The market for specialty products is large, and includes processed foods sold through retailers in gift shops, gourmet and specialty food stores, health food stores, upscale delicatessen markets and direct to consumers at farmers' markets, on-farm shops and tourist-oriented farm stores. According to From Kitchen to Market (Hall, 1996), condiments (sauces, dressings, seasonings, herbs and spices) make up 40% of the average sales in gourmet shops, while prepared foods, confections, meats and miscellaneous foods (including mushrooms, fruits and vegetables, soups, rice and pasta) each account for about 10% of sales. Beverages, coffees/teas, and cheeses each make up about 5% of sales.

Horticultural produce is processed to become part of the following categories:
Condiments (salsas, pickles, chutneys, herb-vinegars, jams, jellies and preserves)
Beverages (juices, sparkling fruit-flavored waters)
Confections (fruit-based candies, cookies, cakes)
Miscellaneous (bottled herbed-mushrooms, fruit or vegetable-based snack-foods).

Start-up costs for a nationally distributed specialty food product can be enormous, and investment in production, packaging, labelling, advertising and promotion may not be repaid for years, if at all. We suggest, instead, that you start with a small product line or even one product,
and sell it directly to the people who now purchase your fresh produce. All food processing must be done in a location that will pass a health department inspection. Most likely this means you will need to rent an industrial kitchen (perhaps in a local restaurant during off hours) or work with a co-packer (a food processor of a similar product who has extra capacity).

The average annual growth of processed fruits and vegetables in India over the past 5 years is about 22%.

(Source: Ministry of Food Processing Industries/Government of India)

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>lakh tonnes</td>
<td>3.60</td>
<td>4.69</td>
<td>5.59</td>
<td>6.76</td>
<td>8.50</td>
<td>9.60</td>
</tr>
</tbody>
</table>

This chapter will provide information on 1) produce types and cultivars known to result in high quality canned and bottled products, 2) a variety of pre-treatments used to reduce quality deterioration of processed products, 3) details on methods of boiling water bath and pressure canning, 4) packaging options for canned or bottled produce. If you choose not to process produce yourself, it is usually simple to find one of the many food processors who offer co-packing services. The chapter concludes with an example designed to help you to work out the costs and benefits related to producing and processing fresh produce and handling, storing and marketing canned or bottled products.
GENERAL DOs AND DON'Ts FOR CANNING/BOTTLING HIGH QUALITY SPECIALTY PRODUCTS

Market test your processed products on a small scale by providing samples to your fresh produce customers.

Start with only the best quality, freshest ingredients.

Use only high quality containers and food grade caps/liners for a proper seal.

Sort and wash produce thoroughly before chopping/slicing/pre-treating.

Follow recommended procedures for pre-treatments such as blanching, peeling, seeding or coring to ensure high quality.

Leave enough headspace when filling containers.

Measure acidity to determine the proper processing method to use.

Make sure canned/bottled products are processed at the proper temperature and/or pressure for the recommended length of time.

Adjust processing times for altitude. Add 5 minutes to boiling water bath times for altitudes from 3001 to 6000 ft; 10 minutes for altitudes from 6001 to 8000 ft. For altitudes over 100 ft, increase the pressure for processing via pressure canners to 15 lbs pressure (weighted gauge) or 12 lbs (dial gauge).

Follow the safety practices outlined in Chapters 10 and 15 to prevent food safety problems during processing.

Work with a reputable co-packer to process produce if you are unwilling to make the investments necessary to ensure high quality and food safety.

Store products in a cool, dark place.

Check containers to make sure a vacuum seal is present. Signs that products have spoiled include broken seals, seepage, mold, yeast growth, gassiness, fermentation, spurting liquid when jar is opened, sliminess, cloudiness, and disagreeable odors.
PREPARATION FOR PROCESSING

Some vegetable produce benefits from blanching in boiling water or steam before canning. Blanching is quick, incomplete cooking, which ends certain enzymatic reactions in the fresh product, expels tissue gases. Blanching decreases the microbial population present on the surface of fresh produce and helps retain bright color, good texture and fresh flavor after processing. Follow the chart below for blanching times, and always rinse blanched produce under very cold water or dip the hot produce into and ice water bath to stop the cooking process. Steam blanching takes a little longer, but results in less loss of vitamins B₁, B₂, niacin and C than boiling water blanching.

### Blanching times for selected commodities

<table>
<thead>
<tr>
<th>Commodity</th>
<th>Blanching time (minutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Boiling water</td>
</tr>
<tr>
<td>Asparagus</td>
<td>3</td>
</tr>
<tr>
<td>Broccoli</td>
<td>3</td>
</tr>
<tr>
<td>Brussels sprouts</td>
<td>4</td>
</tr>
<tr>
<td>Cabbage (wedges)</td>
<td>5</td>
</tr>
<tr>
<td>Carrots</td>
<td>5</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>3 (add 4 tsp or 45 ml of salt)</td>
</tr>
<tr>
<td>Collards</td>
<td>3</td>
</tr>
<tr>
<td>Corn (sweet)</td>
<td>7</td>
</tr>
<tr>
<td>Green Beans</td>
<td>3</td>
</tr>
<tr>
<td>Eggplant</td>
<td>4 (add 4 oz or 125 ml lemon juice)</td>
</tr>
<tr>
<td>Leafy greens</td>
<td>2</td>
</tr>
<tr>
<td>Mushrooms</td>
<td>3 to 5</td>
</tr>
<tr>
<td>Okra</td>
<td>3 to 4</td>
</tr>
<tr>
<td>Parsnips</td>
<td>3</td>
</tr>
<tr>
<td>Peas</td>
<td>2</td>
</tr>
<tr>
<td>Potatoes (new)</td>
<td>4 to 10, until translucent</td>
</tr>
<tr>
<td>Pumpkin</td>
<td>2 to 3, until soft</td>
</tr>
<tr>
<td>Sweetpotatoes</td>
<td>15 to 20, until soft</td>
</tr>
<tr>
<td>Zucchini/summer squash</td>
<td>3</td>
</tr>
</tbody>
</table>

Canning and Bottling Methods

Two types of canners are commonly used to process horticultural crops. These are the boiling water canner, and the pressure canner. The choice of method depends on the acid content of the produce you are processing. Canners come in all sizes, and can be matched to the facilities you have for cooking and heating.

Boiling water bath

A water bath canner is a large pot with a loose cover and a rack to hold jars off the bottom. The pot should be deep enough to cover the canning jars by one to two inches and still have another inch of space to allow brisk boiling. The diameter of the pot should be no more than four inches wider than the diameter of the stove's burner to ensure even heating.

Acidic foods such as fruits, tomatoes, pickles and relishes (pH < 4.5), and high sugar foods such as jams, jellies, syrups and marmalades can be safely processed using a boiling water bath.

Source: Georgia Cooperative Extension Service, 1984
CHAPTER 14: CANNING AND BOTTLING SPECIALTY PRODUCTS

Pressure canning

A pressure canner is required for processing low acid foods such as vegetables (pH > 4.5). A pressure canner is a specially made heavy pot with a locking lid, an inner rack and a steam vent in the lid. The vent can be adjusted using a weight, valve or screw, depending on the type of canner. A pressure gauge registers the air pressure inside the canner. A dial gauge gives a reading of the actual pressure, while weighted gauges will rock gently when the canner is at the proper pressure. Ten pounds of pressure at 115 °C (240 °F) is recommended for canning vegetables at 0 to 1000 ft altitude.

Pressure Canners

Source: Georgia Cooperative Extension Service, 1984

CANNING CONTAINERS

There are several types of glass canning jars used for processing horticultural crops. The ball type jar and the zinc capped jar both require rubber rings as seals. These can sometimes be difficult to obtain, but if locally available, make excellent containers. Most people are familiar with the two-piece lids used for home canning. Currently containers (bottles or jars) with a plastisol lined lid are the most commonly used container for small-scale processing. Air bubbles must be removed by gently running a non-metallic spatula around the inside of the jar between the food and the side of the jar.

No matter which jar is used, when filling containers, it is important to leave a small amount of headspace to allow for expansion of the food while processing. If a jar is filled too full, it may explode. If too much headspace is left, the food may spoil, since all the extra air may not be driven out during processing. As a rule, leave 2.5 cm (1 inch) headspace for low acid foods and vegetables; 1.3 cm (1/2 inch) headspace for acid foods (pH < 4.5), fruits and tomatoes; and 0.7 cm (1/4 inch) headspace for juices, jellies and jams, pickles and relishes (Ball, 1995).
Processed Products: Juices

Fruits
To process tomatoes or fruits to juices, fruits are simmered in water or their own juice in a stainless steel, glass or enamelware pot. When tender, the product is cut into pieces and pressed through a food mill, colander or several layers of cheesecloth. Sugar or lemon juice can be added, to taste.

The juices must then be either frozen or canned for storage. Juices can be frozen in jars or freezer containers (leave 1.3 cm or 1/2 inch headspace). Most fruit juices can be canned in a boiling water bath for 20 minutes, but apple and grape juices can be processed in hot water (82 °C or 180 °F) for 30 minutes. Recent problems with apple juice (Odwalla) have lead to requirements for labelling on pasteurization.

**Apple juice:**
24 lbs apples
2 liters or quarts water
Wash apples, drain, remove stem and blossom ends, chop and place in a large pot. Add water and cook until tender, stirring frequently. Strain through several layers of cheesecloth into a second pot.
Heat juice just to a boil, then fill hot jars, leaving 0.7 cm or 1/4 inch headspace. Add caps and process in a boiling water canner for 10 minutes. Yield about 12 half-liters or pints.

**Mango Squash:** Use ripe fruits, washed with clean water and dried. Squeeze each fruit, rolling it between your palms to break down the pulp, then remove the stem end and squeeze out the thick pulp and juice. To make a 25% pulp squash, combine 1.75 kg sugar, 40 g citric acid and 1.25 kg water and bring to a boil. Cool and filter through a muslin cloth. Add 1 kg mango pulp, filter again through a muslin cloth. Add 2.9 g potassium metabisulfite as a preservative (dissolved in a small quantity of juice) and mix thoroughly. Fill clean, dry glass bottles, leaving about 1 inch headspace. Source: Department of Food Science and Technology, PAU.
Vegetables
Vegetables should be chopped or shredded, then simmered for 45 to 50 minutes until mushy. The juice can then be pressed or strained from the vegetable pulp, and frozen or canned. Canning vegetable juices requires processing at 10 pounds of pressure in a pressure canner. Pints should be processed for 55 minutes, and quarts for 85 minutes.

Processed Products: Pickles and Vinegars
The high acid content of pickled vegetables allows you to use a boiling water bath rather than a pressure canner, and reduces the time required for processing. The salt used for pickling is free of additives found in table salt, which will cause clouding. Flavored vinegars are so highly acid that no further processing is necessary if vinegar is decanted into sterilized bottles. To sterilize containers: fill with hot water place in an open pot; cover with water and boil for 10 minutes.

Spicy Dill Green Beans
(Tilgner, 1998)

Ingredients:
green beans, whole, washed, drained, trimmed and cut to fit vertically in jars
(1 lb makes about two pint jars)

5 parts vinegar
5 parts water
0.5 parts canning salt

per pint jar
1/4 tsp crushed hot red pepper
1/2 tsp whole mustard seeds
1/2 tsp dill seed
1 clove peeled garlic
5 sprigs fresh dill

Pack beans into hot, clean jars. Add pepper, mustard seed, dill seeds, garlic and fresh dill. Combine vinegar, water and salt; heat mixture to boiling. Pour liquid over beans, filling to 1/2 inch below top of jar. Seal jars, adjust lids (not too tight). Process in a boiling water bath for five minutes. Remove from boiling water, complete seals (tighten lids) and let cool completely before handling.
Mango Pickle (Achar):
Use sour varieties of well developed but under-ripe mangoes, washed and cut lengthwise into slices.

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>mango slices</td>
<td>1 kg</td>
</tr>
<tr>
<td>salt</td>
<td>250 g</td>
</tr>
<tr>
<td>fenugreek (methi)</td>
<td>50 g</td>
</tr>
<tr>
<td>fennel (saunf)</td>
<td>50 g</td>
</tr>
<tr>
<td>nigella (kalaunji)</td>
<td>20 g</td>
</tr>
<tr>
<td>red chilli powder</td>
<td>25 g</td>
</tr>
<tr>
<td>turmeric powder (haldi)</td>
<td>20 g</td>
</tr>
<tr>
<td>black pepper</td>
<td>25 g</td>
</tr>
<tr>
<td>cumin (zira)</td>
<td>25 g</td>
</tr>
<tr>
<td>thyme (ajwain)</td>
<td>25 g</td>
</tr>
<tr>
<td>mustard oil</td>
<td></td>
</tr>
</tbody>
</table>

Dip mango slices into 2% salt solution (brine) to prevent blackening of cut surfaces. Drain the brine, spread slices on trays and place in the sun for 1 to 2 hours to remove surface moisture. Mix fenugreek, fennel, nigella, black pepper, cumin and thyme and fry in mustard oil until slightly browned. Cool to room temperature and add salt, turmeric and red chilli powder. Add mango slices and mix thoroughly.

Transfer mixture to a large glass or stone jar, press well to squeeze the air out and cover content with a layer of mustard oil.

Examine the pickle after 2 or 3 days and add oil if needed to ensure the pickle is covered with oil. The pickle is ready for eating in 2 to 3 weeks.

Source: Department of Food Science and Technology, PAU.

Flavored Vinegars:
Use only glass or enamel pots and glass containers since vinegar is corrosive. Crush flavorings (fresh herbs of your choice, spice seeds, peeled shallots or onions, hulled berries) and place them in a glass jar. Use 250 ml (1 cup) of herbs or 125 ml (1/2 cup) of berries for each 0.5 L (16 oz) of cider vinegar. Slowly heat the vinegar in a glass pot until warm (not boiling). Pour the vinegar into the glass jars over the herbs/flavorings and seal tightly. Place the jars in a sunny location and let vinegar mature for about two weeks. Shake daily and taste periodically. When vinegar has reached desired taste, filter through cheesecloth into a clean sterile bottle. Add fresh herbs or spices for decoration and seal. Use only cork, plastic or glass lids. Store in a cool, dark place.

Herbs in cider vinegar:
tarragon, dill, marjoram, sage, thyme, chile peppers.

Use white vinegar for red basil or chive blossoms.
Processed Products: Preservation in Oil or Salt

One of the simplest methods of preservation is to cover peeled or dried produce with edible oil and seal it in a clean container. In India the most popular products are preserved in mustard oil. Use high quality olive oil for the best flavor and highest market price in the U.S. and Europe. Salt cured products are becoming less popular as people change their food habits and eat less salty foods. An exception is olives, for which there are many recipes and well-guarded secret processing methods. The example provided here comes from Morocco.

Products in oil:
- Dried tomatoes
- Dried chili peppers

**Moroccan black olives:**
- 10 kg black olives, very mature, defect free
- 2 kg unrefined canning salt
- 1/2 liter olive oil

Mix olives and salt and put the mixture into deep baskets. Cover with something heavy that will press the liquid out of the olives (during 2 to 3 weeks) and leave in a shady place. After 3 weeks, wash olives thoroughly with clean water, dry in sunlight for 1 to 2 days. Mix with 1/2 liter olive oil and ladle into jars, close firmly.

Processed Products: Specialty Sauces, Salsas, Chutneys

A few inexpensive ingredients that you produce on your farm can be combined into specialty products that yield high prices at the market. Recipes are from Ball (1995) and Chioffi and Mead (1991).

**Spicy tomato ketchup:**

Ingredients
- 35 to 45 medium tomatoes, very ripe, peeled, quartered, cored
- 2 sweet red peppers, seeded and cut into pieces
- 2 sweet green peppers, seeded and cut into pieces
- 2 hot red peppers, diced
- 4 large onions, diced
- 3 cups cider vinegar
- 2 cups sugar or honey (use less if desire less sweetness)
- 3 Tbsp salt
Tie into a cheesecloth bag:
1 tsp whole allspice, 1 tsp whole cloves, 1 tsp broken cinnamon stick.

Combine vegetables in a large pot, cook until tender (15 to 30 minutes). Remove from heat and run through a food mill. Add all remaining ingredients except vinegar and simmer uncovered until thick while stirring frequently. Add vinegar and cook an additional 15 minutes. Remove bag of spices, ladle into hot clean jars. Add lids and process for 15 minutes in a boiling water canner. Yield: 8 to 10 cups.

Hot Salsa:
6 lbs tomatoes, ripe, peeled, seeded, cored, chopped.
2 lbs green peppers, seeded and chopped
1.5 lbs onions, chopped
1 lb hot peppers, chopped (remove seeds if you desire a milder version)
1 1/4 cups cider vinegar
3 cloves garlic, minced
2 Tbsp cilantro, minced
3 Tbsp salt

Combine all ingredients in a large pot, bring mixture to a boil. Reduce heat and simmer 10 minutes. Ladle hot salsa into hot jars, leaving 1/4 inch headspace. Add lids, process 15 minutes in a boiling water canner. Yield: 12 cups.

Peach chutney:
Ingredients
20 medium peaches, peeled, pitted and chopped
1 cup raisins (250 ml)
1 medium chopped onions
2 cups brown sugar (500 ml)
1/4 cup mustard seed (125 ml)
2 Tbsp ginger (40 ml)
2 tsp salt (15 ml)
1 clove garlic, minced
1 hot red pepper, finely chopped
5 cups vinegar (1.25 L)

Combine all ingredients in a large pot. Cook slowly until thick (about 40 minutes), while stirring frequently. Ladle hot chutney into hot jars, leaving 0.7 cm (1/4 inch) headspace. Add lids and process 10 minutes in a boiling water canner. Yield: 14 jars (250 ml each).
REGULATIONS AFFECTING FOOD PROCESSING

Food safety and sanitation requirements
Contact the Food and Drug Administration and ask for a current copy of their publications on how to start a food business and Current Good Manufacturing Processes. The FDA has an office in Washington, DC and in each US state.

Food and Drug Administration
Center for Applied Nutrition  FDA (HFS-585)
200 C Street, SW
Washington, DC  20204

The Government Printing Office can provide you with a copy (for a fee) of the current Code of Federal Regulations. Chapters 1 through 3 of the Code cover the regulations affecting food processing operations, including use of additives, color, good manufacturing practices and food standards.

Superintendent of Documents
GPO
Washington, DC  20402

Labeling
Products shipped interstate which do not conform to the FDA labeling regulations will be removed from store shelves. Some key elements include a list of ingredients and a net weight statement (in metric measurements) on the lower third of the label.

THE NUTRITIONAL LABELING AND EDUCATION ACT (1990):

Exceptions to the law that all products carry nutritional information include coffee, tea and spices, containers too small to carry a nutritional label, and producers whose total annual revenues are less than $500,000.
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Packaging

If you are aiming for the gourmet market, your processed product better look beautiful! Visit http://www.packstrat.com for information on all sorts of packaging materials. Here are some sources of labels, design services, marketing materials and containers:

Labels Plus
2407 106th St. SW
Everett, Washington 98204
(206) 745-4592
FAX: (206) 523-1973

Packagemasters, Inc.
P O Box
118352 Sindle Ave.
Little Falls, New Jersey 07424
(201) 890-7511
FAX: (201) 890-0470

Presentation Packaging
870 Louisiana Ave. South
Minneapolis, Minnesota 55426
(800) 326-2698 or (612) 540-9544
FAX: (612) 540-9522 or -9628

Southern Atlantic Label
1300 Cavalier Blvd.
Chesapeake, Virginia 23323
(804) 487-2525
FAX: (804) 487-9712

Sources of containers (metal, plastic, PET, and glass):

Agri-Pack
870 Louisiana Ave South
Minneapolis, Minnesota 55426
(800) 328-1784

Berlin Packaging
111 North Canal St., Suite 300
Chicago, Illinois 60606
(800) 4-BERLIN
FAX: (800) 423-7545

Fruit and vegetable containers.
Fruit and jam gift containers.
Largest U.S. distributor of glass, plastic and metal containers.
Bottles, jars, vials.

Glass and plastic bottles, vials and jars.
Metal caps with plastisol liners.
Wide range of PET containers.

Manufacture and distribution of packaging materials.

Vinegar bottles, vials, canning jars.

Decorative containers, tamper-evidence bands.
CO-PACKERS

Working with a local co-packer can reduce many of the costs associated with food processing and packaging. Some co-packers can even provide product distribution services through their marketing networks. According to Hall, (1996), benefits and cost savings of co-packing include:

- elimination of capital costs of facilities and processing equipment
- access to experts in food processing
- compliance with the complex process of meeting federal, state and local regulations
- product uniformity and quality control
- purchasing power (containers, labels, etc)
- networking
- low cost technical services
- marketing assistance
- distribution

Some co-packers specialize in processing either dry or liquid products, while others provide only packaging or only labeling services. Contact co-packers in your area to identify which companies can provide the services you need. A few examples of California based companies are provided here, and many more can be found in telephone directories and in the Appendix on co-packers provided in Hall, 1996.

California Style Gourmet Products
6161 El Cajon Blvd., #200
San Diego, CA 92115
(800) 243 5226
Fax (619) 265 0893

Lodi Nut Co., Inc.
1230 S. Fairmont Ave.
Lodi, CA 95240
(209) 334 2081
FAX (209) 369 6815

Radich Bor-do-lay, Inc.
8130 Berry Ave., Suite 100
Sacramento, CA 95828
(916) 387 2107
FAX (800) 795 8349

Spectrum Naturals, Inc
(specializes in organic products)
133 Copeland Street
Petaluma, CA 95476
(707) 778 8900
FAX (707) 765 1026
COSTS AND BENEFITS OF CANNING AND BOTTLING SPECIALTY PRODUCTS

Costs:
- fresh produce
- materials
- containers, labels
- equipment
- power for processing
- labor

Benefits:
- longer shelf life
- added value
- reduced postharvest losses

Example 1: Preparation, packaging and marketing of a low sugar kiwi-strawberry jam. Approximately $100 worth of fresh produce grown in California is processed to yield $1350 of processed product.

Costs:
- equipment (pots, ladles, cooling rack) $50
- kiwifruit (100 lbs, trimmed, peeled) $50
- strawberries (100 lbs of very ripe berries) $50
- bottles and lids (300 each) $150
- labels--custom printed (300) $75
- sugar (50 lbs) $5
- pectin (5 lbs) $10
- fuel for cooking $5

Total costs $395

Benefits:
- Market value
- 300 (10 oz) jars of specialty jam @ $4.50/jar $1350
Example 2: Preparation, packaging and marketing of mango pickle. Approximately Rs 500 worth of fresh produce is processed to yield Rs 6000 of processed product.

Costs:
- equipment (drying trays, stone jar) Rs 500
- labor (1 day @ Rs 80/day) Rs 80
- mangoes (100 kgs, trimmed, peeled) Rs 500
- salt Rs 100
- spices and mustard oil Rs 1000
- bottles and lids (400 @ Rs 3) Rs 1200
- labels-- custom printed (400 @ Rs 0.10) Rs 40

**total costs** Rs 3420

Benefits:
- Market value
- 400 (0.5 kg) jars of specialty pickles @ Rs 30/kg Rs 6000

**SOURCES OF PROCESSING AND CANNING/BOTTLING EQUIPMENT AND SUPPLIES**

- **bottle capper** Countryside General Store
- **bottling equipment** Orchard Equipment and Supply Co.
- **can sealer** Countryside General Store
- **cider jugs, plastic** Rockford Package Supply Co.
- **hand-press** Michigan Orchard Supply
  Orchard Equipment and Supply Co.
  Garden Way Country Kitchen
- **juice presses**
  /non-citrus Goodnature Products, Inc
  Michigan Orchard Supply
  Orchard Equipment and Supply Co.
REFERENCES


