Storing Fruits and Vegetables at Home
From your garden to your kitchen

Presented by the
UCCE Master Food Preservers,
El Dorado County

From Your Garden to Your Kitchen

- What’s What?
- Harvesting Tips
- Deterioration Causes
- Storage: Where & How Long
- Eat it!

What’s What?

Classification of Vegetables
- Webster’s dictionary definition: a herbaceous plant grown for an edible part that is usually eaten as part of a meal.
- The part of the plant eaten often serves as a common method of classification.

What’s What?

- Fruits and vegetables come from all parts of a plant:
  - Seeds and pods – peas, beans
  - Bulbs - onions
  - Stems – celery, rhubarb
  - Leaves – leafy greens
  - Roots & tubers – potatoes, sweet potatoes

What’s What?

- Is it a fruit or a vegetable?
- These fruits are most commonly consumed as if they were vegetables: cucumber, tomato, eggplant and avocado.
- And rhubarb, a vegetable, is most commonly consumed as if it were a fruit!
Storing Fruits & Vegetables at Home

What’s What?

<table>
<thead>
<tr>
<th>Development</th>
<th>Breakdown</th>
<th>Death</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>Maturation</td>
<td>Ripening Senescence</td>
</tr>
<tr>
<td>pea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>summer squash</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pea</td>
<td></td>
<td></td>
</tr>
<tr>
<td>apple</td>
<td></td>
<td></td>
</tr>
<tr>
<td>tomato</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Harvesting Tips

- Know how you plan to use the produce
  - Eat it, store it, preserve it?
- Harvest only what you can use
  - A meal’s worth or the “batch” you plan to preserve

Harvesting Tips: When?

- General guideline: Days to maturity
- Temperature, daylight hours, rainfall, variety and soil conditions all affect maturity
- Harvest in the cool morning hours
  - After dew is gone

Harvesting Tips: How?

- Hold plant with one hand and remove fruit with the other hand
- Use the right tools and containers
- Know your plants – some plants need to be harvested to continue bearing

http://postharvest.ucdavis.edu/producefacts

From your garden to your kitchen

- Cool the product to the appropriate temperature as quickly as possible after harvesting
- Sort produce
- Store unwashed until just before using

Deterioration Causes

- Temperature & Time
- Water loss
- Respiration
- Time
- Damage
- Light
Deterioration Cause: Temperature

- Harvested fruits and vegetables are living structures.
- **Respiration:**
  - Sugar + O$_2$ → CO$_2$ + H$_2$O + Heat
- **Transpiration:**
  - Tissues lose water as they breathe

Deterioration Cause: Temperature

- Refrigerating some fruits and vegetables causes chill injury
- **Chill Injury Signs:**
  - pitting of the skin
  - browning of the flesh
  - water-soaked areas
- Refrigeration causes toxic products to accumulate in the tissue, and cells die.

### Days to Visible Chilling Symptoms

<table>
<thead>
<tr>
<th>Temperature</th>
<th>Black Bell</th>
<th>Japanese</th>
<th>Chinese</th>
</tr>
</thead>
<tbody>
<tr>
<td>32°F</td>
<td>1-2</td>
<td>--</td>
<td>2-3</td>
</tr>
<tr>
<td>36°F</td>
<td>4-5</td>
<td>5-6</td>
<td>5-6</td>
</tr>
<tr>
<td>41°F</td>
<td>8-7</td>
<td>8-9</td>
<td>10-12</td>
</tr>
<tr>
<td>45°F</td>
<td>12</td>
<td>12-14</td>
<td>15-16</td>
</tr>
<tr>
<td>50°F</td>
<td>no chilling</td>
<td>no chilling</td>
<td>no chilling</td>
</tr>
</tbody>
</table>

Deterioration Cause: Temperature

- Tomatoes are commonly stored or transported at 45°F. This temp. results in decay and poor color.
- Chilling injury on sweet basil stored at different temperatures.
  A score of 3 - limit for marketability.
  (A score of 0 = no injury, 8 = severe injury).
Deterioration Cause: Water Loss

- <3% no visual effect, texture
- 3-5% visual quality affected
- >5% shrivel

Water loss is Cumulative

Deterioration Cause: Water Loss

- Storage to reduce water loss:
  - Vented plastic bowl (countertop)
  - Perforated plastic bag (countertop & fridge)

- Storage that increases water loss:
  - Sealed plastic bags on counters

Fruit Respiration Patterns

- **Climacteric fruits** exhibit a burst of respiration as senescence begins.
  - Triggered by plant hormone ethylene
  - Apples, avocados, bananas, pears, peaches, tomatoes

- **Non-climacteric fruits** exhibit a decline in respiration through ripening and senescence.
  - Blueberries, cherries, citrus, cucumbers, grapes, pineapple, strawberries

Postharvest Respiration

Ethylene - an Important Factor

Useful:
- Accelerates ripening
- Causes abscission
- Chlorophyll destruction

Problematic:
- Accelerates ripening
- Causes abscission
- Accelerates senescence
Induce Ripening with Ethylene

Situation: Climacteric fruits like bananas and apples will ‘ripen’ if exposed to ethylene.
• Avocados, bananas, pears and other fruits can be forced to go through some changes associated with ripening by exposing them to ethylene gas.
• At home, hasten fruit ripening by putting them in a paper bag with an apple!

Deterioration Cause: Damage

• Pesky pests
  – IPM
• Poor harvesting techniques
• Long fingernails
  – Wear gloves

Deterioration Cause: Damage

Preventing Disease During Storage
• Most fruits and vegetables will resist disease as long as the skin is intact.
• Before storage, carefully inspect produce for cuts, bruises and signs of decay.
• Maintaining the correct moisture level is also important.
  ➔ Do not preserve damaged produce!

Deterioration Cause: Light

• Potatoes: store in dark, well ventilated area to prevent greening
• Solanine: toxic alkaloid

Storage: Where & How Long

Storage Compatibility
• Group by similar humidity and temperature requirements
• Ethylene-producing fruits can damage other produce
  – No apples near lettuce, asparagus, beans
  – Separate drawers in refrigerator
• ‘Beware’ of strong odors
  – Don’t store cut onions near apples or potatoes

Storage: Where & How Long

• Cool and dry
  – 50-60 F and 60% relative humidity
• Cold and dry
  – 32-40 F and 65% relative humidity
• Cold and moist
  – 32-40 F and 95% relative humidity
• U of MN Ext: Harvesting and Storing Home Garden Vegetables
Storage: Where & How Long

- Carrots: cold & moist, 8 months
- Winter Squash: cool & dry, 2-6 months
- Peppers: cool (>45º), 2 weeks
- Beans (snap): moist & cool, 1 week
- Cucumbers (6" long): cool & dry, 1 week
- Summer squash (6" long): cool & dry, 1 week
- Tomatoes (red): cool, 5 days

Refrigerator:
- Apples (> 7 days)
- Apricots
- Berries
- Asian pears
- Grapes
- Figs
- Artichokes
- Asparagus
- Beans
- Leafy veggies
- Cabbages
- Celery
- Mushrooms
- Squashes
- Sweet Corn

Counter to Ripen, then Refrigerator
- Avocados
- Kiwi
- Nectarines
- Peaches
- Pears (not Asian Pears)
- Plums
- Plumcots

Room Temperature
- Basil (in water)
- Cucumbers
- Peppers
- Potatoes
- Winter squashes
- Tomatoes

Building a Storage Area
- Outdoor storage: in-garden storage, mounds or pits, or buried containers
- Indoor storage: basement, cellar, attic….you choose!

Storing Vegetables and Fruits at Home
(Washington State EB1326)

From Your Garden to Your Kitchen

… to your table
- Preparing to eat what you’ve stored
Wash…For Safety

- Wash hands and surfaces well
- Rinse all produce under running water; do not use soap
  - Do not soak produce
- Scrub the surface of melons, potatoes, and thick-skinned produce items
- Gently rinse berries

Wash…For Safety

- Remove outer leaves of leafy greens
  - Wash bagged produce, just for insurance
- Remove tops of carrots and beets, and stems, where appropriate

Resources

- WSUCE: Storing Fruits & Veggies at Home
  http://cru.cahe.wsu.edu/CEPublications/eb1326/eb1326.pdf
- CSU Ext: Storage of Home-Grown Vegetables
  http://www.ext.colostate.edu/pubs/garden/07601.html
- Cornell Ext: Guidelines for Harvesting Vegetables
  http://www.gardening.cornell.edu/factsheets/vegetables/harvestguide.pdf
- UMN Ext: Harvesting and Storing Home Garden Vegetables
  http://www.extension.umn.edu/distribution/horticulture/DG1424.html
- California Backyard Orchard
  http://homeorchard.ucdavis.edu/
- UC Garden Web
  http://ucanr.org/sites/gardenweb/
- UCCE Small Farm Project
  http://sfp.ucdavis.edu/docs/postharvest.html

Produce Facts

- Harvest indices
- Quality indices
- Temperature and RH
- Freezing point/damage
- Respiration rates
- Ethylene production
- Effects of ethylene
- Effects of modified atmospheres
- Physiological disorders
- Postharvest diseases
- Mechanical injury
- PHOTOS

Recap

- Harvest fruits and vegetables at optimum maturity for best storage
  - Only a few fruits ripen after harvest
  - Plan ahead to minimize waste!
- Minimize deterioration
  - Temperature, time, water loss, respiration
- Store in proper environment
- Wash properly
Enjoy the bounty of your harvest!
Guidelines for Harvesting Vegetables

From Cornell Cooperative Extension, Chemung County

More gardening information at www.gardening.cornell.edu

Knowing when to harvest your vegetables is as important as knowing how to grow them. Each vegetable has a window of opportunity for harvest. While some vegetables are quite forgiving in having a long harvest window, others can go from tender and tasty to tough and bitter overnight.

Counting days to maturity cannot always be relied upon as growth depends on many factors, including precipitation, temperature, and soil fertility, and so can vary from year to year. The best way to determine when a vegetable is ready to harvest is from the characteristics of the plant itself. These signs can often be subtle and it takes practice to familiarize yourself with them.

It should also be noted that harvest for many vegetables is determined by the freezing temperatures of autumn. Some vegetables need to be harvested before any frost occurs, while others need freezing temperatures to complete their ripening. The following table gives a brief description of some of the physiologic and environmental clues that help us know when to harvest our vegetables.

Note:

- A frost can occur anywhere from 36 F to 32 F. A light freeze refers to temperatures between 28 F and 31 F, a moderate freeze between 24 F and 28 F, and severe freeze below 24 F.

- Many root crops can be left in the ground through the winter if “mulched heavily.” This means covering your root crops before the ground freezes with 1 to 2 feet of a mulch such as hay, leaves, or straw.

- Some vegetables need to be cured after harvest. This involves exposing the produce to warm, dry air so that the outer skin hardens and protects the succulent core from rotting.

Asparagus: Harvest by snapping 6”-10” spears off at ground level. Limit harvest period to 6-8 weeks or until stems are pencil thin.

Beans, Lima: Harvest when pods are filled but before yellowing. For tender lima beans, harvest when slightly immature; for meaty beans, wait until fully mature.

Beans, Snap: Bean pods will be the most tender when the small seed inside is one-fourth normal size. From this stage on, the pods become more fibrous and the beans more starchy.

Beets: Begin Harvest when beet is 1” in diameter. Beet tops at this time make excellent tender greens. Begin main harvest when beets are 2”-3”. Harvest spring planted beets before hot weather (July). Harvest fall beets before the first moderate freeze or mulch heavily for winter harvest.

Helping You Put Knowledge to Work

Cornell Cooperative Extension provides equal program and employment opportunities. NYS College of Agriculture and Life Sciences, NYS College of Human Ecology, and NYS College of Veterinary Medicine at Cornell University, Cooperative Extension associations, county governing bodies, and U.S. Department of Agriculture, cooperating.
Broccoli: Harvest terminal head while florets are still tight and of dark green color, before flowers start to open. Smaller sized heads will develop off side shoots.

Brussels Sprouts: Remove lowest leaves from stalk to improve sprout size. Harvest sprouts (small heads) when they are firm in size starting from the bottom. Frost improves flavor, but harvest before first severe freeze.

Cabbage: Harvest when heads are solid. If heads become over mature they may split. To delay harvest and prevent splitting, pull upward on head until upper roots snap.

Cabbage, Chinese: Grow only in fall. Harvest heads after the first moderate frost.

Cantaloupe: There are three ways to tell when to harvest muskmelon; when stem slips easily from vine, surface netting turns beige, and blossom end is soft and smells sweet.

Carrots: Harvest at 1”-2” thickness. Harvest spring carrots before hot weather (July). Fall planted carrots should be harvested before ground freezes, or mulch heavily for winter harvest.

Cauliflower: Tie outer leaves above the head when curds are about 1”-2” in diameter. Heads will be ready for harvest in 1-2 weeks. Pick before head becomes yellow, ricey or blemished.

Chard (Swiss): A green that may be harvested continuously by breaking off outer leaves. Spring planting will provide greens from early summer to first moderate freeze.

Corn, Sweet: Wait to harvest sweet corn until tip feels full through husk. Silks will be dry and kernels filled out. To check for maturity, open top of ear and press a kernel with thumbnail. If it exudes a milky sap, it is ready for harvest. Use as soon as possible after harvest.

Cucumber: Cucumbers are best when slightly immature, just as the spines soften and before the seeds become half-size. This will vary with variety. Most varieties will be 1 ½”-2 ½” in diameter, 5”-8” long. Pickling cucumbers will be blocky and not as long.

Eggplant: Harvest when fruits are nearly full-grown but color is still bright and shiny. Overripe when color dulls and seeds turn brown.

Horseradish: Harvest after several severe freezes or mulch heavily for winter harvest.

Kale: Harvest leaves and leaf stems when they reach suitable size. Frost improves flavor.

Kohlrabi: Harvest when the swollen stems are 2”-3” in diameter. Stems become woody if left too long before harvest or if grown under poor conditions.

Lettuce, Head: Harvest entire plant when head feels firm but before center bolts.

Lettuce, Leaf: Harvest outer leaves as they attain suitable size. Timely picking increases length of harvest.

Okra: Okra pods are ready to harvest when they are 2”-3” long and snap easily. Over-mature pods become tough and woody.

Onions, Green: Harvest green onions when they attain sufficient size.
Onions, Dry: Harvest at ¼”-1” for fresh table use, 1”-1 ½” for boiling and pickling, and when tops have fallen over & necks are shriveled for storage and general cooking. Fingers will not dent mature bulbs. Cure onions by placing in a single layer or mesh bag in a dry, well-ventilated area out of direct sunlight for 3-4 weeks. Remove tops when fully dry.

Parsnips: Harvest in late fall after several moderate freezes or mulch heavily for winter harvest. Exposure to cold improves flavor.

Peas, Garden: Harvest when pods are light green and filled out but before yellowing. Flat, dark green pods are immature.

Peas, Snow: As opposed to garden peas, snow peas should be harvested when they attain full size and seeds begin to show. Do not allow pod to fill out.

Peppers, Hot: Harvest as needed. Young, green peppers are hotter than mature, colored ones. For long-term storage, pull plants late in season and hang to dry in a warm, well-ventilated place.

Peppers, Sweet: Harvest when fruits are firm and full size. If red fruits are desired, leave on plant until red color develops.

Potato: Harvest new potatoes 2 weeks after blooming. Harvest main crop after tops have died down and when ground is dry. Dig carefully to avoid bruising and allow to surface dry. Cure for 10-14 days in a dark, well-ventilated location at 45 F to 60 F.

Pumpkins: See Squash, Winter

Radish: Harvest when ½”-1” in diameter. Harvest spring radishes before hot weather (July). Winter radishes should be harvested before ground freezes, or mulch heavily for winter harvest.

Rhubarb: Leaf stalks are harvested when ½”-1” in diameter. Do not use leaves!

Spinach: Harvest when leaves attain suitable size. Break off outer leaves as plant grows or harvest entire plant at once. Harvest fall spinach sparingly to allow for spring regrowth.

Squash, Summer: Best when harvested young and tender. Skin should be easily penetrated with the thumbnail.

Squash, Winter: Maturity can be roughly determined by pressure from the thumbnail on the fruit skin. Mature fruit will be hard and impervious to scratching. Harvest squash before the first hard frost with a sharp knife, leaving at least 1” of stem attached. Fruit picked without the stem will soon decay around the stem scar. Cure in a dry, well-ventilated area for 10 days at 75 F to 85 F.

Sweet Potato: Harvest in fall before frosts and freezing temperatures. Handle carefully in digging as bruised tubers will rot. Cure for 1 week at 80 F to 85 F.

Tomato: Harvest when fruits are uniformly red, but before end softens. Ripe fruit sinks in water. Vine-ripened tomatoes are sweetest, but tomatoes will ripen off the vine if picked green. Green tomatoes, harvested before frost, should be wrapped in newspaper and kept at 55 F to 70 F. Tomatoes stored in this manner should last 3-5 weeks. Be sure to inspect each week for ripeness.
**Turnip:** Turnips can be harvested from the time they are 1” in diameter. They are best as a fall crop and can withstand several light freezes. Frost improves flavor. Stems become woody if left too long before harvest or if grown under poor conditions.

**Watermelon:** Best indicator for ripe fruit is by the sound. Thumping a mature melon gives a dull hollow thud while an immature melon gives a ringing metallic sound. Also, the underside of a ripe melon turns from white to yellow and the tendril at the juncture of the fruit stem and the vine usually dies when the fruit is mature.

### Vegetable Harvest Calendar

<table>
<thead>
<tr>
<th></th>
<th>APR</th>
<th>MAY</th>
<th>JUN</th>
<th>JUL</th>
<th>AUG</th>
<th>SEP</th>
<th>OCT</th>
<th>NOV</th>
<th>DEC</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASPARAGUS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEANS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BEETS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BROCCOLI</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CABBAGE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CANTALOUPE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CARROTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CAULIFLOWER</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CELERY</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CORN</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CUCUMBERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EGGPLANT</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>KALE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LETTUCE</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ONIONS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEAS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEPPERS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>POTATOES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PUMPKINS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RADISHES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RHUBARB</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SPINACH</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SQUASH, Summer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SQUASH, Winter</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOMATOES</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TURNIPS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>WATERMELON</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Compiled by Eric de Long  
Chemung, 10/01
References

Anonymous. Harvest Calendar for Fresh Fruits & Vegetables. NYS Dept. of Ag. & Markets leaflet.


Specific harvest and storage information for some commonly-grown vegetables. Expected shelf-life times are only estimates.

**cool and dry** (50-60°F and 60% relative humidity)

**cold and dry** (32-40°F and 65% relative humidity)

**cold and moist** (32-40°F and 95% relative humidity)

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>When to Harvest</th>
<th>How to Store</th>
<th>Expected Shelf-life</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>asparagus</td>
<td>third year after planting when spears are 6-9 inches long</td>
<td>cold and moist</td>
<td>2 weeks</td>
<td>keep upright</td>
</tr>
<tr>
<td>basil</td>
<td>when leaves are still tender</td>
<td>at room temperature</td>
<td>5 days</td>
<td>keep stems in water; will discolor if kept in refrigerator for 10 days</td>
</tr>
<tr>
<td>beans, snap</td>
<td>about 2-3 weeks after bloom when seeds still immature</td>
<td>cold and moist</td>
<td>1 week</td>
<td>develop pitting if stored below 40°F</td>
</tr>
<tr>
<td>beets</td>
<td>when 1.25-3 inches in diameter</td>
<td>cold and moist</td>
<td>5 months</td>
<td>store without tops</td>
</tr>
<tr>
<td>broccoli</td>
<td>while flower buds still tight and green</td>
<td>cold and moist</td>
<td>2 weeks</td>
<td></td>
</tr>
<tr>
<td>brussels sprouts</td>
<td>when heads 1 inch in diameter</td>
<td>cold and moist</td>
<td>1 month</td>
<td></td>
</tr>
<tr>
<td>cabbage</td>
<td>when heads compact and firm</td>
<td>cold and moist</td>
<td>5 months</td>
<td></td>
</tr>
<tr>
<td>carrots</td>
<td>when tops 1 inch in diameter</td>
<td>cold and moist</td>
<td>8 months</td>
<td>store without tops</td>
</tr>
<tr>
<td>cauliflower</td>
<td>while heads still white, before curds &quot;ricey&quot;</td>
<td>cold and moist</td>
<td>3 weeks</td>
<td></td>
</tr>
<tr>
<td>corn, sweet</td>
<td>when silks dry and brown, kernels should be milky when cut with a thumbnail</td>
<td>cold and moist</td>
<td>5 days</td>
<td></td>
</tr>
<tr>
<td>cucumbers</td>
<td>for slicing, when 6 inches long</td>
<td>cool spot in kitchen 55°F in perforated plastic bags; storage in refrigerator for a few days okay</td>
<td>1 week</td>
<td>develops pitting and water-soaked areas if chilled below 40°F; do not store with apples or tomatoes</td>
</tr>
<tr>
<td>eggplant</td>
<td>before color dulls</td>
<td>like cucumbers</td>
<td>1 week</td>
<td>develops pitting, bronzing, pulp browning if stored for long period below 50°F</td>
</tr>
<tr>
<td>kohlrabi</td>
<td>when 2-3 inches in diameter</td>
<td>cold and moist</td>
<td>2 months</td>
<td>store without tops</td>
</tr>
<tr>
<td>lettuce</td>
<td>while leaves are tender</td>
<td>cold and moist</td>
<td>1 week</td>
<td></td>
</tr>
<tr>
<td>Vegetable</td>
<td>When to Harvest</td>
<td>How to Store</td>
<td>Expected Shelf-life</td>
<td>Comments</td>
</tr>
<tr>
<td>-------------------------</td>
<td>-----------------------------------------------------</td>
<td>----------------------</td>
<td>---------------------</td>
<td>---------------------------------------------------------------------------</td>
</tr>
<tr>
<td>muskmelons (cantaloupe)</td>
<td>when fruits slip off vine easily, while netting even, fruit firm</td>
<td>cold and moist</td>
<td>1 week</td>
<td>develops pitting surface decay with slight freezing</td>
</tr>
<tr>
<td>onions</td>
<td>when necks are tight, scales dry</td>
<td>cold and dry</td>
<td>4 months</td>
<td>cure at room temperature 2-4 weeks before storage, do not freeze</td>
</tr>
<tr>
<td>parsnips</td>
<td>when roots reach desired size, possibly after light frost</td>
<td>cold and moist</td>
<td>4 months</td>
<td>do not wax or allow roots to freeze; sweetens after 2 weeks storage at 32°F</td>
</tr>
<tr>
<td>peas</td>
<td>when pods still tender</td>
<td>cold and moist</td>
<td>1 week</td>
<td></td>
</tr>
<tr>
<td>peppers</td>
<td>when fruits reach desired size or color</td>
<td>like cucumbers</td>
<td>2 weeks</td>
<td>develops pitting below 45°F</td>
</tr>
<tr>
<td>potatoes</td>
<td>when vine dies back</td>
<td>cold and moist; keep away from light</td>
<td>6 months</td>
<td>cure at 50-60°F or 14 days before storage, will sweeten below 38°F</td>
</tr>
<tr>
<td>pumpkins</td>
<td>when shells harden, before frost</td>
<td>cool and dry</td>
<td>2 months</td>
<td>very sensitive to temperatures below 45°F</td>
</tr>
<tr>
<td>radishes</td>
<td>when roots up to 1.25 inches in diameter</td>
<td>cold and moist</td>
<td>1 month</td>
<td>store without tops</td>
</tr>
<tr>
<td>rutabagas</td>
<td>when roots reach desired size</td>
<td>cold and moist</td>
<td>4 months</td>
<td>do not wax</td>
</tr>
<tr>
<td>spinach</td>
<td>while leaves still tender</td>
<td>cold and moist</td>
<td>10 days</td>
<td></td>
</tr>
<tr>
<td>squash, summer</td>
<td>when fruit 4-6 inches long</td>
<td>like cucumbers</td>
<td>1 week</td>
<td>do not store in refrigerator for more than 4 days</td>
</tr>
<tr>
<td>squash, winter</td>
<td>when shells hard, before frost</td>
<td>cool and dry</td>
<td>2-6 months, depending on variety</td>
<td>curing unnecessary; do not cure Table Queen</td>
</tr>
<tr>
<td>tomatoes, red</td>
<td>when color uniformly pink or red</td>
<td>like cucumbers</td>
<td>5 days</td>
<td>loses color, firmness and flavor if stored below 40°F; do not refrigerate!</td>
</tr>
<tr>
<td>turnips</td>
<td>when roots reach desired size, possibly after light frost</td>
<td>cold and moist</td>
<td>4 months</td>
<td>can be waxed</td>
</tr>
<tr>
<td>watermelons</td>
<td>when underside turns yellow or produces dull sound when slapped</td>
<td>like cucumbers</td>
<td>2 weeks</td>
<td>will decay if stored below 50°F for more than a few days</td>
</tr>
</tbody>
</table>

*Cindy Tong, Extension Postharvest Horticulturist, Department of Horticultural Science*
Storing Fresh Fruits and Vegetables for Better Taste

The flavor of fruits and vegetables is influenced by maturity and quality at harvest and by how they are stored afterwards. To maintain the freshness and flavor of the produce you buy at the market or grow in your garden, it is important to know how to store it at home.

Many fruits and vegetables should be stored only at room temperature because refrigerator temperatures (usually 38°F to 42°F [3.3°C to 5.6°C]) damage them or prevent them from ripening to good flavor and texture. For example, when stored in the refrigerator, bananas develop black spots and ripen too fast, while watermelons lose their flavor and deep red color if they are stored for longer than 3 days in the refrigerator. Pink tomatoes ripen to a better taste and red color if they are stored at room temperature. In the refrigerator, they do not turn red, and even red tomatoes kept in the refrigerator lose their flavor.

Other produce can be ripened on the counter and then stored in the refrigerator. A few fruits and fruit-type vegetables gain sugar or soften when stored at room temperature. For example, Bartlett pears ripen on the counter and then stored in the refrigerator. After they have ripened, they can be stored for 1 to 3 days in the refrigerator. Pink tomatoes ripen to a better taste and red color if they are left at room temperature. In the refrigerator, they do not turn red, and even red tomatoes kept in the refrigerator lose their flavor.

Countertop Storage

The counter storage area should be away from direct sunlight to prevent produce from becoming too warm. Fruits and vegetables that can be stored at room temperature for a few days without shriveling do not lose moisture rapidly. Even so, moisture loss can be reduced by placing produce in a vented plastic bowl or a perforated plastic bag. Do not place produce in sealed plastic bags on the counter because this slows ripening and may increase off-odors and decay due to accumulation of carbon dioxide and depletion of oxygen inside the sealed bag.

Ripening in a bowl or paper bag can be enhanced by placing one ripe apple with every 5 to 7 pieces of fruit to be ripened. Apples produce ethylene that speeds ripening. (Fuji and Granny Smith apples do not produce much ethylene and do not enhance ripening.)

Refrigerator Storage

Refrigerated fruits and vegetables should be kept in perforated plastic bags in the produce drawers of the refrigerator. You can either purchase perforated plastic bags or make small holes with a sharp object in unperforated plastic bags (about 10 holes per medium-size bag). Separate fruits from vegetables (use one drawer for each group) to minimize the detrimental effects of ethylene (produced by the fruits) on the vegetables. Use all refrigerated fruits and vegetables within a few days since longer storage results in loss of freshness and flavor.

---

<table>
<thead>
<tr>
<th>Storage Location</th>
<th>Fruits and Melons</th>
<th>Vegetables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Store in refrigerator</td>
<td>apples (more than 7 days)</td>
<td>artichokes</td>
</tr>
<tr>
<td></td>
<td>apricots</td>
<td>green onions</td>
</tr>
<tr>
<td></td>
<td>blackberries</td>
<td>herbs (not basil)</td>
</tr>
<tr>
<td></td>
<td>blueberries</td>
<td>leafy vegetables</td>
</tr>
<tr>
<td></td>
<td>cherries</td>
<td>leeks</td>
</tr>
<tr>
<td></td>
<td>cut fruits</td>
<td>lettuce</td>
</tr>
<tr>
<td></td>
<td>figs</td>
<td>mushrooms</td>
</tr>
<tr>
<td></td>
<td>grapes</td>
<td>peas</td>
</tr>
<tr>
<td></td>
<td>nashi (Asian pears)</td>
<td>spinach</td>
</tr>
<tr>
<td></td>
<td>raspberries</td>
<td>sprouts</td>
</tr>
<tr>
<td></td>
<td>strawberries</td>
<td>summer squashes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sweet corn</td>
</tr>
<tr>
<td>Ripen on the counter 1st, then store in the refrigerator</td>
<td>avocados</td>
<td>basil (in water)</td>
</tr>
<tr>
<td></td>
<td>kiwifruit</td>
<td>cucumber</td>
</tr>
<tr>
<td></td>
<td>nectarines</td>
<td>dry onions*</td>
</tr>
<tr>
<td></td>
<td>peaches</td>
<td>eggplant†</td>
</tr>
<tr>
<td></td>
<td>pears</td>
<td>garlic*</td>
</tr>
<tr>
<td></td>
<td>plums</td>
<td>ginger</td>
</tr>
<tr>
<td></td>
<td>plumscest</td>
<td>jicama</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pepperc</td>
</tr>
<tr>
<td></td>
<td></td>
<td>potatoes*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>pumpkins</td>
</tr>
<tr>
<td></td>
<td></td>
<td>winter squashes</td>
</tr>
<tr>
<td></td>
<td></td>
<td>sweet potatoes*</td>
</tr>
<tr>
<td></td>
<td></td>
<td>tomatoes</td>
</tr>
</tbody>
</table>

*Store garlic, onions, potatoes, and sweet potatoes in a well-ventilated area in the pantry. Protect potatoes from light to avoid greening.
†Cucumbers, eggplant, and peppers can be kept in the refrigerator for 1 to 3 days if they are used soon after removal from the refrigerator.

---

Postharvest Technology Research and Information Center • Department of Pomology • University of California, Davis

1/10/00
Quick Facts...

Many home-grown vegetables lend themselves to storage.

Storing vegetables can be quicker, easier and more economical than canning, freezing or dehydrating.

Root crops store best where they are grown until there is a danger of soil freezing.

Storage facilities can be constructed at little or no cost.

Storing vegetables produced in the home garden can be easier, quicker and more economical than freezing, canning or dehydrating them. The storage facilities can be built at little or no cost. Stored vegetables can represent considerable savings in food dollars.

Harvesting

Root crops store best where they are grown until there is a danger of soil freezing. Postpone harvesting by hilling the soil over the shoulders of carrots and beets to protect from freezing. If straw and soil are piled over the row as insulation, harvest may be delayed even longer. While in the row, the vegetables are readily accessible and the time and damage associated with harvesting and storage are circumvented. Dig the remaining roots before the soil freezes, top, clean, and put into storage.

Harvest onions soon after the tops fall over. Pull the onions, remove the tops, and cure the onions in mesh bags or crates where they have good air circulation until the necks dry down. When they rustle upon handling, they are ready to move to a cool, dry storage area.

Do not harvest winter squash and pumpkins until the vines are frost-killed and the skin is hard to the thumbnail. Leave stems on the fruit to protect against disease invasion.

Parsnips will withstand freezing. Leave part of the crop in the ground and dig in the spring when the flavor is greatly improved.

Kale and collards can be left in the garden long after the first fall frost. Harvest as needed until the foliage finally succumbs to cold weather. Wind protection will prolong its usefulness.

Celery and late cabbage may be harvested after the frost has stopped their growth. Pull celery with its roots attached. Cut cabbage and remove the loose outer leaves.

Storage

Root crops, including potatoes, carrots, beets, turnips, rutabagas, winter radishes, kohlrabi and parsnips, adapt to home storage. This group stores best at near freezing with a high relative humidity. Store onions near freezing but with a low relative humidity to discourage neck rot. Leafy crops such as celery and cabbage may also be stored. Store them by themselves — they give off ethylene gas while in storage, which has proven detrimental to other vegetables.

Celery may be harvested and stored directly in trenches that are dug for that purpose. Pull the celery plants and pack them upright in the trench. Cover with paper, boards and soil. They will root, bleach, tenderize and develop a nutty flavor when removed in late December.
Pack cabbage upside down so the covering soil does not work into the heads.

Pumpkins and winter squash store longer at 50 to 60 degrees F and a low relative humidity.

When selecting vegetables for storage, discard any unsound produce. This includes immature, damaged or diseased specimens. Also, when using vegetables from storage, check over the produce and discard any showing signs of rot. If allowed to remain, they will affect adjacent sound produce.

Outdoor Pit

This pit may be either lined or unlined. A lined pit is one that is sealed against ground water and rodents. This may be a barrel buried semi-horizontally in the ground (Figure 1). Place the roots in the barrel and put the lid loosely in place to allow for air transfer. Cover the barrel with straw held in place by a layer of soil. The straw may be 1 to 3 feet deep, depending upon the amount of cold that must be endured.

In the unlined pit, the roots are piled on a layer of straw and the pile is covered with straw held in place by a layer of soil. The unlined pit must be dug in an area where water will not fill the pit and where rodents are not a problem.

Storage Mound

A storage mound (see Figure 2) is similar to the unlined pit. It is used where groundwater is a problem or where only a short storage period under mild temperatures is anticipated. The vegetables are piled on a layer of straw on top of the ground. The mound then is covered with a layer of straw that is held in place by a layer of soil. The mound usually contains one or two bushels of mixed roots, so when the mounds are removed, all the produce can be taken into the house.

House Cellar

The root cellar under the house was the most popular means for storing vegetables before the days of central heating. However, acceptable storage can be constructed in a heated basement by partitioning off a storage room that includes a basement window (see Figure 3). Insulate the ceiling and walls of the room and open or close the window to provide the desired temperature. The temperature should be between 33 and 45 degrees. Add bins and shelves for efficient storage.

Root vegetables store best at high humidities, and onions, pumpkins and squash at lower humidities. Pack root crops in bins with moist sand or vermiculite. These are preferable to organic materials because they don’t decompose and are easier to handle than soil. Store dahlia roots and gladiolus corms dry in bins with perlite or vermiculite until spring.

---

1J.E. Ells, Colorado State University
Extension vegetable crop specialist and associate professor (retired); C.J. Jorgensen, former associate professor; horticulture and landscape architecture. Reviewed by D. Whiting, Extension consumer horticulture specialist, master gardener coordinator and resident instructor.

Colorado State University, U.S. Department of Agriculture, and Colorado counties cooperating. CSU Extension programs are available to all without discrimination. No endorsement of products mentioned is intended nor is criticism implied of products not mentioned.


Storing Vegetables and Fruits at Home

Reviewed by Virginia “Val” Hillers, Extension Food Specialist, Department of Food Science and Human Nutrition, Washington State University

Many vegetables and fruits can be stored in pits, cellars or basements without refrigeration during cool fall and cold winter months. Successful storage, however, depends on providing the right temperature, humidity, and ventilation.

Outdoor Storage

Produce that requires cool-to-cold moist surroundings can be stored outdoors. All outdoor storage has the disadvantage of being unaccessible sometimes and subject to damage by rodents and other vermin. A well-drained location is essential to prevent excessive accumulation of water.

Usually the produce must be insulated for protection from frost and fluctuating temperatures. Insulating materials commonly used are straw, hay, dry leaves, corn stalks, or wood shavings, and some soil. Be sure that the insulating materials used are not contaminated with pesticides.

In-Garden Storage

It is possible to leave some root crops, such as carrots, turnips, and parsnips in the garden where they grew, for part or all of the winter. (See fig. 1.) After the ground begins to freeze in the late fall, cover the root crops with a foot or more of mulch-straw, hay, or dry leaves. Do not place mulch on warm soil because doing so will cause vegetables to decay rapidly. Wait until the ground is cold.

Produce can be difficult to dig out of the frozen ground, but it will not be adversely affected until the temperature around the roots drops to 25˚F or less. Carrots are damaged at about 25˚F, but parsnips can stand somewhat lower temperatures.

If rodents are a problem, it may be wise to store produce in a buried container or an indoor storage area. One gopher can consume a whole row of carrots left in the ground.

Parsnips, horseradish, and turnips actually improve in flavor by light freezing. At temperatures between 28˚F and 34˚F, the starch changes to sugar.

Other crops, such as beets, cabbage, Chinese cabbage, cauliflower, celery, endive, cos or romaine lettuce, kale, leeks, and onions can withstand the early light frosts and can be stored for several weeks under a heavy mulch.

Mounds, Pits

Mounds or pits are a very economical way to store cabbage and root crops, such as carrots, beets, celeriac, kohlrabi, rutabagas, turnips, and winter radishes. (See fig. 2.)
Select a well-drained location, and cover the ground with an insulating mulch. Making a shallow excavation (from 6 to 10 inches deep) and placing the produce partly below the surface will ensure better frost protection, but it will also increase the danger of excess water. Place mulch over vegetables. A ditch around the storage perimeter will help remove surface water.

Vegetables keep very well in pits and mounds, but once these storage areas are opened all the produce should be removed. After it’s removed, the produce will keep for 1 or 2 weeks at most. It does not keep as long after removal from storage as will freshly harvested produce.

Root crops can be mixed, but should be separated with mulch to prevent cross-transfer of odors. (See “Separating Fruits and Vegetables,” ahead.)

**Buried Containers**

A 20-gallon trash can, buried in the ground, makes a convenient and economical storage for many kinds of vegetables. Metal cans are more rodent proof than plastic. (See fig. 3.)

Several holes should be made in the bottom to facilitate drainage. The container must be free of substances that might give off-flavor to the produce. **Never use drums or containers that might have held pesticides or other chemicals.**

An insulated box or other container can be buried in a well-drained area. Buried containers are more easily opened and closed than mounds and trenches. This type of storage could be located in a breezeway, shed, or garage for easier access and greater frost protection. However, if you plan to store food in or near a garage, you must more carefully wrap and protect the produce from car fumes, which produce easily picks up. (See fig. 4.)

---

**Figure 3. Buried trash can storage.**

- 1–2’ of insulating material
- Drill several holes in bottom for drainage.
- Set on rocks for drainage.
- Layers of vegetables separated by straw
- At least 2” above grade

**Figure 4. Buried insulated box storage.**

- Separate compartments for fruits and vegetables
- Locate inside a shed, breezeway, or other building for convenience
There are many areas in dwellings that naturally provide, or can be adapted to provide a variety of temperature and moisture conditions for storage. These include the attic, unheated rooms, the basement, or cellar. (See fig. 5)

Assess your own storage possibilities. Use a thermometer to monitor temperatures. Any spot that is sufficiently and evenly cool (32°F–60°F) can be adapted for some type of food storage. The relative humidity of these locations will also affect what type of produce can be stored.

Even basement window wells can be converted to small storage areas. They can provide cool, moderately moist conditions and can be used to store some types of apples or a variety of root crops. But be sure to separate the produce properly. (See “Separating Fruits and Vegetables,” ahead.) Insulate produce with bales of hay or straw.

A pantry or unheated room is useful for short-term storage of potatoes and onions, and long-term storage of spices, vegetable oils, nuts, and commercially canned goods. Low storage temperatures extend the shelf life of dried foods, such as dried beans, herbs, dried fruits and vegetables, and the life of other products, such as coffee, flour, rice, pasta, and cereals.

Use containers with tight-fitting lids to keep humidity low and rodents and insects out. Guard against freezing when storing in unheated areas.

A warm storage area, such as an attic, can be a good environment in the fall for drying herbs, beans, walnuts, or hickory nuts.

**Basement**

A well-ventilated basement with central heating is generally dry and has a temperature range of 50°F to 60°F. It may be used for ripening tomatoes and for short-term storage of pumpkins, winter squash, potatoes, sweet potatoes, and onions.

If you will be storing only a small amount of produce, an old refrigerator placed in one corner of the basement may be an excellent investment. It can be used for storing head lettuce, cauliflower or cabbage, or apples.
Basement Storage Room

For long-term storage over winter you will need to partition off a room and insulate it to control temperature and moisture.

Build a storage room on the north or east side of the basement, if practicable, and make sure there are no heating ducts or pipes running through it. You will need at least one window for cooling and ventilating the room. Two or more windows are desirable, particularly if the room is divided for separate storage of fruits and vegetables.

A room 4 x 4 x 6 feet is large enough for most households. An area 6 x 7 x 7 feet will hold approximately 30 bushels of produce—5 bushels per month for 6 months. An area 8 x 10 x 7 feet will hold approximately 60 bushels of produce—10 bushels per month for 6 months. (See fig. 6)

To deter rodents, carefully install sheathings or screens on the partition walls so there are no openings at the floor or ceiling. Young mice can crawl through a quarter-inch hole. (See fig. 7)
Regulating the Temperature

Proper temperatures are critical to long-term storage of vegetables and fruits. Improper temperatures, whether too cool or too warm, can cause rapid deterioration of produce quality.

Two reliable thermometers (preferably that record minimum and maximum temperatures) should be used to observe and regulate storage temperatures carefully. Place one thermometer in the coldest location of the basement or cellar, and place the other thermometer outdoors. Regulate storage temperature by opening and closing doors, windows, or other openings used as ventilators.

Outdoor temperatures well below 32˚F are necessary to cool storage air to 32˚F and to maintain that temperature. Once cooled to 32˚F, the temperature will rise again if ventilators are closed, even when outdoor temperature is about 25˚F. Close ventilators tightly whenever the outdoor temperature is higher than the storage temperature. Watch indoor and outdoor temperatures closely. In most regions, daily adjustment of ventilators is usually necessary to maintain desired storage temperatures.

The danger of overventilating during subfreezing weather is that stored products will freeze if you are not careful. For example, in a study made of an insulated storage cellar partly above ground, full ventilation both day and night was necessary to maintain a temperature of 32˚F if outdoor temperatures ranged between 18˚F and 30˚F during the day and dipped to 10˚F at night. If minimum temperature at night, with normal air movement, was 8˚F for 5 or 6 hours, the storage temperature dropped to 30˚F. During a night of high wind, however, a minimum of 12˚F cooled the cellar to 30˚F.

Keep a pail of water in the storage area in very cold weather; water will freeze before the crops. However, very low temperatures can cause chilling injury to some produce, like potatoes, and leave them unusable or increase decay.

Maintaining Proper Moisture

The proper humidity level is also very important to long-term storage and maintenance of good quality produce. This is generally measured as relative humidity, which is the percentage of moisture in the atmosphere at a given time as related to the maximum amount (100%) that could be retained at that temperature. A humidity level of 95% is almost rainfall and rather difficult to achieve indoors.

A relative humidity of 90%–95% is very moist and good for storage of potatoes and other root crops. A relative humidity of 60%–75% is dry and good for storage of pumpkins and other squash.

Two ways of maintaining proper humidity are first, to use water to raise the humidity of the storage air, and secondly, to use ventilated polyethylene bags and box liners. Moisture can be added to storage air by sprinkling the floor frequently, by placing large pans of water under fresh-air intake vents, by covering the floor with wet materials such as straw or odorless sawdust, or by a combination of these methods. However, these strategies will not prevent shriveling of root crops.

The easiest and most effective way to control moisture loss in root crops and in certain other crops is to put them in polyethylene bags or box liners. Cut many \( \frac{1}{4} \) - to \( \frac{3}{8} \)-inch holes in the sides of the bags or liners to permit ventilation. Tie the bags and fold over the tops of box liners, but do not seal them.

Excessive humidity is conducive to mold and decay organisms, if water droplets are allowed to form on the surface of the product. Plastic bags and liners used for moisture retention should always be perforated at regular intervals to permit air circulation and prevent condensation.

Sanitation

At least once a year, remove all containers from the storage area and clean and air them in the sun. The room itself should also be thoroughly aired, cleaned and washed down with a disinfectant, such as diluted chlorine bleach (1 cup bleach mixed with 9 cups water), to kill off any molds or bacteria that could lie dormant and ruin future crops.

Sanitation

At least once a year, remove all containers from the storage area and clean and air them in the sun. The room itself should also be thoroughly aired, cleaned and washed down with a disinfectant, such as diluted chlorine bleach (1 cup bleach mixed with 9 cups water), to kill off any molds or bacteria that could lie dormant and ruin future crops.

Sanitation

At least once a year, remove all containers from the storage area and clean and air them in the sun. The room itself should also be thoroughly aired, cleaned and washed down with a disinfectant, such as diluted chlorine bleach (1 cup bleach mixed with 9 cups water), to kill off any molds or bacteria that could lie dormant and ruin future crops.

Sanitation

At least once a year, remove all containers from the storage area and clean and air them in the sun. The room itself should also be thoroughly aired, cleaned and washed down with a disinfectant, such as diluted chlorine bleach (1 cup bleach mixed with 9 cups water), to kill off any molds or bacteria that could lie dormant and ruin future crops.
Vegetables and fruits that are to be stored should be handled carefully to prevent damage. Give special attention to containers that you use for harvesting and storing. Use containers that have smooth inner surfaces. Protruding wire staples in baskets and hampers are particularly damaging.

Lightweight tub buckets and plastic-coated stave baskets (egg baskets) are good containers for harvesting. If the soil is sandy, rinse the containers frequently to reduce skin breaks.

Standard apple boxes and lug boxes used for shipping tomatoes, grapes, and nectarines are good storage containers. Slatted crates can be made easily from wooden melon crates.

Discard all crushed, cut, or decaying vegetables and fruits. If damaged or infected garden products are placed in storage, serious losses from decay are likely to occur.

See that vegetables and fruits have as little field heat as possible when you put them in storage. Harvest in early morning, or let the crops cool outdoors overnight before storing them.

Harvest during dry weather, not too soon after a rain, and allow the surface of the product to dry, since wet produce is very much more susceptible to disease. Handle carefully when harvesting and preparing for storage in order to keep bruising to a minimum.

Waxing vegetables for home storage is not recommended, although wax has been used for several years on certain fresh vegetables and fruits to improve their sales appearance and to reduce moisture loss.

Separating Fruits and Vegetables

If a large quantity of fruits and vegetables is going to be stored, it is advisable to separate the storage areas or add a central partition in a basement storage area to make two storage areas. Ideally, each area should have its own ventilation system. At least, store fruits and vegetables as far away from each other as possible. Wrapping fruits individually also helps to prevent cross-transfer of odors.

Do not store apples with potatoes or carrots. Ethylene gas produced by apples can cause potatoes to sprout and carrots to become bitter. Potatoes cause apples to take on a musty flavor. Cabbage and turnips can give their odors to celery, pears, and apples. Cabbage, kale, rutabagas, turnips, and winter radishes give off strong odors that could spread through a house, and, therefore, should be stored in outdoor storage areas only.

Figure 9 gives the average storage time for commonly stored fruits and vegetables. Tables 1 and 2 give details for preparation and storage of fruits and vegetables.

<table>
<thead>
<tr>
<th># of months</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Celery, Leeks</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Beets, Pears</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Apples, Pumpkins, Squash</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carrots, Potatoes</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Onions</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Figure 9. Average storage duration for commonly stored produce.
Table 1. Fruit preparation and storage.

<table>
<thead>
<tr>
<th>Fruit</th>
<th>Preparation</th>
<th>Temperature °F</th>
<th>Humidity*</th>
<th>Storage Life</th>
</tr>
</thead>
</table>
| **Apples** | Store loosely wrapped in plastic bags with lots of holes, in boxes, cellars, or insulated boxes in outbuildings at a temperature as close to 32°F as possible. Apples ripen about 4 times as fast at 50°F than at 32°F and become overripe rapidly at 70°F.  
  Pick apples when mature but still hard. Do not mix apples that have glassy spots in flesh (water core, overripe or injured) with good apples.  
  Length of storage depends on variety. Best for home storage are late maturing varieties: Winesap, Rome Beauty, Northern Spy, Newton.  
  Do not store apples with cabbage, carrots, turnips, or potatoes; apples will pick up off-flavor or cause changes in the vegetables. | 32–35          | Very Moist | Late Season  
  Winesap  
  5–7 months  
  Granny Smith  
  5–7 months  
  Rome Beauty  
  4–5 months  
  Northern Spy  
  4–5 months  
  Mid-Season  
  Yellow Newton  
  5–6 months  
  Red Delicious  
  3–4 months  
  Early Season  
  McIntosh  
  2–4 months  
  Jonathan  
  2–3 months  
  Golden Delicious  
  2–3 months |  
| **Grapes** | Grapes readily absorb odors from other vegetables and fruits. Store alone away from other produce.                                                                                                           | 32             | Moist     | 4–6 weeks             |
| **Pears** | Harvest when mature but still hard and very green; ready to pick when they change from deep green to pale green.  
  Wrap individually in tissue paper and store in cardboard boxes lined with perforated plastic. Store with apples.  
  If held too long or ripened at too high a temperature, they will break down and become rotten on the inside. | 31             | Very Moist| Bartlett  
  1–2 months  
  Winter Pears (d’Ajou, Bosc, Comice)  
  2–3 months |  
*Relative humidity: Very moist = 90%–95%; Moist = 80%–90%; Dry = 60%–75%.
After first frost, pull with root attached. Store in outdoor storage areas (pits, garbage cans, cellars) with soil around roots. Do not store in basement because cabbage odor will spread through house. Do not store with celery, endive, apples, or pears, which pick up cabbage flavor.

Cut off root. Leave protective outer leaves. Wrap and pack with loose moist sand in outdoor storage area, because it gives off strong odors. Or store in refrigerator in the basement.

Mulch in the garden until hard frost. Pull with root ball attached. Store upright close together in moist sand or soil. Tie leaves of endive together to help blanching. Do not store with cabbage. Store kale only in outdoor storage area, because it gives off odors. All others can be stored in a storage room.

All can be stored in garden by mulching with 1 foot of hay or straw if there are no rodents. Parsnips, salsify and horseradish can withstand freezing but are injured by alternate freezing and thawing. Dig as needed.

All must be mature and dry to keep well. Ones with thick necks and those grown from sets are hard to keep. Before storing, spread on newspapers out of sunlight in a well-ventilated place to cure for 2–3 weeks or until skins are papery and roots completely shriveled and dry. Store in a cool, dry, well-ventilated place, such as an attic, or in an unheated room in well-ventilated containers like mesh bags.

Dry by threading mature fruit onto a string and hang in a well-ventilated place. Peppers should not touch each other.

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Preparation</th>
<th>Storage Conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cabbage</td>
<td>After first frost, pull with root attached. Store in outdoor storage areas</td>
<td>Temperature F: 32</td>
</tr>
<tr>
<td></td>
<td>(pits, garbage cans, cellars) with soil around roots. Do not store in</td>
<td>Humidity*: Very</td>
</tr>
<tr>
<td></td>
<td>basement because cabbage odor will spread through house. Do not store with</td>
<td>moist</td>
</tr>
<tr>
<td></td>
<td>celery, endive, apples, or pears, which pick up cabbage flavor.</td>
<td>Storage Life: 3–4</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>Cut off root. Leave protective outer leaves. Wrap and pack with loose moist</td>
<td>months</td>
</tr>
<tr>
<td></td>
<td>sand in outdoor storage area, because it gives off strong odors. Or store in</td>
<td></td>
</tr>
<tr>
<td></td>
<td>refrigerator in the basement.</td>
<td></td>
</tr>
<tr>
<td>Late celery</td>
<td>Mulch in the garden until hard frost. Pull with root ball attached. Store</td>
<td></td>
</tr>
<tr>
<td>Chinese cabbage</td>
<td>upright close together in moist sand or soil. Tie leaves of endive together</td>
<td></td>
</tr>
<tr>
<td>Endive</td>
<td>to help blanching. Do not store with cabbage. Store kale only in outdoor</td>
<td></td>
</tr>
<tr>
<td>Kale</td>
<td>storage area, because it gives off odors. All others can be stored in a</td>
<td></td>
</tr>
<tr>
<td>Leeks</td>
<td>storage room.</td>
<td></td>
</tr>
<tr>
<td>Root Crops</td>
<td>All can be stored in garden by mulching with 1 foot of hay or straw if there</td>
<td></td>
</tr>
<tr>
<td>Rutabagas</td>
<td>are no rodents. Parsnips, salsify and horseradish can withstand freezing but</td>
<td></td>
</tr>
<tr>
<td>Turnips</td>
<td>are injured by alternate freezing and thawing. Dig as needed.</td>
<td></td>
</tr>
<tr>
<td>Winter radishes</td>
<td>Store rutabagas, turnips, and winter radishes only in outdoor storage areas</td>
<td></td>
</tr>
<tr>
<td>Beets</td>
<td>because they give off odors. Other root vegetables can be stored in basement</td>
<td></td>
</tr>
<tr>
<td>Carrots</td>
<td>storage room. Dig when soil is dry. Cut plant tops 1/2 inch above crown.</td>
<td></td>
</tr>
<tr>
<td>Celeriac</td>
<td>Store in layers of moist sand, peat, or sphagnum moss or in polyethylene</td>
<td></td>
</tr>
<tr>
<td>Horseradish</td>
<td>bags with about four 1/4-inch holes. Storage at 45˚F causes them to</td>
<td></td>
</tr>
<tr>
<td>Parsnips</td>
<td>sprout new tops and become woody. Store in the lowest areas of basement</td>
<td></td>
</tr>
<tr>
<td>Salsify</td>
<td>storage area (usually coldest, moistest).</td>
<td></td>
</tr>
<tr>
<td>Onions</td>
<td>Onions must be mature and dry to keep well. Ones with thick necks and those</td>
<td>Temperature F: 32</td>
</tr>
<tr>
<td>Garlic</td>
<td>grown from sets are hard to keep. Before storing, spread on newspapers out</td>
<td>Humidity*: Dry</td>
</tr>
<tr>
<td></td>
<td>of sunlight in a well-ventilated place to cure for 2–3 weeks or until skins</td>
<td>Storage Life: 5–8</td>
</tr>
<tr>
<td></td>
<td>are papery and roots completely shriveled and dry. Store in a cool, dry,</td>
<td>months</td>
</tr>
<tr>
<td></td>
<td>well-ventilated place, such as an attic, or in an unheated room in well-</td>
<td></td>
</tr>
<tr>
<td></td>
<td>ventilated containers like mesh bags.</td>
<td></td>
</tr>
<tr>
<td>Peppers, hot</td>
<td>Dry by threading mature fruit onto a string and hang in a well-ventilated</td>
<td>Temperature F: 32</td>
</tr>
<tr>
<td></td>
<td>place. Peppers should not touch each other.</td>
<td>Humidity*: Dry</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Storage Life: 1 year</td>
</tr>
</tbody>
</table>
Table 2 (continued).

<table>
<thead>
<tr>
<th>Vegetable</th>
<th>Preparation</th>
<th>Storage Conditions</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Potatoes</td>
<td>Late varieties can be held longer than early ones. Harvest after vines have</td>
<td>Temperature F˚</td>
<td></td>
</tr>
<tr>
<td></td>
<td>died down and when ground is dry. Cure in darkness at 45°F-60°F for 10–14</td>
<td>Humidity*</td>
<td></td>
</tr>
<tr>
<td></td>
<td>days after harvest. Then store at 40°F in basement storage area. Lower</td>
<td>Storage Life</td>
<td></td>
</tr>
<tr>
<td></td>
<td>temperatures tend to result in overly sweet flavor. Remove sprouts as they</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>appear. Sprouting indicates too high storage temperature or may be caused</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>by gas from apples. Do not store potatoes and apples together. Apples will</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>become musty. As optimum temperature for potatoes is higher than for most</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>root crops, store them high up in the cellar.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pumpkins</td>
<td>Harvest when mature before frost. The skin on mature fruit is hard and</td>
<td>55–60</td>
<td>Dry</td>
</tr>
<tr>
<td>Most winter squash</td>
<td>impervious to thumbnail scratching. Leave 1 inch of stem. Cure for 10 days</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>at 80°F-85°F (usually near a furnace) to harden rinds and heal surface cuts.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Acorn squash</td>
<td>Do not cure acorn squash like other squash; they become orange and stringy</td>
<td>45–50</td>
<td>Dry</td>
</tr>
<tr>
<td></td>
<td>at 80°F.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tomatoes</td>
<td>Pick from vigorous vines. Sort tomatoes for ripeness. Pack green tomatoes</td>
<td>55–70</td>
<td>Moist</td>
</tr>
<tr>
<td>Red sweet peppers</td>
<td>one or two layers deep in shallow boxes or trays for ripening. Separate</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(mature green)</td>
<td>with layers of paper or individually wrap each tomato. At 55°F mature green</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>tomatoes will ripen slowly in 25–28 days. At 65°F-70°F tomatoes will ripen</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>faster-in about 14 days. Store in unheated room or airy cellar.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Relative humidity: Very moist = 90%–95%; Moist = 80%–90%; Dry = 60%–75%.