

Want to Ferment Vegetables? Start with Sauerkraut

What is fermentation? During sauerkraut fermentations, lactic acid bacteria change vegetable sugars to acids and flavor compounds. Commercial sauerkraut may be fermented by naturally occurring lactic acid bacteria or by added starter cultures. At home, fermentations are allowed to occur naturally without adding cultures. Acid production (fermentation) in vegetables requires conditions supporting the growth of desirable lactic acid bacteria; supportive conditions include water, nutrients, appropriate temperature, appropriate salt concentration, and the absence of air. Science-based, tested recipes for fermenting vegetables address factors you can control - temperature, salt concentration and lack of air.

According to Dr. Fred Breidt, Jr., a USDA microbiologist who specializes in the safety of fermented and acidic foods, the scientific literature has never recorded a case of food poisoning from raw vegetables that have been fermented properly. But he emphasizes that the key word is "properly," which some people who quote him fail to include in that sentence.

Fermented vegetables can be safer than raw vegetables since fermentation kills harmful bacteria. However, basic food safety practices must be followed. Start with vegetables that have been grown using good food safety practices. Make sure the vegetables did not come into contact with manure or improperly cured compost (that may still contain pathogens such as E. coli or Salmonella). Wash vegetables, hands, any cutting or preparation utensils, surfaces where vegetables will be cut or chopped, and any containers used for them. Follow tested procedures.

Sauerkraut: Making sauerkraut is a good first step in gaining experience with vegetable fermentations.

Containers for sauerkraut fermentation: Use large stoneware crocks, large glass jars or food-grade plastic containers. Do not use aluminum, copper, brass, galvanized or iron containers for fermenting sauerkraut; these metals will react with the acids and salt in the sauerkraut, discolor it and leach into it. Use large enough containers to allow 4 to 5 inches of space between the top of the cabbage and the top of the container. A 1-gallon volume typically is required for each 5 pounds of fresh cabbage (use a 5-gallon container for the following recipe).

Weights for sauerkraut fermentation: Fermenting cabbage must be completely submerged in brine to limit air and support growth of lactic acid bacteria. One option is to use a heavy plate or glass lid that fits inside the container. If extra weight is needed, set a filled, sealed glass jar containing water on top of the plate or lid. Cabbage should be covered by 1 to 2 inches of brine.

Alternatively, place one extra-large food-grade plastic bag inside another and fill the inside bag with brine (1½ tablespoons salt per quart water). Close the end securely. Use this filled double bag as the weight on top of the cabbage. Filling the bag with brine is a precaution, in case the bags are accidentally punctured.

Ingredients: For the best sauerkraut, use firm heads of fresh cabbage. Shred cabbage and start kraut within 48 hours of harvest.

- 25 pounds cabbage
- ¾ cup canning or pickling salt

Expected yield: About 9 quarts

Procedure:

- Work with about 5 pounds of cabbage at a time. Discard outer leaves (removes many undesirable microorganisms typically found on cabbage outer leaves.) Rinse heads under cold running water and drain.
- Cut heads in quarters and remove cores. Shred or slice to a quarter-inch thickness. (Increases surface area and makes the nutrients in cabbage more available to lactic acid bacteria.)
- Put shredded cabbage in fermentation container. Add 3 tablespoons canning or pickling salt.
- Mix thoroughly, using clean hands. Pack firmly until salt draws juices from cabbage. (Salt not only draws juices and nutrients from cabbage but also helps to keep undesirable bacteria from growing. The desired final concentration of 2.25% to 2.5% salt favors leuconostoc lactic acid bacteria; these organisms produce lactic acid and desirable flavor compounds in kraut.)
- Repeat shredding, salting and packing until all cabbage is in the container.
- Ensure that juice covers cabbage; if not, add boiled and cooled brine (1½ tablespoons salt per quart water). (Lactic acid bacteria grow best in the absence of air.)
- Add weights, cover container with a clean bath towel.
- Store kraut at 60°F to 70°F while fermenting (optimal growth temperature for kraut-fermenting lactic acid bacteria). At 60°F to 65°F, fermentation may take 5 to 6 weeks. At temperatures between 70°F and 75°F, kraut will fully ferment in 3 to 4 weeks but will contain more acid and less flavor. At temperatures lower than 60°F, kraut may not ferment. Above 75°F, kraut may become soft.
- If you weigh down the cabbage with a brine-filled bag, do not disturb the container until fermentation is completed and bubbling ceases. If you use jars as weights, check kraut two to three times each week and remove any scum that forms.
- Cabbage is converted to sauerkraut due to growth and acid production by a succession of lactic acid bacteria. Salt and limited air creates desirable conditions for the leuconostocs – a group of less acid tolerant lactic acid bacteria that grow better at 60°F to 70°F. As the leuconostocs grow, they produce flavor compounds, lactic acid and carbon dioxide creating an environment that favors more acid tolerant lactobacilli (grow well above 70°F). Acid production in kraut is completed by lactobacilli occasionally in combination with other lactic acid bacteria.

Storage: Fully fermented kraut may be kept tightly covered in the refrigerator for several months or may be canned as follows:

- **Hot Pack:** Bring kraut and liquid slowly to a boil in a large kettle, stirring frequently. Remove from heat and fill jars rather firmly with kraut and juices, leaving ½-inch headspace. Adjust lids and process pints for 10 minutes and quarts for 15 minutes in a boiling water bath canner.
- **Raw Pack:** Fill jars firmly with kraut and cover with juices, leaving ½-inch headspace. Adjust lids and process 20 minutes for pints and 25 minutes for quarts in a boiling water bath canner.

Clemson University Cooperative Extension. <https://www.clemson.edu/extension/food/canning/canning-tips>

Kraut fermentation, if done properly, will bring food to the “safe” acid level - pH 4.6 or below. To ensure that fermentation is done properly, follow tested recipes obtained from credible sources such as university Extension sites (see those listed below).

References and Additional Information:

Cookson Beecher, March 11, 2014 Fermenting Veggies at Home: Follow Food Safety ABCs. Food Safety News <http://www.foodsafetynews.com/2014/03/fermenting-veggies-at-home-follow-food-safety-abcs/#.U4y7rXYSaql>

So Easy to Preserve. 2006. 5th ed. Revised by Drs. E.L. Address and J.A. Harrison. Cooperative Extension, The University of Georgia, Athens, GA. (<http://setp.uga.edu>; currently out of print; 6th edition expected this summer.) This book is the authoritative source for canning procedures and recipes and offers excellent troubleshooting tips.

Clemson University [Home & Garden Information Center](#)

[HGIC 3380 Dill Pickles and Sauerkraut](#)

[HGIC 3100 Pickle Basics](#)

[HGIC 3101 Common Pickle Problems](#)

[HGIC 3040 Canning Foods at Home](#)

National Center for Home Food Preservation. University of Georgia, (www.nchfp.uga.edu)

Complete Guide to Home Canning. 2009. USDA NIFA. Agriculture Bulletin 539. Free download available at http://nchfp.uga.edu/publications/publications_usda.html.

Ball Blue Book Guide to Preserving. 2010. Hearthmark, LLC, d.b.a. Jarden Home Brands, Daleville, IN.

FPM Knowledge Center. 2013. Sauerkraut fermentation. <https://www.foodpreservationmethods.com/sauerkraut-kimchi-pickles-relishes/sauerkraut/fermentation>