



IOWA STATE UNIVERSITY Extension and Outreach

CANNING: PICKLES

Pickling is preserving a food with acid and salt. The key to safe pickling is making sure that the acid is high enough to kill any microorganism that can lead to spoilage and illness. There are four types of pickles: fermented or brined, quick pack, fruit, and relishes. See more information and recipes beginning on page 6.

INGREDIENTS

All vegetables, fruits, spices, and herbs used in pickle products should be fresh and of high quality. Pickling will not improve poor quality products.

Cucumbers Plant a variety of cucumbers intended for pickling. Immature salad or slicing cucumbers do not make good quality pickles. Burpless cucumbers are not recommended for pickles because they have a tough skin that may inhibit brine absorption and also contain enzymes that could cause pickles to soften. If you purchase cucumbers, make sure they have not been waxed. Although the wax used on cucumbers is completely safe, it may inhibit penetration of the brine and pickling solutions.

Pickle quality is affected by the time lapse between harvesting and pickling. Plan to pickle fruits or vegetables within 24 hours after harvesting. Soil can harbor bacteria that can cause spoilage or softening, so be sure vegetables are washed well, especially around the stem. Blossoms contain enzymes that can cause softening, so always remove a 1/16-inch slice from the blossom end of the vegetable.

Vinegar Cider vinegar or white distilled vinegar can be used in pickle recipes. Cider vinegar tastes more mellow, but may darken white or light-colored fruits and vegetables. White distilled vinegar has a sharper taste and should be used when a light color is important.

Do not use homemade vinegar. The level of acidity is important to both the flavor and safety of the product. Never alter the amount of vinegar or water. All USDA tested pickle recipes are based on the use of vinegar with 5 percent acetic acid. This is the acidity level of most high quality, commercially bottled vinegar.

Some fermented pickle products, like sauerkraut, do not require vinegar or acetic acid because of lactic acid produced during brining and fermentation. In certain recipes for genuine dill pickles, some vinegar is added initially and lactic acid is formed during the fermentation process.

Salt Use only canning or pickling salt. Table salt is pure but contains iodine and anti-caking agents that might cause pickles to darken or the liquid to become cloudy. Do not use flaked salt or rock salt.

Reduced sodium salt may be used in quick pickle recipes but the pickles will have a different flavor. Reduced sodium salt should not be used in fermented pickle recipes.

Always use the amount and type of salt specified. Salt, as used in brining, functions as a preservative. The brine draws moisture and natural sugars from the vegetable. Lactic acid is then produced, which prevents spoiling.

Water Use soft water for best results. Extremely hard water can interfere with curing and cause discoloration of pickles, particularly if the water has a high iron content. Some types of hard water can be softened by the following method. Boil water for 15 minutes, remove the scum, cover and let the water stand 24 hours. When the sediment has settled to the bottom, pour off the water without disturbing the sediment. Discard sediment and use water. Distilled or bottled water can be used for pickles also, but may be expensive.

Sugar Use white granulated sugar unless otherwise specified. Brown sugar may darken the liquid and change the flavor slightly. If you plan to use a nonnutritive sweetener, use tested recipes that accompany these products.

Spices and Herbs Spices and herbs lose quality rapidly after opening; for best flavor, buy fresh seasonings yearly.

Use clean, fresh, insect-free heads of dill. Avoid overmature, dry, brown dill. Fresh dill is preferred because it gives better flavor, but 1 to 3 teaspoons dill seed can be substituted for one head fresh dill.

Lime Using quality ingredients and current pickling methods eliminates the need for crisping or coloring ingredients. Calcium increases the firmness of both pickled and fermented cucumber; alum only improves the firmness of fermented cucumbers. Pickling lime (calcium hydroxide) is a common calcium source added to firm pickles. DO NOT use quick lime or agriculture lime as they are unsafe for human consumption. Food-grade lime can be purchased at most supermarkets and drugstores.

Lime should be used only as a soak solution, not in the processing liquid. The absorbed lime will increase to the pH of the cucumbers so they must be rinsed thoroughly before processing according to the tested recipe.

Combine 1 cup pickling lime with ½ cup canning or pickling salt and 1 gallon water in a 2- or 3-gallon crock or enameled container. Avoid inhaling lime dust when mixing solution. Soak cucumbers in lime water for 12 to 24 hours. To rinse, drain the lime water solution, then put cucumbers in a large clean container and soak in fresh, cold water for 1 hour. Repeat rinsing and soaking steps two more times, using fresh, cold water each time. Drain well.

Store any leftover pickling lime in a clean, labeled glass jar with a tight fitting lid to keep the powder dry and free-flowing.

EQUIPMENT

Use unchipped enamel-ware, stainless steel, aluminum, or glass pots for heating pickling liquids. Do not use copper, brass, iron, pewter, or galvanized pans or utensils. These metals can react with acids or salts to produce undesirable changes in color or flavor, or even form toxic compounds.

Genuine dill pickles and sauerkraut are traditionally fermented in stoneware crocks but can be brined in large containers made of glass, unchipped enamel-ware, or food-grade plastic. Large plastic pails can be purchased in home winemaking shops or at restaurant supply stores. Do not use plastic pails that have been used previously for chemicals, raw meats, poultry or seafood; plastic wastebaskets or garbage cans or copper, iron, or galvanized metal containers.

Fermented pickles and sauerkraut must be kept submerged during the fermentation period. The vegetables should be covered by 1 to 2 inches of brine. Cover pickles with a clean, heavy glass lid, pie plate, or dinner plate and weight down with clean, sealed jars of water. Do not use stones or bricks that might introduce impurities. A heavy, food-grade plastic bag filled with brine makes a good cover and weight for sauerkraut and pickles. For extra protection use two plastic bags. The bag is filled with brine as a precaution; if it is punctured accidentally the brine in the container will not be diluted.

Cover the container of fermenting vegetables with a clean, heavy bath towel to prevent contamination from insects and molds. Be sure the towel does not smell like detergent or fabric softener because this could impart a perfumed or soapy flavor to the pickles.

JARS

Use standard canning jars and two-piece lids for packing pickles. Jars should be free of chips, cracks, or nicks that could prevent an airtight seal. Mayonnaise jars or other commercial jars are not recommended for home canning because they are not designed for use with two-piece lids and because the glass is more likely to break during heat processing. To clean jars, wash them in hot, soapy water and rinse well. If a sterilized jar is needed, follow the instructions given below. Prepare bands according to manufacturer's directions.

Mineral deposits or hard water film on jars can be removed by soaking the empty jars for several hours in a solution of 1 cup vinegar per gallon of water. To avoid mineral deposits on jars during processing, add ¼ cup vinegar per gallon of water used in the boiling water canner.

Sterilize empty jars Sterile jars should be used for all pickled products processed in a boiling water canner for less than 10 minutes or by low-temperature pasteurization. Jars do not have to be sterilized if food will be processed 10 minutes or longer.

To sterilize empty jars, put them right side up on the rack in a boiling water canner. Fill canner and jars with hot (not boiling) water to 1 inch above the tops of the jars. Boil 10 minutes if you are canning at altitudes of less than 1,000 feet or for 11 minutes if elevation is between 1,000 and 2,000 feet. Using a jar lifter or tongs, remove and drain hot sterilized jars one at a time. Fill with food, add lids, tighten screw bands and process. Save the hot water for processing filled jars.

PROCESSING

All pickle products must be heat processed to destroy yeast, mold, and bacteria that cause spoilage and to inactivate enzymes that might affect color, flavor, or texture of the product. Heat processing also ensures a good, airtight seal.

Processing time varies with altitude. As altitude increases, water boils at a lower temperature (less than 212°F). Since lower temperatures are less effective for killing bacteria, processing time must be increased as altitude increases when using a boiling water canner. Refer to the map on page 5 for the altitude of your county.

Pickle products can be heat processed in a boiling water canner or, if indicated in the recipe, by low-temperature pasteurization.

Processing times for the boiling water canner and low-temperature pasteurization are not interchangeable. Level of acidity (pH), size of food pieces (density), and percentage of salt determine the processing time and procedure necessary to safely preserve pickles. If processing in the boiling water canner, make sure the water is boiling (212°F) and use the specific time recommended in Table 1.

If the recipe indicates the pickles should be processed by the low-temperature pasteurization method, make sure the water is maintained at 180°F to 185°F and that the pickles are processed for the entire 30 minutes.

To process in a boiling water canner Fill canner halfway with water and preheat to 180°F for hot pack or 140°F for raw pack. Load jars into canner. Be sure water can circulate freely around each jar. Add boiling water to a level of 1 to 2 inches above the jars. Bring water in canner to a vigorous boil, adjust heat to maintain a gentle boil, cover, and process for the time specified in Table 1. Leave the lid on the canner. Keep water boiling (212°F) during the entire processing period. If water evaporates, add boiling water to keep it at least one inch over the top of jars. Do not reduce the processing time. When processed for the recommended time, turn off the heat and remove the canner lid. Wait five minutes before removing the jars.

To process by low-temperature pasteurization

Caution: Use only when recipe indicates. Low-temperature pasteurization results in better pickle texture but must be carefully managed to avoid possible spoilage. Place jars in a canner filled halfway with warm (120-140°F) water. Add hot water to a level 1 to 2 inches above jars. Regulate heat to maintain 180 to 185°F water temperature for 30 minutes. Check with a candy or jelly thermometer to be certain water temperature is at least 180°F during the entire 30 minutes. Temperatures above 185°F could cause unnecessary softening of pickles; temperatures below 180°F could result in spoilage. Do not change the processing time. Remove jars when processing time is up.

Remove and store jars After waiting five minutes, take jars from canner and set upright on a rack or on a folded cloth away from drafts. Do not tighten screw bands. Allow jars to cool undisturbed for 12 to 24 hours. Check for sealing failures. To test jar, press center of lid. If lid is down and will not move, jar is sealed. Remove screw bands carefully. Wash, dry, label, and store jars in a cool, dark place. If any jars have not sealed, refrigerate them. Pickles may be reprocessed starting with new lids and clean jars, but quality will be affected. Pickle products are safe as long as lids remain sealed. Never use products that show evidence of mold.

QUALITY

Many factors affect pickle quality, including soil and growing conditions, type of salt and vinegar used, variety and maturity of produce, time lapse between gathering and pickling, and method of processing. Always use USDA tested recipes and follow the directions exactly. Spoilage can result when improper processing, unsanitary techniques, or poor quality ingredients are used.

Always look for signs of spoilage before opening the jar. An unsealed lid means the product has probably spoiled. Other obvious signs are mold, a soft or slippery product, change of color, or disagreeable odor. If any of these are present or if you question the safety of the product, don't taste it. Discard contents so they cannot be eaten by humans or animals. Wash jar in hot, soapy water and then place in boiling water for 15 minutes before using the jar again.

For information about specific pickle and sauerkraut problems, see Tables 2 and 3 (page 4).

Table 1.
Recommended Processing Times in a Boiling Water Canner

PRODUCT	STYLE of PACK	JAR SIZE	PROCESS TIMES at ALTITUDES of	
			0-1,000 FT	1,001-6,000 FT
QUICK FRESH-PACK DILL PICKLES	Raw	Pint	10 minutes	15 minutes
		Quart	15 minutes	20 minutes
BREAD AND BUTTER PICKLES	Hot	Pint or Quart	10 minutes	15 minutes
PICKLE RELISH	Hot	Half-pint or Pint	10 minutes	15 minutes
DILL PICKLES	Raw	Pint	10 minutes	15 minutes
		Quart	15 minutes	20 minutes

Table 2. Common Pickle Problems

PROBLEM	CAUSE
Soft or slippery	<ol style="list-style-type: none"> 1. Brine or vinegar was too weak. Use vinegar of 5% acidity. 2. Pickles were not kept covered with liquid during brining and when packed in jars. 3. Scum was not kept removed from top of brine; it should be removed daily during the brining process. 4. Pickles were not processed long enough to destroy spoilage microorganisms. 5. If unspoiled, pickles were overprocessed or heated at too high a temperature (over 200°F). 6. Blossom end was left attached to cucumbers and enzymes present caused softening. 7. Pickles were stored in an area that was too warm.
Dark or discolored	<ol style="list-style-type: none"> 1. Iron present in hard water. 2. Brass, iron, copper, or zinc utensils were used. 3. Ground spices were used instead of whole spices. 4. Whole spices used to flavor pickling liquid were not removed prior to packing. 5. Iodized salt used. 6. Cider or malt vinegar used for light colored pickles.
White sediment in bottom of jars and firm, fermented pickles.(If pickles are soft, spoilage is evident. Do not use.)	<ol style="list-style-type: none"> 1. Harmless yeast grew on the surface and then settled. The presence of a small amount of white sediment is common. 2. Table salt was used. 3. Temperature was not controlled.
Hollow	<ol style="list-style-type: none"> 1. Faulty growth of cucumber. When washing cucumbers, note that hollow cucumbers usually float. These can be used in relishes. 2. Cucumbers were not fresh when pickling was begun. 3. Wrong variety of cucumber used; must use pickling variety. 4. Temperature was too high during fermentation. 5. Fermentative yeasts caused a gaseous type spoilage. 6. Sugar added to brine. 7. Improper heat treatment to pasteurize.
Bitter flavor	<ol style="list-style-type: none"> 1. Cucumbers had dry growing season. 2. Too much spice.
Shriveled	<ol style="list-style-type: none"> 1. Too much time lapse between gathering and pickling cucumbers. 2. Brine was too strong at beginning of curing. 3. Too much salt, sugar, or vinegar used. 4. Cooked too fast in strong salt or sugar solution. 5. Overcooking or over processing.
Dull, faded color	<ol style="list-style-type: none"> 1. Cucumbers were over-mature, sunburned, grown under unfavorable conditions, or of poor quality. 2. Pickles not covered with liquid.

Table 3. Common Causes of Spoilage in Sauerkraut

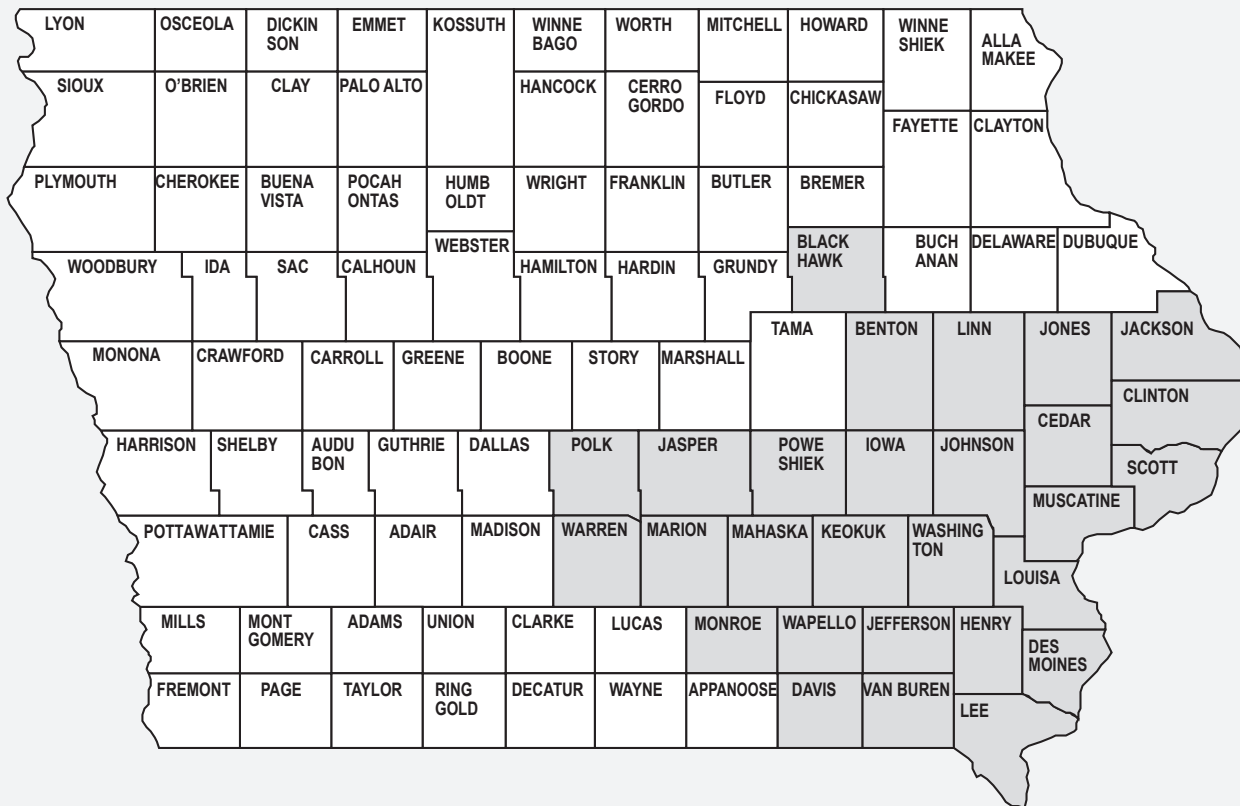
If sauerkraut becomes soft, slimy, or develops a disagreeable odor or unnatural color, discard it.

PROBLEM	CAUSE
Soft Kraut	<ol style="list-style-type: none"> 1. Not enough salt. 2. Temperature was too high during fermentation. 3. Uneven distribution of salt. 4. Air pockets caused by improper packing.
Pink Kraut	<ol style="list-style-type: none"> 1. Growth of certain types of yeast on surface. 2. Uneven distribution of salt. 3. Improperly covered or weighted during fermentation.
Dark Kraut	<ol style="list-style-type: none"> 1. Unwashed and improperly trimmed cabbage. 2. Juice did not cover fermenting cabbage. 3. Uneven distribution of salt. 4. Exposure to air. 5. High temperatures during fermentation, processing, and storage. 6. Long storage period.
Rotted Kraut	Usually found at surface where the cabbage has not been covered sufficiently to exclude air during fermentation.

Altitudes of Iowa Counties

Shaded areas are less than 1,000 feet

Unshaded areas are 1,000 to 2,000 feet



Fermented pickles and sauerkraut are cucumbers and cabbage that may be fermented by bacteria producing lactic acid. The lactic acid helps preserve the food by lowering the pH to less than 4.0, making them simple to preserve. The fermentation process changes the flavor, texture and color of the foods. This process can take between two to six weeks. Examples include genuine dill pickles, sweet gherkins and sauerkraut.

Quick or fresh packed pickles include whole cucumber slices and bread and butter pickles. These are easily prepared pickles that have a tart flavor. These are cured in a salt solution for several hours or directly combined with boiling hot vinegar, spices, and other seasonings.

Pickled fruit consist of whole fruit usually simmered in a spicy, sweet-sour syrup.

Relishes are made from chopped fruit and vegetables that are seasoned and cooked to the desired consistency in a spicy vinegar solution.

Below are a few pickling recipes for you and your family to enjoy.

RECIPES

Quick Fresh-Pack Dill Pickles

Yield: 7-9 pints

8 pounds pickling cucumbers (3- to 5-inch)	2 quarts water
1 ¼ cups canning or pickling salt	2 tablespoons whole mixed pickling spice
2 gallons water	14 heads of fresh dill (1 ½ heads per pint jar) OR
1 ½ quarts vinegar (5%)	4 ½ tablespoons dill seed (1 ½ teaspoons per pint jar)
¼ cup sugar	
About 3 tablespoons whole mustard seed (1 to 2 teaspoons per pint jar)	

Wash cucumbers. Cut ⅛-inch slice off blossom end and discard; leave ¼-inch of stem attached. Place cucumbers in a large suitable container. Dissolve ¾ cup salt in 2 gallons water. Pour over cucumbers and let stand 12 hours. Drain. Combine vinegar, remaining ½ cup salt, sugar, and 2 quarts water. Place pickling spices in a spice or cheesecloth bag and add to pickling solution. Heat to boiling. Fill jars with cucumbers. Add 1 teaspoon mustard seed and 1 ½ heads fresh dill per pint. Cover with boiling pickling solution, leaving ½-inch headspace. Remove air bubbles and adjust headspace if needed. Wipe jar rims. Adjust lids and process in boiling water canner for time specified in Table 1 or use low-temperature pasteurization as described on page 3.

Bread-and-Butter Pickles

Yield: About 8 pints

6 pounds pickling cucumbers (4- to 5-inch)	4 ½ cups sugar
8 cups thinly sliced onions (about 3 pounds)	2 tablespoons mustard seed
½ cup canning or pickling salt	1 ½ tablespoons celery seed
Crushed or cubed ice	1 tablespoon ground turmeric
4 cups vinegar (5%)	

Wash cucumbers. Cut ⅛-inch off blossom end and discard. Cut cucumbers into ¾-inch slices. Place cucumbers and onions in a large bowl. Add salt. Cover with 2 inches crushed or cubed ice. Refrigerate 3 to 4 hours, adding more ice as needed. (For firmer pickles see variation with pickling lime.)

In a large pan heat remaining ingredients to boiling. Boil 10 minutes. Add well-drained cucumbers and onions and slowly reheat to boiling. Fill jars with hot cucumber slices and cooking syrup, leaving ½-inch headspace. Remove air bubbles and adjust headspace if needed. Wipe jar rims. Adjust lids and process in boiling water canner for time specified in Table 1 or use low-temperature pasteurization described on page 3. After processing and cooling, pickles should be stored 4 to 5 weeks to develop ideal flavor.

Variation for firmer pickles: Wash cucumbers. Cut ⅛-inch off blossom end and discard. Cut into ¾-inch slices. Mix 1 cup pickling lime and ½ cup pickling or canning salt with 1 gallon water in a 2- to 3-gallon crock or enameled container. CAUTION: Avoid inhaling lime dust while mixing the lime-water solution. Soak cucumber slices in lime water for 12 to 24 hours, stirring occasionally. Using a slotted spoon, remove cucumbers from lime solution, place in a colander or strainer, and rinse well. Put cucumbers in a large clean container and soak in fresh, cold water for 1 hour. Repeat rinsing and soaking steps two more times, using fresh, cold water each time. Handle carefully, as slices will be brittle. Drain well and proceed as above.

Pickle Relish

Yield: About 9 pints

3 quarts chopped cucumbers	Ice
3 cups chopped sweet green peppers	Water
3 cups chopped sweet red peppers	2 cups sugar
1 cup chopped onions	6 cups white vinegar (5%)
¾ cup canning or pickling salt	
4 teaspoons each: mustard seed, turmeric, whole allspice, and whole cloves	

Add cucumbers, peppers, onions, and salt to ice water (4 cups ice in 8 cups water); let stand 4 hours. Drain and cover vegetables with fresh ice water (4 cups ice in 8 cups water) for another hour. Drain again.

Place spices in a spice or cheesecloth bag. In a saucepan combine sugar and vinegar; add spice bag. Heat to boiling and pour mixture over vegetables. Cover and refrigerate 24 hours. Heat mixture to boiling. Fill clean jars with hot pickle relish, leaving ½-inch headspace. Remove air bubbles and adjust headspace if needed. Wipe jar rims. Adjust lids and process in boiling water canner for time specified in Table 1.

Dill Pickles

Use the following quantities for each gallon capacity of your container.

- 4 pounds pickling cucumbers (4-inch)
- 2 tablespoons dill seed (4 to 5 heads fresh or dry dill weed)
- ½ cup salt
- ¼ cup vinegar (5%)
- 8 cups water and one or more the following:
 - 2 cloves garlic (optional)
 - 2 dried red peppers (optional)
 - 2 teaspoon whole mixed pickling spices (optional)

Wash cucumbers. Cut ⅛-inch off blossom end and discard. Leave ¼-inch of stem attached. Place half of dill and spices on the bottom of a clean, suitable container (page 2 of this handout). Add cucumbers, remaining dill, and spices.

Dissolve salt in vinegar and water. Pour over cucumbers. Add suitable cover and weight (page 2 of this handout).

Store in an area where the temperature is between 70°F and 75°F for approximately 3 to 4 weeks while fermenting. Temperatures between 55°F and 65°F are acceptable, but the fermentation period will take 5 to 6 weeks. It is important to avoid temperatures over 80°F or pickles will become too soft during fermentation.

Check the container several times a week. Promptly remove surface scum or mold. If the pickles become soft, slimy or develop a displeasing odor, discard them.

After Fermentation:

Refrigerating: Fully fermented pickles may be stored in the original container for about 4 to 6 months in the refrigerator. Remove surface scum and mold regularly.

Canning: Canning fully fermented pickles is a better way to store them. To can fully fermented pickles pour the brine into a pan and heat slowly to a boil. Simmer for 5 minutes. Filter the brine through paper coffee filters to decrease cloudiness (optional). Fill canning jar with pickles and hot brine, leaving ½-inch headspace. Remove air bubbles and adjust headspace if needed. Wipe jar rims. Adjust lids and process in boiling water canner for the time specified in Table 1 or use low-temperature pasteurization described on page 3.

The following treatment results in a better product texture but must be carefully managed to avoid possible spoilage. Place jars in a canner filled half way with warm (120° to 140°F) water. Then, add hot water to a level 1 inch above jars. Heat the water enough to maintain 180° to 185°F water temperature for 30 minutes. Check with a candy or jelly thermometer to be certain that the water temperature is at least 180°F during the entire 30 minutes. Temperatures higher than 185°F may cause unnecessary softening of pickles.

FOR MORE FOOD PRESERVATION INFORMATION

- Call AnswerLine (800) 262-3804 (voice) or (800) 735-2942 (telecommunications device for deaf)
- Download ISU Extension and Outreach fact sheets from store.extension.iastate.edu
- Access the U.S. Department of Agriculture's *Complete Guide to Home Canning* at nchfp.uga.edu

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Map prepared by Iowa Department of Natural Resources, Geological Survey Bureau

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