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Apples are Peaking; Choose the Best Preservation Method

Elizabeth L. Anndress, National Center for Home Food Preservation, June 2016

Did you know that once an apple tree begins to bear fruit, it will do so for a century? Today, there are over 2,500 varieties of apples grown in the United States. Fall weather brings the best fresh apples in bushels.

While we are in a season of peak apple production in many states, you might consider preserving some specialties that will add variety to menus throughout the year. Apples can be dried, made into applesauce or apple butter, or even made into a delicious apple pear jam. Apples do not make the highest quality canned or frozen slices, but they can be preserved by those methods, also.

Whether you are buying apples by visiting the nearby orchard, the grocery store or market, or even picking apples from your own backyard, choose the preservation method that is best for your apple variety. Varieties that are good for freezing include: Golden Delicious, Rome Beauty, Stayman, Jonathan and Granny Smith. Varieties that are good for making applesauce and apple butter include: Golden Delicious, Rome Beauty, Stayman, Jonathan, Gravenstein and McIntosh. Red Delicious apples are best eaten fresh. They do not freeze or cook well.

When selecting your apples, remember that their flavor is best when they are at the peak of maturity. To judge the maturity of apples, do not go by size. Different varieties have different typical diameters. Choose apples that are free of defects, such as bruises, skin breaks and decayed spots. Little brown spots appearing solely on the skin of the apple, called “russeting,” does not affect quality. Beware and on the lookout for browning or broken skins that are evidence of actual spoilage such as rotting or mold. Also look for firm (hard) apples since soft apples tend to have a mealy texture and overripe flavor.

If making applesauce, apple butter or dried slices with your apples, use them as soon as possible after harvest. If any apples must be stored, keep them in a cool, dark place. They should not be tightly covered or wrapped up; a perforated plastic or open paper bag, basket or wooden crate are good choices. If kept in the refrigerator, apples should be placed in the humidifier compartment or in a plastic bag with several holes punched in it (or in a zipper-type vegetable bag). This prevents loss of moisture and crispness. Apples should not be placed close to foods with strong odors since the odor may be picked up by the apples.

Backgrounder: Heat Processing of Home-canned Foods

Why do individual home-canned foods have different heat processing times?

There are several factors that affect the way in which heat is distributed through the food in a jar during a home-canning process. It is this variation in heat penetration that determines the position of the “cold spot” (the slowest heating area) of the jar, which can be different for different jar sizes and shapes as well as different foods. The heating rate at the cold

spot determines how long the process time needs to be. In the case of low-acid foods, this is to ensure that the food receives the heat necessary to kill *Clostridium botulinum* spores. Left alive inside a sealed jar of low-acid food at room temperature, the spores become bacterial cells that multiply and produce the toxin that causes botulism poisoning.

The time and temperature combinations at which *C. botulinum*, its spores and other bacteria are killed are established under certain conditions. However, the substrate (food) in which these bacteria are found is an important variable factor in the rate of destruction. The food factors that will influence the amount of heating needed to kill bacteria include: the consistency of the food; the pH (acidity); and, the presence of nutrients that are "protective" for bacteria (e.g., high protein and sugar levels). Other influences on the amount of heat delivered to the food in the jar are: the shape and size of the jar; the size, shape and texture of food pieces; the solid to liquid ratio; the temperature of the food at the beginning of the process; and, the temperature inside the canner. For example, heat penetration through a mass of liquid (faster) will be very different from heat penetration through puréed or mashed food (slower). This is apparent during stove-top cooking too, where different foods heat up differently based on their composition and consistency.

If the food is thick, puréed, or mashed; if there are large pieces of food in the jar; or, if the food is packed in too tightly, heat penetration can be slower than in more liquid or loosely packed foods. If a specific heat process is not calculated for each food and style of pack, the heating may not be adequate, and the food will be underprocessed.

How is the processing time for a food determined experimentally?

Heat penetration experiments, which are necessary for all low-acid foods and some acid foods, are carried out in a properly equipped laboratory. The food prepared by specific procedures is filled into jars and thermocouples (temperature measuring devices) are inserted through the lid, jar or can into the food in the jar. These are connected by wires to a monitor, and the temperature at the end of each thermocouple is recorded throughout the time the canner comes up to processing temperature, during a process at that temperature (e.g., boiling water or 240°F under pressure), and during at least some of the cooling period.

Determining the heat penetration curve is a two-step procedure. The first step is to put thermocouples in several areas of the jar to determine the "cold spot" (slowest-heating location) of the jar. Once that spot is located, more data is collected at the cold spot to have enough information to calculate the process time for this food under these specific conditions – i.e., in a particular jar type in this canner. The process time is the time needed to achieve a certain level of "lethality", or killing of a number of target pathogens or spoilage organisms for that food.

In the case of low-acid foods, the processing time needs to ensure that the minimum temperature and time combination to destroy spores of *C. botulinum* is reached, so that the food will be safe when stored on the shelf. Microbiological confirmation tests then need to be done for low-acid foods to make sure that spores of *C. botulinum* will not survive the process time calculated from heat penetration data. In the case of acid foods, the target microorganisms will be different and ones determined to be the most heat resistant ones for that particular food that could make someone sick or spoil the food.

This process has to be done separately with each food, as well as any variation that alters pH, consistency, texture, distribution of solids and liquids, or other factors that result in a "new' product". Experimentally determining safe processing times for home-canned foods is thus a lengthy, expensive and time-consuming process, which explains why there are fewer home-canned processes available than many people would like. In short, there is no easy formula to work out processing times without experimentation and analysis that take into account how each food product heats in a particular canning situation.

Why do some foods have both hot and raw pack processing times, while others have one or the other?

The offering of hot and/or raw packs is usually based on quality issues with the finished product. However, USDA process recommendations have been developed over time by different laboratories and researchers. Sometimes it has

been the choice of the researchers who developed the process recommendation to only use one method. Individual food characteristics can also lead to the need for specific preparation procedures. For example, in a hot pack process for a starchy food like potatoes, the food is precooked in water that is then discarded (some of the starch is drawn out into the water) and replaced by fresh boiling water when filling jars. If a raw pack process was chosen for the same product, the starch that now cooks out in the jar may later gelatinize and/or cause excessive cloudiness in the finished "raw pack". This amount of starch in the jar also causes safety concerns during the canning processing, and makes it hard to detect any post-processing spoilage in the stored jar. As another example, many pickled products are hot packs because the pre-heating starts to acidify the food before it goes in the jar and results in a safer product.

Why are hot and raw pack processing times sometimes the same?

Hot pack and raw pack variations, if they are offered in USDA recommendations, have each been researched separately. This includes collecting heat penetration data and calculating an independent process time for each. So the process time is determined by the actual heating characteristics of the pack. Depending on preparation procedures and the type of process, the final result may be the same. Other times, it might be different. The temperature of the process (boiling water or pressure) and the length of the process needed can influence the differences between hot and rack pack rates of heating. Another consideration is that USDA home-canning processes are rounded off to the next higher 5-minute interval. If the hot and raw pack process times vary by less than 5 minutes, but in the same interval, the recommended process time will be the same. For example, if the hot pack is calculated as 11 minutes and the raw pack requires 14 minutes, they will both get rounded off to, and published as, a 15-minute process time.

Why should I not make up a processing time for a food that I wish to can?

Underprocessed low-acid foods run the risk of allowing survival of *Clostridium botulinum* and its spores, and consumption of these foods can lead to botulism, an often fatal disease, and one that involves expensive health-care costs and health complications for those that do survive. Again, there is no formula for converting a process time for one low-acid food to that for another food or jar size. Too many characteristics of the particular food and processing procedures can influence the rate of heating. If you are experimenting with untested recipes for pickled products or other acidified foods such as salsas and there is not enough acid to treat them as a boiling-water canned food, you may also end up with the same risk of botulism by underprocessing. Even if you have an acid food and do not process it long enough, food spoilage can result.

Why should I not purée or mash foods before canning them?

Packing food into a jar may seem easier or less wasteful of jar space with mashed or puréed food, but this style of pack greatly increases the product density and will have a very different heat penetration pattern than pieces of food in a liquid cover. Current USDA home-canning recommendations do not include mashed or puréed vegetables because there have not been the resources to do the amount of experimentation needed (e.g., to cover all variations in density that may result when a consumer mashes or purées food). So far, methods of preparation that are likely to result in more uniform results of heating patterns have been offered. The USDA process times are only intended for use with the preparation procedures that accompany them. Consumers put themselves at great risk for botulism if they choose to purée or mash vegetables and use the same processing time for a pack that is intended to be pieces of food in liquid.

Why should I not make additions/deletions of my own to the canning recipe? I want the canned food to taste exactly like one of my own recipes.

We all would like the convenience of great-tasting "one jar meals". But, any additions or deletions made to an approved canning recipe would need a new process time calculated for it. It is not safe to change the recipe and use the same process time. One-dish meals often include thickening ingredients or are cooked down to a thicker consistency than expected for the process time for an individual ingredient. These situations are likely to result in hazardous foods. You may add your special ingredients after you open up the jar, when reheating or assembling the dish. Also keep in mind

that after canning and storage, your special recipe may no longer taste exactly the same as when it is made fresh. Sometimes special recipes are best enjoyed as freshly made dishes.

What should I do if I desire to preserve one of my own recipes that does not match something with a recommended canning process?

We can't recommend making up your own canning process for your recipe. One option is to choose something close to yours that does have an approved procedure for home canning and can that product or recipe instead of yours. After canning, when you are ready to consume/reheat the food, add your special ingredients to adjust the recipe to your taste. Alternately, you may make your recipe and freeze it to preserve it, instead of canning.

Keep in mind that several products that we desire to have 'home-canned' are not available commercially, either. The commercial food manufacturing industry puts a lot of time and expense into research for their own safely canned products (they do not have a 'blanket processing' method or formula for adjustments, without collecting heat penetration data, either). Also, just because a canned food is made commercially and found on a store shelf does not mean a home canning process is available for the same or similar item. The heating characteristics under home preparation methods and canning procedures would have to be studied to come up with a home-canning process. The commercial canning industry also has more resources and methods at its disposal for controlling the consistency and maturity of raw ingredients going into a canned food. There will be more variability to take into account when researching a home-canning process to cover all the potential variables.

Fermenting Yogurt at Home

Brian A. Nummer, Ph.D., National Center for Home Food Preservation, October 2002

Introduction

Yogurt is made by adding *Streptococcus thermophilus* and *Lactobacillus bulgaricus* into heated milk. After this inoculation the milk is held at 110°F ± 5°F until firm. The milk is coagulated (thickened) by an increase in acidity from lactic acid produced by the bacteria. With its slightly sour taste, creamy texture, and good nutrient content, skim or whole milk yogurt remains a healthy food itself and one that can be used in recipes from appetizers to desserts.

History

Yogurt is thought to have originated many centuries ago among the nomadic tribes of Eastern Europe and Western Asia. Milk stored in animal skins would acidify and coagulate. The acid helped preserve the milk from further spoilage and from the growth of pathogens (disease-causing microorganisms).

Ingredients to make 4-5 cups of yogurt:

- 1-quart milk (cream, whole, low fat, or skim) — In general the higher the milk fat level in the yogurt the creamier and smother it will taste. *Note:* If you use home-produced milk it **must** be pasteurized before preparing yogurt.
- Nonfat dry milk powder — Use 1/3-cup powder when using whole or low fat milk, or use 2/3-cup powder when using skim milk. The higher the milk solids the firmer the yogurt will be. For even more firmness add gelatin (directions below).
- Commercial, unflavored, cultured yogurt — Use ¼-cup. Be sure the product label indicates that it contains a **live** culture. Also note the content of the culture. *L. bulgaricus* and *S. thermophilus* are required in yogurt, but some manufacturers may in addition add *L. acidophilus* and/or *B. bifidum*. The latter two are used for slight variations in flavor, but more commonly for health reasons attributed to these organisms. All culture variations will make a successful yogurt.
- (*Optional*) 2 to 4 tablespoons sugar or honey.

- (*Optional*) For a thick, firm yogurt swell 1 teaspoon unflavored gelatin in a little milk for 5 minutes. Add this to the milk and non-fat dry milk mixture before cooking.

Tools

- Double Boiler, preferred or regular saucepan 1-2 quarts in capacity larger than the volume of yogurt you wish to make.
- Cooking or Jelly Thermometer. A thermometer that can clip to the side of the saucepan and remain in the milk works best. Accurate temperatures are critical for successful processing.
- Mixing spoon
- Yogurt containers, e.g. cups with lids or canning jars with lids.
- Incubator: a yogurt-maker, oven, heating pad, or warm spot in your kitchen. To use your oven, place yogurt containers into deep pans of 110°F water. Water should come at least halfway up the containers. Set oven temperature at lowest point to maintain water temperature at 110°F. Monitor temperature throughout incubation making adjustments as necessary.

Processing

1. Pasteurization for any non-commercial milk. Heat water in the bottom section of a double boiler and pour milk into the top section. Cover the milk and heat to 165°F while stirring constantly for uniform heating. Cool immediately by setting the top section of the double boiler in ice water or cold running water. Store milk in the refrigerator in clean containers until ready for making yogurt.
2. Combine ingredients and heat. Heating the milk is a necessary step to change the milk proteins so that they set together rather than to form curds and whey. Do not substitute this heating step for pasteurization. Place cold, pasteurized milk in top of a double boiler and stir in nonfat dry milk powder. Adding non-fat dry milk to heated milk will cause some milk proteins to coagulate and form strings. Add sugar or honey if a sweeter, less tart yogurt is desired. Heat milk to 200°F, stirring gently and (a) hold for 10 minutes for thinner yogurt or (b) hold 20 minutes for thicker yogurt. Do not boil. Be careful and stir constantly to avoid scorching if not using a double boiler.
3. Cool and inoculate. Place the top of the double boiler in cold water to cool milk rapidly to 112-115°F. Remove one cup of the warm milk and blend it with the yogurt starter culture. Add this to the rest of the warm milk. The temperature of the mixture should now be 110-112°F.
4. Incubate. Pour immediately into clean, warm container(s); cover and place in prepared incubator. Close the incubator and incubate about 4 - 7 hours at 110°F ± 5°F. Yogurt should set firm when the proper acid level is achieved (pH 4.6). Incubating yogurt for several hours past the time after the yogurt has set will produce more acidity. This will result in a more tart or acidic flavor and eventually cause the whey to separate.
5. Refrigerate. Rapid cooling stops the development of acid. Yogurt will keep for about 10-21 days if held in the refrigerator at 40°F or lower.

Yogurt Types

- Set yogurt: A solid set where the yogurt firms in a container and not disturbed.
- Stirred yogurt: Yogurt made in a large container then spooned or otherwise dispensed into secondary serving containers. The consistency of the "set" is broken and the texture is less firm than set yogurt. This is the most popular form of commercial yogurt.
- Drinking yogurt: Stirred yogurt to which additional milk and flavors are mixed in. Add fruit or fruit syrups to taste. Mix in milk to achieve the desired thickness. The shelf life of this product is 4-10 days, since the pH is raised by fresh milk addition. Some whey separation will occur and is natural. Commercial products recommend a thorough shaking before consumption.

- Fruit yogurt: Fruit, fruit syrups, or pie filling can be added to the yogurt. They are placed on top, on bottom, or stirred into the yogurt.
- Yogurt cheese: Line a large strainer or colander with cheesecloth. Place this over a bowl and then pour in the yogurt. Do not use yogurt made with the addition of gelatin. Gelatin will inhibit whey separation. Let it drain overnight covered with plastic wrap. Empty the whey from the bowl. Fill a strong plastic storage bag with some water, seal and place over the cheese to weigh it down. Let the cheese stand another 8 hours after which it is ready to use. The flavor is similar to a sour cream with a texture of a soft cream cheese. A pint of yogurt will yield approximately 1/4 lb. of cheese. The yogurt cheese has a shelf life of approximately 7-14 days when wrapped and placed in the refrigerator and kept at less than 40°F. For uses, recipes, and more information on yogurt cheese see the "Resources"; section below.
- Frozen yogurt: Follow directions given with most home ice cream makers.

Trouble-shooting

If your:

- Milk forms some clumps or strings during the heating step. Some milk proteins may have jelled. Take the solids out with a slotted spoon or in difficult cases after cooking pour the milk mixture through a clean colander or cheesecloth before inoculation.
- Yogurt fails to coagulate (set) properly. Milk proteins will coagulate when the pH has dropped to 4.6. This is done by the culture growing and producing acids.
    - Adding culture to very hot milk (+115°F) can kill bacteria--Use a thermometer to carefully control temperature.
    - Too hot or too cold of an incubation temperature can slow down culture growth--Use a thermometer to carefully control temperature.
    - The starter culture was of poor quality--Use a fresh, recently purchased culture from the grocery store each time you make yogurt.
- Yogurt tastes or smells bad.
    - Starter culture is contaminated--Obtain new culture for the next batch.
    - Yogurt has over-set or incubated too long--Refrigerate yogurt immediately after a firm coagulum has formed.
    - Overheating or boiling of the milk causes an off-flavor--Use a thermometer to carefully control temperature.
- Whey collects on the surface of the yogurt. This is called syneresis. Some syneresis is natural. Excessive separation of whey, however, can be caused by incubating yogurt too long or by agitating the yogurt while it is setting.

Food safety, spoilage and shelf life?

Yogurt provides two significant barriers to pathogen growth: (a) heat and (b) acidity (low pH). Both are necessary to ensure a safe product. Acidity alone has been questioned by recent outbreaks of food poisoning by *E. coli* O157:H7 that is acid-tolerant. *E. coli* O157:H7 is easily destroyed by pasteurization (heating). Therefore, always pasteurize milk or use commercially pasteurized milk to make yogurt.

Discard batches that fail to set properly, especially those due to culture errors. Yogurt generally has a 10-21 day shelf life when made and stored properly in the refrigerator below 40°F. Molds, yeasts and slow growing bacteria can spoil the yogurt during prolonged storage. Ingredients added to yogurt should be clean and of good quality. Introducing microorganisms from yogurt add-ins can reduce shelf life and result in quicker spoilage--"*garbage in, garbage out*". Discard any yogurt samples with visible signs of microbial growth or any odors other than the acidity of fresh yogurt.

Always use clean and sanitized equipment and containers to ensure a long shelf life for your yogurt. Clean equipment and containers in hot detergent water, then rinse well. Allow to air dry.

Kitchen Notes
When making this recipe in our test kitchen we used a saucepan instead of a double boiler. Despite constant stirring we still had some minor scorching. We took care not to stir or scrape the scorched area. During the cooking step milk proteins formed strings that we scooped out with a slotted spoon. We inoculated our entire batch of milk with starter and poured the mixture into separate containers. To some containers we added different amounts of honey or sugar stirring to dissolve the sweetener, while others we left plain. Our yogurt reached pH 4.7 in approx. four hours, pH 4.6 in approx. five hours and pH 4.5 in approx. six hours. The yogurt set was firm after six hours and the taste was mild. The yogurt was immediately refrigerated until the next day. On the following day we processed the yogurt into some of the variations listed above under "Yogurt Types".

Packaging and Storing Dried Foods

Dried foods are susceptible to insect contamination and moisture reabsorption and must be properly packaged and stored immediately. First, cool completely. Warm food causes sweating which could provide enough moisture for mold to grow. Pack foods into clean, dry insect-proof containers as tightly as possible without crushing.

Store dried foods in clean, dry home canning jars, plastic freezer containers with tight-fitting lids or in plastic freezer bags. Vacuum packaging is also a good option. Pack foods in amounts that can be used all at once. Each time a package is re-opened, the food is exposed to air and moisture that can lower the quality of the food and result in spoilage.

Pack food in amounts that will be used in a recipe. Every time a package is re-opened, the food is exposed to air and moisture that lower the quality of the food.

Fruit that has been sulfured should not touch metal. Place the fruit in a plastic bag before storing it in a metal can. Sulfur fumes will react with the metal and cause color changes in the fruit.

Dried foods should be stored in cool, dry, dark areas. Recommended storage times for dried foods range from 4 months to 1 year. Because food quality is affected by heat, the storage temperature helps determine the length of storage; the higher the temperature, the shorter the storage time. Most dried fruits can be stored for 1 year at 60ºF, 6 months at 80ºF. Vegetables have about half the shelf-life of fruits.

Foods that are packaged seemingly "bone dry" can spoil if moisture is reabsorbed during storage. Check dried foods frequently during storage to see if they are still dry. Glass containers are excellent for storage because any moisture that collects on the inside can be seen easily. Foods affected by moisture, but not spoiled, should be used immediately or redried and repackaged. Moldy foods should be discarded.

Conditioning Fruits
The moisture content of home dried fruit should be about 20 percent. When the fruit is taken from the dehydrator, the remaining moisture may not be distributed equally among the pieces because of their size or their location in the dehydrator. Conditioning is the process used to equalize the moisture. It reduces the risk of mold growth.

To condition the fruit, take the dried fruit that has cooled and pack it loosely in plastic or glass jars. Seal the containers and let them stand for 7 to 10 days. The excess moisture in some pieces will be absorbed by the drier pieces. Shake the jars daily to separate the pieces and check the moisture condensation. If condensation develops in the jar, return the fruit to the dehydrator for more drying. After conditioning, package and store the fruit as described above.

Determining Dryness of Vegetables

Vegetables should be dried until they are brittle or "crisp." Some vegetables actually shatter if hit with a hammer. At this stage, they should contain about 10 percent moisture. Because they are so dry, they do not need conditioning like fruits.

Understanding and Making Kimchi

What is kimchi?

Kimchi is a flavorful, sour, salty mix of fermented vegetables and seasonings that plays an important role in Korean culture. There are more than 200 variations of kimchi; the types of ingredients and the preparation method have a profound impact on the taste. Napa cabbage, radishes, green onions, garlic, and ginger, along with a specific red pepper, are used in classical baechustyle, but region, seasonality, and cultural traditions influence the unique types of kimchi.

The nutritional value of kimchi varies with ingredients but it is generally low in calories and contains vitamins A, C, and B complex, as well as various phytochemicals and live cultures of microorganisms which confer a health benefit to the host. Eating kimchi can be a healthful way to include more vegetables and probiotic microorganisms in the diet.

How is kimchi made?

Making kimchi requires maintaining a clean environment and good hygiene practices, carefully following all steps, and monitoring temperatures to foster the growth of *Weissella* species, *Lactobacillus* species, and other bacteria contributing to the fermentation process.

The process of making kimchi involves brining (salting) the vegetables to draw out the water, which helps in preservation and allows the seasonings to penetrate the food over time; the final salt concentration ranges from 2-5%.

Kimchi is typically fermented by 'wild cultures' naturally present on the vegetables. The formation of organic acids (primarily lactic and acetic acid) results in an optimum kimchi pH of 4.2.

The kimchi fermentation process is very short in comparison to making sauerkraut. Kimchi ferments at room temperature in only 1-2 days or more slowly in the refrigerator. For safety, kimchi should be stored refrigerated and is best eaten within 1 week, as the quality of kimchi deteriorates with longer fermentation.

Making Baechu (Bet-schu) Kimchi: Mack (Chopped Cabbage) Style

Kimchi is a fermented vegetable condiment, traditional to Korean cuisine. Season will impact vegetable size and quality, as well as time needed for fermentation. Look for light-green Napa cabbage with compact, elongated heads that feel heavy for size. In summer, Napa cabbage may be softer and ferment faster; while in winter, Napa cabbage may be firmer and need more time to ferment. Some ingredients, such as Korean red pepper powder and Korean radish, may need to be purchased through specialty Asian stores or ordered online.

During preparation, proper sanitation practices must be followed to prevent contamination by spoilage or harmful microorganisms. This includes proper hand washing as well as using clean equipment, utensils, and surfaces throughout all preparation steps.

Equipment:

- Large sharp knife and cutting board
- Blender or food processor (optional for blending ginger and garlic)
- Measuring cup, measuring spoons, and mixing utensils
- 1-quart saucepan for making sweet rice paste

- Food-safe, glass or plastic storage container with tight fitting lid. For example: plastic rectangle kimchi container, glass mason jars with bands and lids, or gallon-size re-sealable zipper plastic bags. Do not use metal containers nor earthenware with cracks or chips. Container(s) must fit in your refrigerator, but big enough to hold 2 cabbages.
- Large glass, plastic, or stainless steel mixing bowl
- Disposable food handler gloves (highly recommended) for protection from red pepper powder while handling kimchi

Ingredients:

- 2 medium heads Napa cabbage (about 6-8 pounds total)
- 1 1/2 cups coarse salt, non-iodized, divided (baked or sea salt recommended)
- 1 gallon + 1/2 cup cold water, divided
- 2 Tbsp. sweet rice flour
- 1-10 cloves garlic, depending on taste preference
- About 3 slices fresh ginger root (about 0.2-0.4 oz.)
- 1 cup Korean red pepper powder - specific “for kimchi"
- 1/2 Korean radish (about 1-1.5 pounds), or daikon radish
- 1 Asian pear (optional)
- 10 green onions
- 1 tsp. fish sauce (optional)
- 2 tsp. finely ground salt (optional, as needed)

Procedure:

1. *Prepare Napa cabbage:*
    a. Rinse heads under cold water and drain.
    b. Cut away and discard any spoiled or damaged spots.
    c. Cut Napa cabbage into four quarters and remove core from each. Chop quarters into 2-inch pieces.
2. *Salt cabbage:*
    a. Prepare saltwater solution of 1/2 cup course, non-iodized salt and 1 gallon cold water in large mixing bowl.
    b. Dip cabbage pieces briefly in the saltwater solution, to facilitate penetration of salt into the cabbage pieces. Discard saltwater solution.
    c. Drain and place cabbage pieces in a bowl. Sprinkle 1 cup of course, non-iodized salt over the cut cabbage and massage it into the cabbage well. Allow cabbage to sit covered at room temperature for 3 to 6 hours (a longer time will make it more salty).
    d. Rinse cabbage pieces 3 to 4 times with cold water to rinse away the salt, then place in a colander to drain out excess water from the cabbage for at least 30 minutes.
3. *Prepare seasonings:*
    a. Add sweet rice flour to 1/2 cup water in small saucepan. Bring to a boil and set aside to cool.
    b. Clean, peel, and finely mince (or use blender with small amount of water) garlic and ginger. Mix with cooled sweet rice flour paste and add Korean red pepper powder.
    c. Clean and peel radish, clean and trim green onions, and if desired, clean and peel Asian pear. Slice all Julienne style, or into matchsticks about 1 inch in length.
    d. Using clean hands and disposable food handler gloves, mix above seasoning paste and Julienned vegetables together in large mixing bowl. Then mix in fish sauce to create a spicy veggie paste. Add salt only as needed.
    e. Combine cabbage with the spicy veggie paste, rub together and mix thoroughly.
4. *Pack container:*
    a. Pack kimchi tightly into container, minimizing air exposure and encouraging brine formation. Fill container about 2/3rdfull, as fermenting microorganisms will release carbon dioxide (CO_2) and create bubbling and fizzing.

   b. Cover tightly. If using jars, seal to finger-tip tight. If using bags, squeeze out excess air. Place on plate or in bowl to catch potential overflow.
5. *Ferment!*
   a. Option 1**:** Kimchi may be placed in refrigerator so it ferments slowly over 3 to 4 days. This may be preferred, especially during hot weather.
   b. Option 2**:** Place sealed container in a well-ventilated location (may become pungent), with a relatively constant room temperature, around 68˚F is ideal. Ferment only 1 to 2 days at room temperature, tasting it daily until it reaches preferred tangy taste and desired texture.
6. *Store and enjoy!*
   a. Store fermented kimchi covered tightly in the refrigerator. Keep it pressed down to minimize air exposure. Kimchi may become more sour over time. Discard if you observe indications of surface mold.
   b. Kimchi can be enjoyed in countless recipes! Try it with eggs, rice, noodles, potatoes, in stir fry, fried rice, soup, pancakes, or on a sandwich or hot dog. Happy kimchi making!

Recipe provided by HyoJung Kang, local kimchi expert, with edits by Laura Bauer, PhD, RD, in collaboration with CSU Food Science & Human Nutrition Extension. For additional information, contact: Marisa Bunning, PhD; Associate Professor and Extension Specialist-food safety: marisa.bunning@colostate.edu

Vine Drying

One method of drying out-of-doors is vine drying. To dry beans (navy, kidney, butter, great northern, lima, lentils and soybeans) leave bean pods on the vine in the garden until the beans inside rattle. When the vines and pods are dry and shriveled, pick the beans and shell them. No pretreatment is necessary. If beans are still moist, the drying process is not complete and the beans will mold if not more thoroughly dried. If needed, drying can be completed in the sun, oven or a dehydrator.

Pasteurization
Like sun dried fruits, vine dried beans need treatment to kill insects and their eggs.

1. *Freezer Method* – Seal the food in freezer-type plastic bags. Place the bags in a freezer set at 0ºF or below and leave them at least 48 hours.
2. *Oven Method* – Place the food in a single layer on a tray or in a shallow pan. Place in an oven preheated to 160ºF for 30 minutes.

2017 Reappointment Test Questions

1) Which variety of apples is not the best choice when canning applesauce and apple butter?
   a. Red Delicious
   b. Stayman
   c. Golden Delicious
   d. McIntosh

2) Which factor does not impact the processing time for a salsa using a boiling water or atmospheric steam canner?
   a. Shape and texture of the salsa ingredients
   b. pH level of the total product
   c. solid to liquid ratio
   d. Pungency measurement of the peppers on the Scoville Scale
   e. Starting temperature of the food in the jars

3) What is the food safety reason why pickled products are usually processed using a hot pack?
   a. The quality of the finished product is higher
   b. The pickles start to acidify while heating in a cooking pot
   c. More product can be packed into a jar because of higher pliability
   d. The heat removes impurities from the water, resulting in a pasteurized liquid

4) A client calls and wants to can an old family favorite recipe and asks for processing recommendations. What recommendation(s) do you give?
   a. Don't create a custom processing recipe
   b. Find a reputable recipe that is close to the old family favorite
   c. Add those special ingredients when ready to serve the food
   d. Freeze the food using the original ingredient list and freeze it instead of canning it
   e. All of the above

5) For how long and at what temperature should fermented yogurt be incubated to achieve pH of 4.6?
   a. 2 hours at 135°F
   b. 1-3 hours at 130°F
   c. 4-7 hours at 115°F
   d. 8-10 hours at 100°F

6) Which item is not considered an acceptable incubator for home fermented yogurt?
   a. Commercial yogurt maker
   b. Warm oven
   c. Heating pad
   d. Steam canner base with simmering water on the stove
   e. Excalibur dehydrator without trays

7) What percentage moisture content is found in properly processed home dried fruit and vegetables?
   a. 10% moisture for both fruits and vegetables
   b. 15% moisture for fruits and 10% moisture for vegetables
   c. 20% moisture for fruits and 10% moisture for vegetables
   d. 10% moisture for fruits and 20% moisture for vegetables
   e. 20% moisture for both fruits and vegetables

8) What is the ideal pH level of properly fermented kimchi?
   a. 4.0
   b. 4.2
   c. 4.4
   d. 4.6
   e. 4.8

9) How long will it take to fully ferment kimchi during the hot summer months in a refrigerator?
   a. 1-2 days
   b. 2-3 days
   c. 3-4 days
   d. 5-6 days
   e. 1 week

10) Why do you need to pasteurize vine-dried beans?
   a. To kill insects and their eggs
   b. To kill Clostridium botulinum bacteria
   c. To distribute any residual moisture in the beans
   d. All of the above

11) Which of the following resources is not included on the statewide UC Master Food Preserver website as a source for credible research-based recipes?

a. Ball (Jarden Home Brands)
b. Penn State Extension - "Let's Preserve"
c. Preserve@Home
d. University of Alaska Cooperative Extension
e. Weck (Weck Canning Jars)

12) What is the title of the UC Master Food Preserver Safety Note number 4?

a. Safe Lifting Practices
b. Microwave Oven Safety
c. Slips, Trips, and Falls
d. Kitchen Knife Safety
e. Hot Surfaces in the Kitchen