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### Title

Nuts: Safe Methods for Consumers to Handle, Store, and Enjoy

### Permalink

<https://escholarship.org/uc/item/04f9p7vv>

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### Publication Date

2010-08-01

### DOI

10.3733/ucanr.8406

Peer reviewed

# Nuts: Safe Methods for Consumers to Handle, Store, and Enjoy

## Almonds, Chestnuts, Pecans, Pistachios, and Walnuts

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### WHY EAT NUTS?

Nuts are delicious and they are good for you. After an extensive review of nutrition and health studies, the U.S. Food and Drug Administration has affirmed that

- including nuts in a diet low in saturated fat and cholesterol may help reduce the risk of heart disease
- almonds, pecans, pistachios, and walnuts contribute to health through their protein, dietary fiber, and unsaturated fat

To enjoy nuts and get the most health benefits, nuts must be handled safely.

- Proper storage is necessary to keep the oil in nuts from going rancid.
- Careful handling is needed to prevent nuts from being a source of harmful bacteria.



Photo: Suzanne Paisley

### SAFE HANDLING OF NUTS

Bacteria are everywhere. Some types of bacteria are beneficial to human health, many have no impact on health, and some cause severe illness and even death. Dry foods like nuts are not a common source of harmful bacteria. However, in recent years a number of dried foods have been associated with outbreaks of salmonellosis. This has included outbreaks with raw almonds, cereal, peanut butter, dried pet food, black pepper, and sesame seeds. **Refrigeration and freezing do not destroy this bacteria. The presence of harmful bacteria cannot be determined by sight, smell, taste, or texture.**

Because of their association with two raw almond outbreaks, California almonds sold in retail stores must be treated in some way to eliminate *Salmonella*. Commercial blanching and roasting processes are examples. Almonds that are not roasted or blanched may be treated with a lighter steam or heat treatment or may be treated with the gas propylene oxide or other approved process. These lighter treatments are designed to eliminate *Salmonella* but retain the flavor and texture characteristics of a raw almond and retain the nuts' ability to germinate. The ability to germinate is considered important to some people. **The health benefits, storage life, and flavor of nuts are not affected by these treatments.** Almonds that are not obtained through regular market channels may not be pasteurized. Other nuts available at retail markets may also be treated to eliminate *Salmonella*.

If you grow your own nuts, see UC ANR Publication 8101 entitled *Key Points of Control and Management for Microbial Food Safety: Edible Landscape Plants and Home Garden Produce* for safety measures to use when harvesting tree nuts from the home orchard.

Follow good hygienic practices when shelling and eating nuts:

- Wash hands with soap and water before and after handling nuts.
- If you buy nuts in the shell, crack them in a clean area and into clean containers.
- Store cracked nuts in clean, closed containers and follow the guidelines in table 1 for appropriate storage times and temperatures.
- Washing nuts in the shell is not recommended because the extra moisture could encourage bacteria or mold growth.



Photo: Suzanne Paisley

## STORING NUTS

The length of time you can store nuts depends on storage temperature and humidity (see table 1). Storage life is shorter at room temperature than in a refrigerator or freezer.

- Room temperature storage encourages insect growth (which may be important for backyard-harvested nuts) and causes nut oils to become rancid quicker. Nuts can maintain quality up to a few months at room temperature, with shorter time in a warmer environment. Rancid nuts are not unsafe but they have a sharp flavor that most people find unpleasant.
- Nuts retain quality for a year or more at refrigerator temperature (40°F [4°C] or below) or up to 2 years in the freezer (0°F [-18°C] or below).
- Shelled nuts absorb moisture and external flavors, so they should be packed in clean, moisture-free, and odor-tight packaging such as plastic or glass containers.

If you want to store nuts obtained from a backyard orchard at room temperature, you will need to first freeze the nuts at 0°F (-18°C) for 48 hours to kill insect pests and their eggs and prevent them from destroying your harvest. Freezing the nuts is not necessary if you intend to store the nuts in the refrigerator. You can also use dry ice (frozen carbon dioxide) to destroy insect pests prior to storage. For information on how to treat almonds with dry ice, see UC Cooperative Extension Publication 7184, *Dry Ice: Easy Fumigation for Navel Orangeworm Control in Stored Almond Meats*. These treatments do not destroy harmful bacteria such as *Salmonella*.



Photo: Courtesy of thenutfactory.com.

## Storing Chestnuts

Guidelines for storing chestnuts are different from those for other nuts. Chestnuts are perishable,

high-starch, lowfat foods more like potatoes or apples than tree nuts. Chestnuts lose moisture quickly at room temperature and humidity, causing the kernels to dry and harden. If stored at room temperature (above 50°F [10°C]), chestnuts usually mold within 2 weeks.

Chestnuts will roast properly and taste fresh if you store them at 40°F (4°C) and

at least 90 percent relative humidity within 1 or 2 days after harvest. Maintain proper moisture conditions by storing in-shell nuts in a plastic bag or closed plastic container in a refrigerator. You can store in-shell chestnuts for 1 month at refrigerator temperature of 40°F (4°C) or colder and for a year or more at freezer temperature of 0°F (-18°C) or colder. Shelled and dried chestnuts can be stored for a year or more at refrigerator or

freezer temperature. Dried chestnuts will store longer than fresh chestnuts, but they lose both flavor and texture and will not roast properly. To rehydrate dried chestnuts, soak them in cold water for 3 or 4 hours before use.

## NUTRITION AND HEALTH

Almonds, pecans, pistachios, and walnuts have high levels of unsaturated fatty acids. Extensive research on diet and health indicates that including these nuts in a diet low in saturated fat and cholesterol may protect against heart disease.



Photo: Ashley and Aron Muir Bruhn.

Preparing chestnuts.



Photo: Courtesy of the California Walnut Commission.

Smart tuna salad.

**Table 1.** Typical storage time for nuts at refrigerator or freezer temperatures

| Nut type          | Storage time at refrigerator temperature (40°F [4°C] or colder) | Storage time at freezer temperature (0°F [-18°C] or colder) |
|-------------------|---|---|
| <b>almonds</b>    |   |   |
| in-shell          | 1 year  | 1 year +  |
| shelled           | 1 year  | 1 year +  |
| <b>chestnuts</b>  |   |   |
| in-shell          | 2–3 months  | 1 year +  |
| shelled           | 1 year  | 1 year +  |
| <b>pecans</b>     |   |   |
| in-shell          | 1 year  | 2 years +   |
| shelled           | 1 year  | 2 years +   |
| <b>pistachios</b> |   |   |
| in-shell          | 1 year  | 3 years   |
| shelled           | 1 year  | 3 years   |
| <b>walnuts</b>    |   |   |
| in shell          | 1 year  | 2 years +   |
| shelled           | 1 year  | 2 years +   |

Source: Adapted from *Commodity Storage Manual*. 1995. The Refrigeration Research Foundation (942). Bethesda, MD.

## FOOD ALLERGIES

About 8 percent of children and about 3 to 4 percent of adults in the United States are believed to have food allergies. A food allergy is a reaction of an individual's immune system to a food, usually a protein in the food. This protein is harmless to most people, but to the allergic individual it can cause a serious condition that should be diagnosed and treated by a board-certified allergist. There are approximately 2,000 hospitalizations and 150 to 200 deaths each year due to food allergies.

Tree nuts are among the eight most common food allergens. Other common allergens include milk, eggs, peanuts, soy, wheat, fish, and crustacean shellfish.

Allergic reactions can vary in severity and can include stomach and intestinal upset, skin irritations,

sneezing, and shortness of breath. Some people experience a severe reaction called anaphylaxis. This is a life-threatening reaction that includes swelling of the throat, difficulty talking or breathing, vomiting, diarrhea, and/or a drop in blood pressure, which may result in unconsciousness.

If an individual says they are allergic to nuts, take care that they are not exposed through your cooking or meal preparation. Consider the following precautions:

- Check the label for all foods served. Nuts are used as ingredients in a wide range of foods. For example, sauces like pesto and mole are often made with nuts. Even nut oils can affect a sensitive person.
- If you have any nut products in the house, be sure they are in closed containers. Cooking utensils and any surface that touched nuts should be washed with soap or detergent. Allergic people can react to an extremely

small amount of the allergen, even particles in the air.

- **It is safest to not serve nuts when an allergic individual is present. An allergic person can have a reaction even from kissing a person who has recently eaten a nut.**
- If an allergic person experiences anaphylaxis (throat swelling, shortness of breath, difficulty speaking, or a drop in blood pressure) call 911. For more information about food allergies, including how to cook for an allergic person, contact the Food Allergy and Anaphylaxis Network by phoning (800) 929-4040 or visiting their Web site at <http://www.foodallergy.org>. The Centers for Disease Control and Prevention also has useful information about food allergies on their Web site. (See <http://www.cdc.gov/HealthyYouth/foodallergies>.)

## NUTS GROWN IN CALIFORNIA

Nuts are the edible seed kernel of certain trees. Almonds, chestnuts, pecans, pistachios, and walnuts are all grown commercially in California. Following is a brief background about these California nuts. Nutritional value in the form of a *Nutrition Facts label* is listed for each nut. Except for chestnuts, nutritional value is given for one cup, with calories for one ounce at the bottom of each listing. Adjust for serving size when calculating the actual nutrients consumed.



Roasted asparagus with almonds.



Photo: iStockphoto.com/lofoto.

Photo: iStockphoto.com/lofoto.

## History and Importance of Nuts Grown in California

Photo: Courtesy of the Almond Board of California.



### Almonds

People have enjoyed eating almonds for centuries. The almond tree is thought to have originated in China and Central Asia. Because of the nut's popularity, the trees were planted in Europe. The almond

tree thrived in the warm climate of Spain and Italy. The Spanish Franciscans brought almond trees to California in the mid-1700s. Initially, almond trees were planted in coastal areas, but they were not well suited to this cooler environment. In the 1800s, almond trees were planted in the warmer valleys. Research and cross breeding has developed the major almond varieties planted today.

California is the only place in North America where almonds are grown commercially. Today almonds are the most widely grown nut in California, with over 680,000 acres planted between Bakersfield and Red Bluff. In 2008 California produced over 1,630 million pounds of

almonds, supplying 100 percent of the domestic supply and 70 percent of the world's crop.

Almonds are prized in many cultures as symbols of happiness and good fortune. Ancient Romans were said to give newlyweds almonds as a fertility charm. Jordan almonds (almonds with a hard candy coating) are often served at American weddings to represent happiness and good health. In a Swedish tradition, the diner who finds the almond hidden in a cinnamon-flavored rice pudding served at Christmas will have a year of good fortune.

### Almonds

#### Nutrition Facts

Serving Size 1.0 cup, whole

#### Amount Per Serving

**Calories** 827  
Calories from Fat 652

#### % Daily Value \*

|                               |      |
|-------------------------------|------|
| <b>Total Fat</b> 72g          | 111% |
| Saturated Fat 6g              | 28%  |
| Polyunsaturated Fat 17g       |      |
| Monounsaturated Fat 46g       |      |
| <b>Cholesterol</b> 0mg        | 0%   |
| <b>Sodium</b> 1mg             | 0%   |
| <b>Total Carbohydrate</b> 28g | 9%   |
| Dietary Fiber 17g             | 67%  |
| Sugars 7g                     |      |
| <b>Protein</b> 30g            |      |

Vitamin A 0% • Vitamin C 0%

Calcium 35% • Iron 41%

\* Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs:

|                    |           | Calories: 2,000 | 2,500   |
|--------------------|-----------|-----------------|---------|
| Total Fat          | Less than | 65g             | 80g     |
| Sat Fat            | Less than | 20g             | 25g     |
| Cholesterol        | Less than | 300mg           | 300mg   |
| Sodium             | Less than | 2,400mg         | 2,400mg |
| Total Carbohydrate |           | 300g            | 375g    |
| Dietary Fiber      |           | 25g             | 30g     |

Calories per gram:

Fat 9 • Carbohydrate 4 • Protein 4

1.0 oz (23 kernels) has 163 calories

Photo: Courtesy of the Almond Board of California.



Jade almond stir fry.

### Pecans

Pecans are native to North America and Mexico. Native Americans are believed to have first

cultivated pecan trees. Spanish colonists planted more of the trees in the late 1600s. By the early 1800s, the English and French included pecans in their trade routes.

New Orleans became an important economic center for trading pecans. Nut varieties were improved when an African-American slave gardener from Louisiana, known only as Antoine, successfully grafted a superior wild pecan variety onto a seedling. The new variety was named “Centennial” because it won the Best Pecan Exhibit awarded at the Philadelphia Centennial Exposition in 1876. Mastering the grafting techniques led to the development of the variety of pecans grown today.

A pecan tree can reach a height of over one hundred feet and can live to be over one thousand years old. A pecan tree planted in George Washington’s Mount Vernon residence is said to have been a gift from Thomas Jefferson.

The United States produces about 80 percent of the world’s pecans. Over 3,100 acres of pecans are planted in California, with a production of 3.75 million pounds of nuts in 2008.

#### Pecans

| Nutrition Facts  |                           |
|--|---------------------------|
| Serving Size 1.0 cup, halves   |                           |
| Amount Per Serving   |                           |
| <b>Calories</b>  | Calories from Fat 641     |
| 684  |                           |
| % Daily Value *  |                           |
| <b>Total Fat</b> 71g   | 110%                      |
| Saturated Fat 6g   | 31%                       |
| Polyunsaturated Fat 21g  |                           |
| Monounsaturated Fat 40g  |                           |
| <b>Cholesterol</b> 0mg   | 0%                        |
| <b>Sodium</b> 0mg  | 0%                        |
| <b>Total Carbohydrate</b> 14g  | 5%                        |
| Dietary Fiber 10g  | 38%                       |
| Sugars 4g  |                           |
| <b>Protein</b> 9g  |                           |
| Vitamin A 0% • Vitamin C 2%  |                           |
| Calcium 7% • Iron 17%  |                           |
| * Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs: |                           |
|  | Calories: 2,000 2,500     |
| Total Fat  | Less than 65g 80g         |
| Sat Fat  | Less than 20g 25g         |
| Cholesterol  | Less than 300mg 300mg     |
| Sodium   | Less than 2,400mg 2,400mg |
| Total Carbohydrate   | 300g 375g                 |
| Dietary Fiber  | 25g 30g                   |
| Calories per gram:   |                           |
| Fat 9 • Carbohydrate 4 • Protein 4   |                           |
| 1.0 oz (19 halves) has 196 calories  |                           |



Photo: Courtesy of USDA.

### Pistachios

Archeological evidence indicates that people have been eating pistachios since 6760 BC. Pistachio trees likely originated from the Middle East (Iran) or western Asia (Pakistan and India). Pistachios were brought to Europe from Syria in the first century.

Commercial use of pistachios began in the 1930s, when Iranian businessmen started exporting pistachios to Europe and the United States. After World War II, export of pistachios to the United States increased until the beginning of the Islamic revolution in the 1970s.

#### Raw Pistachios

| Nutrition Facts  |                           |
|--|---------------------------|
| Serving Size 1.0 cup   |                           |
| Amount Per Serving   |                           |
| <b>Calories</b>  | Calories from Fat 492     |
| 685  |                           |
| % Daily Value *  |                           |
| <b>Total Fat</b> 55g   | 84%                       |
| Saturated Fat 7g   | 33%                       |
| Polyunsaturated Fat 17g  |                           |
| Monounsaturated Fat 29g  |                           |
| <b>Cholesterol</b> 0mg   | 0%                        |
| <b>Sodium</b> 1mg  | 0%                        |
| <b>Total Carbohydrate</b> 34g  | 11%                       |
| Dietary Fiber 13g  | 51%                       |
| Sugars 9g  |                           |
| <b>Protein</b> 25g   |                           |
| Vitamin A 0% • Vitamin C 10%   |                           |
| Calcium 13% • Iron 34%   |                           |
| * Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs: |                           |
|  | Calories: 2,000 2,500     |
| Total Fat  | Less than 65g 80g         |
| Sat Fat  | Less than 20g 25g         |
| Cholesterol  | Less than 300mg 300mg     |
| Sodium   | Less than 2,400mg 2,400mg |
| Total Carbohydrate   | 300g 375g                 |
| Dietary Fiber  | 25g 30g                   |
| Calories per gram:   |                           |
| Fat 9 • Carbohydrate 4 • Protein 4   |                           |
| 1.0 oz (49 kernels) has 161 calories   |                           |

Photo: iStockphoto.com/Howard Terrell.



The first pistachios were brought to California in the 1850s. In the 1930s, botanists focused on improving the nuts and adapting them to U.S. growing conditions. Interest in pistachios increased when trade with Iran halted after the American embassy incident in Teheran in 1976, the same year California

harvested the first commercial crop. While Iran continues to lead in production, California is the second largest producer of pistachios worldwide with 118,000 acres planted and 278 million pounds harvested in 2008.

**Walnuts**

Scientists believe that walnut trees have been cultivated for at least 8,000 years. Walnuts are among the oldest fruit- and nut-tree foods, with their origin likely to be in Persia. In the 16th and 17th century, physicians thought the appearance of food reflected the body part the food helped. Because the shells were round and the nut itself resembled the brain, eating walnuts was thought to increase brain power.

The commercial walnut industry began in California in 1867 when an orchardist in Goleta (Santa Barbara County) planted English walnuts. Planted areas spread from Southern California to the central valley. While there are over 30 varieties of walnuts grown in California, the Chandler and Hartley variety account for about 60 percent of production.

China leads the world in quantity of nuts produced, followed by the United States, Iran, and Turkey. California produces 99 percent of the English walnuts in the United States, with Oregon, Washington, Pennsylvania, Michigan, Utah, Iowa,

Photo: Courtesy of the Mariani Nut Company.



Photo: Courtesy of the California Walnut Commission.

Walnut-dusted baked apples and pears.

**Raw Walnuts**

| <b>Nutrition Facts</b>   |                              |
|--|------------------------------|
| Serving Size 1.0 cup shelled (50 halves)   |                              |
| <b>Amount Per Serving</b>  |                              |
| <b>Calories</b>  | Calories from Fat 587        |
| 654  |                              |
| <b>% Daily Value *</b>   |                              |
| <b>Total Fat</b> 65g   | 100%                         |
| Saturated Fat 6g   | 31%                          |
| Polyunsaturated Fat 47g  |                              |
| Monounsaturated Fat 9g   |                              |
| <b>Cholesterol</b> 0mg   | 0%                           |
| <b>Sodium</b> 2mg  | 0%                           |
| <b>Total Carbohydrate</b> 14g  | 5%                           |
| Dietary Fiber 7g   | 27%                          |
| Sugars 3g  |                              |
| <b>Protein</b> 15g   |                              |
| Vitamin A 0%   | Vitamin C 2%                 |
| Calcium 10%  | Iron 19%                     |
| * Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs: |                              |
|  | Calories: 2,000    2,500     |
| Total Fat  | Less than 65g    80g         |
| Sat Fat  | Less than 20g    25g         |
| Cholesterol  | Less than 300mg    300mg     |
| Sodium   | Less than 2,400mg    2,400mg |
| Total Carbohydrate   | 300g    375g                 |
| Dietary Fiber  | 25g    30g                   |
| Calories per gram:   |                              |
| Fat 9 • Carbohydrate 4 • Protein 4   |                              |
| 1.0 oz (14 halves) has 185 calories  |                              |



and Maine contributing to total production. In 2008, 223,000 acres of California walnut trees produced 872 million pounds of nuts.

### Raw Chinese Chestnuts

| <b>Nutrition Facts</b>   |                              |
|--|------------------------------|
| Serving Size 1.0 oz  |                              |
| Amount Per Serving   |                              |
| <b>Calories</b> 64   | Calories from Fat 3          |
| % Daily Value *  |                              |
| <b>Total Fat</b> 0g  | 0%                           |
| Saturated Fat 0g   | 0%                           |
| Polyunsaturated Fat 0g   |                              |
| Monounsaturated Fat 0g   |                              |
| <b>Cholesterol</b> 0mg   | 0%                           |
| <b>Sodium</b> 1mg  | 0%                           |
| <b>Total Carbohydrate</b> 14g  | 5%                           |
| Dietary Fiber 0g   | 0%                           |
| Sugars 0g  |                              |
| <b>Protein</b> 1g  |                              |
| Vitamin A 0% • Vitamin C 17%   |                              |
| Calcium 1% • Iron 3%   |                              |
| * Percent Daily Values are based on a 2,000 calorie diet. Your daily value may be higher or lower depending on your calorie needs: |                              |
|  | Calories: 2,000    2,500     |
| Total Fat  | Less than 65g    80g         |
| Sat Fat  | Less than 20g    25g         |
| Cholesterol  | Less than 300mg    300mg     |
| Sodium   | Less than 2,400mg    2,400mg |
| Total Carbohydrate   | 300g    375g                 |
| Dietary Fiber  | 25g    30g                   |
| Calories per gram:   |                              |
| Fat 9 • Carbohydrate 4 • Protein 4   |                              |

### Chestnuts

The chestnut tree comes from a genus that contains eight or nine species of deciduous trees in the beech family. Chestnuts are native to temperate regions of the northern hemisphere. Chestnuts are often found in the market from September through December. They are frequently used during the winter holidays.

Current worldwide chestnut production is about 500 million pounds, with China leading in production at 40 percent; followed by Korea, 15 percent; Italy, Turkey, and Japan, about 10 percent each; France, Spain and Greece, about 4 percent each; and the United States, Australia, New Zealand, Chile, and Argentina, at less than 1 percent each. Within the last 15 years, California has increased its planting of chestnuts to an estimated 600 acres, of which about half have trees in production.



Photo: Paul Vossen.

Chestnuts in tree.

## ENJOYING NUTS

Nuts can be enjoyed in many ways: eaten out of hand, natural or roasted, tossed on salads or entrees, or included in breads, desserts, or candy. They also make great gifts. Check your local library for cookbooks or magazines with nut recipes. The following are Web sites with a selection of recipes or health information:



Green bean casserole.

Photo: Courtesy of the California Walnut Commission.

### Nuts

<http://www.Diamondofcalifornia.com>

<http://www.Epicurious.com>

<http://www.FoodTV.com>

<http://www.BlueDiamond.com>

<http://www.Nuthealth.org>

<http://www.Nutnutrition.com>

### Canning Nuts

[http://www.uga.edu/nchfp/how/can\\_nuts.html](http://www.uga.edu/nchfp/how/can_nuts.html)

### Almonds

<http://www.almondsarein.com>

### Chestnuts

<http://www.wcga.net/recipes.htm>

### Pecans

<http://www.californiapecangrowers.org>

### Pistachios

<http://www.pistachios.org>

### Walnuts

<http://www.walnuts.org/>

### Peanuts

Peanuts are a legume like soybeans, not a tree nut. Information on storage, safe handling, and allergies pertains to peanuts as well as tree nuts. For information on storing peanut butter, see page 11 of the University of Georgia Web site

[http://www.uga.edu/nchfp/how/store/texas\\_storage.pdf](http://www.uga.edu/nchfp/how/store/texas_storage.pdf)



Cornbread walnut muffins.

Photo: Courtesy of the California Walnut Commission.



## Resources

California Walnuts Web site,

<http://www.walnuts.org/>.

Foodreference.com Web site,

<http://www.foodreference.com/html/artwallnuts.html>.

About.com: Home Cooking Web site,

<http://homecooking.about.com/od/foodhistory/a/pecanhistory.htm>.

National Pecan Shellers Association Web site,

<http://www.ilovepecans.org>.

Waterford Nut Company Web site,

<http://www.waterfordnut.com/history.html>.

California Department of Food and Agriculture Web site,

[http://www.cdffa.ca.gov/files/pdf/card/ResDir07\\_FrtNutGrape.pdf](http://www.cdffa.ca.gov/files/pdf/card/ResDir07_FrtNutGrape.pdf).

## ACKNOWLEDGMENTS

The authors appreciate the guidance from consumers who reviewed a pilot version of this publication. We acknowledge the editorial and artistic contribution of Hang (KC) Nguyen at the Western Institute of Food Safety and Security. This publication was facilitated through a grant from the University of California, Division of Agriculture and Natural Resources.

## FOR MORE INFORMATION

You will find detailed information on harvesting your own nuts as well as safe handling information for a variety of foods in these UC ANR publications:

*Harvesting and Storing Your Home Orchard's Nut Crop*, Publication 8005

*Apples: Safe Methods to Store, Preserve, and Enjoy*, Publication 8229

*Cantaloupe: Safe Methods to Store, Preserve, and Enjoy*, Publication 8095

*Garlic: Safe Methods to Store, Preserve, and Enjoy*, Publication 7231

*Olives: Safe Methods for Home Pickling*, Publication 8267

*Oranges: Safe Methods to Store, Preserve, and Enjoy*, Publication 8199

*Peppers: Safe Methods to Store, Preserve, and Enjoy*, Publication 8004

*Strawberries: Safe Methods to Store, Preserve, and Enjoy*, Publication 8256

*Tomatoes: Safe Methods to Store, Preserve, and Enjoy*, Publication 8116

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### Publication 8406

ISBN-13: 978-1-60107-685-4

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web-08/10-LR/RW