove lid.
  - Turn away from you to avoid steam.
- \* Wait 5 minutes.
- \* Remove jars to protected surface to air cool.

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## Pressure Canner Processing

- \* Have 2" to 3" of water simmering or hot in canner.
  - Hot packed jars - simmering water
  - Raw packed jars – warm to hot water
- \* Place jars on rack in canner.
- \* Put lid on canner with weight off or petcock open.

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## Pressure Canning, cont.

- \* Exhaust canner 10 minutes.
- \* Close vent or petcock.
- \* Start counting process time when correct pressure is reached.
- \* Adjust pressure for altitude, if needed.
- \* Turn off heat at end of processing.
- \* Let pressure drop to 0 psig naturally.

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## Pressure Canning, cont.

- \* Wait 2 minutes after pressure drops to 0 psig.  
(For some canners, check that locks in handles are released.)
- \* Remove weight or open petcock. Wait 10 minutes before removing lid.
- \* Open canner. (Watch steam!)

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## Fluctuating Pressure

- \* Large and/or quick variations in pressure during processing may cause loss of liquid from jars.
- \* If the variation is a drop in pressure after process has begun, it also means the process must be started over.



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## Force Cooling Canners

- \* Done by cooling the canner with running cold water or opening the vent port before canner air cools to 0 psig.
  - Do not cover with wet towels; do not put in cold air drafts.
- \* May result in:
  - Food spoilage.
  - Foodborne illness.
    - Underprocessing
  - Loss of liquid from jars.
  - Seal failures.
  - Warping of canner lid.

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## Cooling Jars

- \* Remove jars to padded surface or rack.
- \* Cool jars 12 to 24 hours, undisturbed.
- \* Check that jars have sealed.

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## Processing Time

- \* Each food and preparation style has its own processing time.
- \* Time differs with size of jar.
- \* Too Little (Underprocessing)
  - Spoilage
- \* Too Much (Overprocessing)
  - Overcooked



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## More Critical Controls

### \* Canning, Acidified Foods

- Some fruits are borderline to low acid and require some acidification.
- Fruits like figs and Asian pears
  - Acidified with bottled lemon juice
  - Asian pears – hot or raw pack
  - Figs – hot pack recommended



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## More Critical Controls

### \* Canning, Acidified Foods

- Tomatoes
  - Acidified except tomato paste
    - Citric acid, bottled lemon juice or vinegar
    - Can be added to bottom of empty jars
  - Choose process time for correct style of pack
    - Crushed – hot pack only
    - Whole or halved packed in water – hot or raw pack
    - Whole or halved packed in tomato juice – hot or raw pack
    - Raw pack – whole or halved with no added liquid



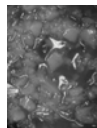
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## More Critical Controls

### \* Canning, Acidified Mixed Foods

- Example: tomato-based salsas
- Boiling water processes require equilibrium pH less than 4.6.
- Low acid ingredients are reduced in pH by addition of acid ingredients such as vinegars, tomatoes, fruit juices.
- The proportion of ingredients is a CRITICAL control.
- Hot vs raw pack can be a CRITICAL control.



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## More Critical Controls

### \* Canning, Low Acid Foods

- Potatoes: white and sweet
- Hot pack only
- Peeled only
- Use FRESH boiling water to cover in jar, not cooking water.
- Intended for “new” or waxy potatoes.
- The excess starch could mean they are underprocessed.




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## Testing Dial Gauges

- \* Accuracy of gauge essential to safety of the canned food.
- \* Two ways:
  - Maximum thermometer
  - Comparing to master dial gauge
    - E.g., Presto testing unit
- \* 1 pound error in a 20-minute process causes over 10% decrease in sterilizing value.
  - 2 pound error a 30% decrease.
- \* +/- 2 pounds → replace (USDA)



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## Testing for Seals

- \* Listen for “pop”.
- \* Lid curved inward, won’t move when pressed.
- \* Clear ringing sound when tapped.

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## Storage of Home Canned Foods

- Properly cool the canned foods after processing.
- When cool, check for seals.
- Remove screw band so it will not rust on.



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## Storage of Home Canned Foods

- Label with day, canner batch, etc.
- Store in a cool, dry, dark place.
  - Sporeforming spoilage bacteria can survive the canning process.
  - Store ideally 50-70°F; not over 95°F.
- Use within one year.
- Examine all canned foods before using them.

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## Food Quality Considerations

- \* Selection of raw material.
- \* Preparation steps.
- \* Using recommended canning steps.
  - Headspace.
  - Hot pack when recommended.
  - Proper use of BWC and PC.



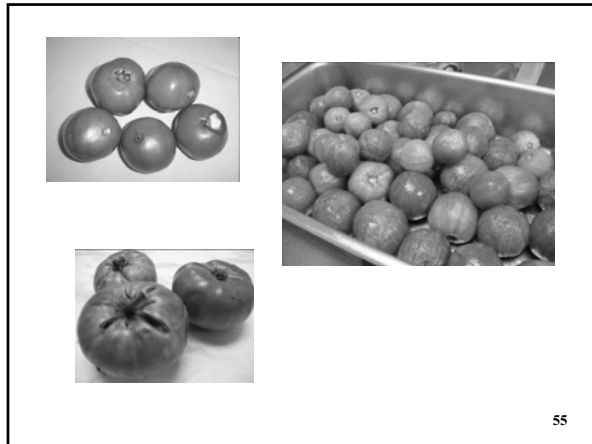
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## Selecting Produce


- \* Choose firm, ripe, unblemished products.
  - Tender veggies, firm fruits.
- \* Do not use overripe or decaying produce.
  - Avoid even slightest evidence of mold.
- \* Gather or purchase only what you are able to prepare or process within 2 to 3 hours.
- \* Use recommended varieties for some foods.

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## Washing Produce

- ★ **Dirt contains many microorganisms that are the hardest to kill.**
  - Spore forms of many bacteria.
- ★ **Wash everything, even foods to be peeled.**
- ★ **Use several water changes.**
- ★ **Lift the food, do not soak.**



## Pretreatments General

- ★ **Washing**
- ★ **Peeling**
- ★ **Trimming**
- ★ **Cutting to size:**
  - Slicing, dicing, chopping, etc.
  - Portioning meats, etc. for freezer.
- ★ **Antidarkening treatments**
  - For light-colored produce.
- ★ **Heating, blanching**

## Pretreatments Heat

- **Canning: Hot packs.**
- **Freezing: Blanching in water or steam.**
- **Drying: Blanching in water or steam or sugar syrup.**
- ★ **Stops enzyme activity.**
  - Color, flavor and texture changes.
- ★ **Removes oxygen from tissues.**
- ★ **Reduces microorganisms.**
- ★ **Shrinks the food for easier packaging.**

## Hot Packs in Canning

- ★ **Has same advantages as blanching for filling jars.**
- ★ **Less floating of produce in jars.**
- ★ **Long term:**
  - Better color retention.
  - Better texture.
- ★ **If acidified foods (mixes of acid and low acid ingredients):**
  - pH equilibrates faster.





## Antidarkening Solutions

- \* Reduce oxidative browning from exposure of cut surfaces to oxygen in the air.
- **Canning: Ascorbic acid solutions**
  - Used in preparing light colored fruits and vegetables.

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## Separation of Tomatoes



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## Do NOT Use These "Canning" Methods

- \* "Open Kettle"
- \* Oven canning
- \* Dishwasher
- \* Aspirin
- \* Steam canners
- \* Small pressure cookers
- \* Microwave oven canners

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## Processing in Cans

- \* Cans are treated differently than jars.
- Cans must be exhausted before lid goes on.
- (a heat treatment after filling but before sealing).



- \* Can sealers are needed.
- \* Training is needed to know how to make sure seals are formed properly with the machines.

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## Processing in Cans, cont.

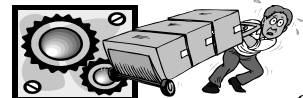
- \* Processing times can differ from jars.
- \* **Cooling:**
  - immerse in cold water.  
(usually a recirculating cooling bath in community canneries)
  - water may contain chlorine.

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## Processing in Cans, cont.

- \* No longer in home canning recommendations.
- Cans are very hard to find in small quantities;
- Special can sealing machine is needed and hard to find.
- Special instruction is needed on how to examine seals for integrity (correct formation).



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## Community Canneries

- Some use home-type equipment in community facilities with large ranges – e.g., a school.
- Some have specialized, small-scale commercial type equipment.
- Some process in metal cans, some don't.
- Some may be using processes that we do not have in our home canning book → still not recommended for home.
- UGA Extension Food Science conducted workshop for Vo-Ag operators several years ago and gave them a manual of process times.

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## Canning Jars

- \* Mason-type preferred with two-piece self-sealing lid.
- \* Range from 4 oz – half gallon.
  - Usually half-pint to quart recommended.
  - Half gallon only for apple and grape juice.

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## Newer Jars

### \* Ball® Collection Elite™ Platinum Jar

- Wide mouth 8 oz (half-pint) – “flattened”
- Platinum color lids
- Use same half-pint process times



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## Other Jars

### \* Ball® Creative Containers™

#### \* STORAGE ONLY

- Wire bales, rubber rings
- 1, 2 and 4 gallon sizes
- 1 gallon with spigot



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## Other Jars

### \* Weck Jars

- Reservations about use



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## Canners

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### Mirro Pressure Canners



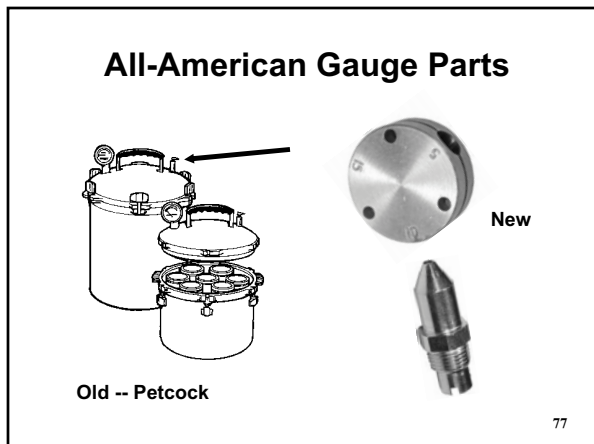
- \* Old weighted gauge
- \* "Tinker-toy"
- \* One piece
- \* 5, 10, 15 holes around outside edge



- \* New weighted gauge
  - Round when fully assembled
  - 3 pieces for 5, 10, 15



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## Other Common Issues

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## Smooth Top Ranges

- **Is everybody buying one???**
  - Glass or glass ceramic tops.
  - Adjustable or set burner sizes.
- **Issues for canning:**
  - Flat bottom pot contact.
  - Scratching.
  - **\*\*Over-heating protections and "cycling".**
    - Cut burners off automatically if too much heat builds up.
  - **\*\*Matching burner size to pot.**
    - Damage to surface.
  - Cooking with aluminum issues.



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## Smooth Top Ranges

- **Canner manufacturer's messages**

- **Mirro pressure canners:**

Please note: This item is not recommended for use on Glass, Ceramic or Flat Top Stoves.

The diameter of this canner is larger than most burners, and may cause heat to transfer outward and damage the surrounding surface.

- **Presto:**
  - Warns consumers about avoiding damage to cooktop.
- **Others??**



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## Smooth Top Ranges

- **Our recommendation:**
- **Follow the manufacturer's recommendation.**
  - Concerned about liability for damage.



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## Changes in Canning Steps

### Boiling Water

At end of process...  
After turning off heat...  
After removing lid....

Wait 5 minutes

...Before removing jars.



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## Changes in Canning Steps

### Pressure

When pressure returns to 0...  
After removing weight....

Wait 10 minutes

...Before removing lid.



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## Resources for Extension

- **So Easy to Preserve**
  - 5<sup>th</sup> edition only - 2006
  - Book
  - Video series



- **USDA Complete Guide to Home Canning - 2009**

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## The Videos - DVDs



- **Eight shows**
  - Canning Fruits
  - Canning Tomatoes and Tomato Sauce
  - Canning Vegetables
  - Freezing Fruits and Vegetables
  - Drying Fruits and Vegetables
  - Jams and Jellies
  - Canned Specialties
    - Tomato chile salsa, jicama relish and mango chutney
  - Pickling
    - Bread & butter, quick whole dills, corn relish



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## www.soeasytopreserve.com

The website features a navigation menu with links to DVD Order Forms, Book Order Forms, and Home to Preserve Food. The 'The Book' section highlights the 5th edition of 'So Easy to Preserve' as a 274-page book with over 100 tested recipes. The 'Demonstrations on DVD' section describes eight 20 to 30-minute videos covering various preservation techniques.

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The 'Old' cover features a circular arrangement of various preserved foods. The 'New' cover, published by the USDA, features a similar circular design but with more detailed illustrations and text, including the title 'Principles of Home Canning'.

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## Exhibits

The exhibits include a booklet titled 'So Easy to Preserve' with sections on 'Water Bath Preservation' and 'Canning'. Below it are 'VEG YOU WITH IT!' cards that provide information on how to safely preserve various vegetables like tomatoes, peppers, and eggplants.

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## Ball Blue Book – Anniversary Edition



Most recent previous edition:



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## National Center for Home Food Preservation

[www.homefoodpreservation.com](http://www.homefoodpreservation.com)

**About Us**  
The National Center for Home Food Preservation is your source for current research-based recommendations for most methods of home food preservation. The Center was established with funding from the Cooperative State Research, Education and Extension Service, U.S. Department of Agriculture (CREEE-USA) to address food safety concerns for those who practice and teach home food preservation and processing methods.

**What's New**  

- **5th Edition of "Preserving Food at Home: A Self-Study"**
- **Introduction to Food Preservation**
- **Canning Acid Foods**
- **Canning Low Acid Foods**

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## On-line Self-Study

**What's New**  

- **5th Edition of "Preserving Food at Home: A Self-Study"**
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## On-line Self-Study

**Registration for Preserving Food at Home: A Self-Study**

Privacy Statement: The information you provide will be used solely to obtain a login account for you to access this course at the University of Georgia. All information will be kept confidential. All fields are required, you may be contacted to verify the information before an account is established for you.

First Name: \_\_\_\_\_  
 Last Name: \_\_\_\_\_  
 e-mail Address: \_\_\_\_\_  
 Phone Number (on the form, 111-022-3333): \_\_\_\_\_

Which of the following would best describe you?  
 Extension Agent  
 Other Community Educator  
 School Teacher  
 Student, Elementary or High School  
 Student, College  
 Food Safety Specialist at a University  
 Industry Professional  
 Media or Food Writer

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## Preserving Food at Home: A Self Study

- ▶ eLC format
- ▶ 4 modules
  - Introduction to Food Preservation
  - Introduction to Home Canning
  - Canning Acid Foods
  - Canning Low Acid Foods
- ▶ Pre- and Post-quizzes grant access to modules; 10 multiple choice questions.

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## Self Study

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LEARNING COMMONS

Home Page

Course Information | Course Content | Course Objectives

If you have problems navigating this course or accessing the content, please contact Jimmy Hansen @ [tuzh@uga.edu](mailto:tuzh@uga.edu)

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  - [www.homefoodpreservation.com](http://www.homefoodpreservation.com)
- \* [www.soeasytopreserve.com](http://www.soeasytopreserve.com)
  - For ordering

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