

Low-Cost Cold Storage Room for Market Growers

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Introduction

Fresh fruits and vegetables start to deteriorate as soon as they are harvested because they are cut off from their source of water and nutrition. They lose weight, texture, flavor, nutritive value, and appeal. Cooling significantly slows down the rate of deterioration, thereby increasing the storage life of the produce. The cooler the temperature, the slower the deterioration and the longer the storage life. Much commercial produce is stored at temperatures just above that which will cause freeze damage to the product so that it can have the maximum possible shelf life (multiple weeks or even months) and be transported very long distances.

Market growers—those selling through farmers' markets, farm stands, or community-supported agriculture (CSA)—typically sell their fruits and vegetables within a few days of when they were picked. They can get premium prices for what they grow because of its "localness" and freshness. In this situation, long storage times at very low temperatures may not be needed, and the high cost for commercial or industrial-grade cooling equipment is difficult to justify. But fresh produce will still deteriorate substantially within a day or two if it is not cooled at all from ambient conditions, especially during the hot summer months. Lower-cost cold storage options can benefit market growers by helping preserve produce freshness and quality for a few additional days. Produce losses can be significantly reduced, especially for growers transitioning to a higher level of production who have excess produce to carry over from one day's market to the next.

Air Conditioner for Refrigeration

A standard window-mounted room air conditioner can provide a low-cost cooling source, but if a producer tries to use it to cool below about 65°F, the cooling coils will freeze up. This limitation can be overcome by outfitting the air conditioner with strip heaters, a thermostat, and a timer to create a defrost cycle that alternates power between the strip heaters and the compressor. At least one manufacturer now offers an off-the-shelf control unit that does the same thing. The control unit is called CoolBot™, and it is available from Store It Cold LLC for about \$300.

The air conditioner can be sized to give enough cooling capacity to cool a certain size cold room the maximum amount needed, down to a temperature of 33°F, according to the company's guidelines given for the Coolbot unit. A smaller air conditioner may be sufficient to cool the same size room enough (down to maybe 55° to 60°F) to take the field heat off a wide range of fruits and vegetables and significantly improve produce quality as compared to storage at ambient conditions.

It should be noted that different produce has different optimum storage temperatures. Many produce items do best at very cold temperatures, just above freezing, but other produce typically handled by market growers, such as cucumbers, peppers, potatoes, watermelons, squash, and beans, do best at higher temperatures of 45° to 60°F. Tomatoes are probably best stored in the 55° to 60°F range; if they are stored at too cold a temperature, they become mealy.

For further information on storing produce, see the following online resources:

- HortFact-7002, "Recommended Storage Conditions for Vegetables" at <http://www.uky.edu/Ag/Horticulture/comveggie.html>, or
- Chapter 7 of "Small-Scale Postharvest Handling Practices" from the Food and Agriculture Organization of the United Nations at <http://fao.org/docrep/009/ae075e/ae075e15.htm>.

Cold Room Construction

To demonstrate its feasibility, a low-cost cold room was constructed from building materials available from building supply stores and cooled by a room air conditioner and the CoolBot control unit. The room, which measures approximately 8 feet by 10 feet by 8 feet tall (outside dimensions), offers enough space for walk-in cold storage for a significant amount of produce, yet is small enough to fit into many existing barns or other covered storage spaces. The floor, walls, and ceiling were constructed using 2 x 6 (floor) or 2 x 4 lumber, and they were insulated with batt insulation and foam board covered with plywood sheathing inside and out. The floor, walls, and ceiling were all insulated to an R-value of 19, a standard value for coolers.

The only nonstandard material used in the demonstration unit was a high-density R-15 batt insulation that achieved the desired insulation value in the walls and ceiling using 2 x 4 rather than 2 x 6 studs. This helped make the unit lighter and more portable. The walls and ceiling could be constructed using 2 x 6 studs and standard R-15 batt insulation for

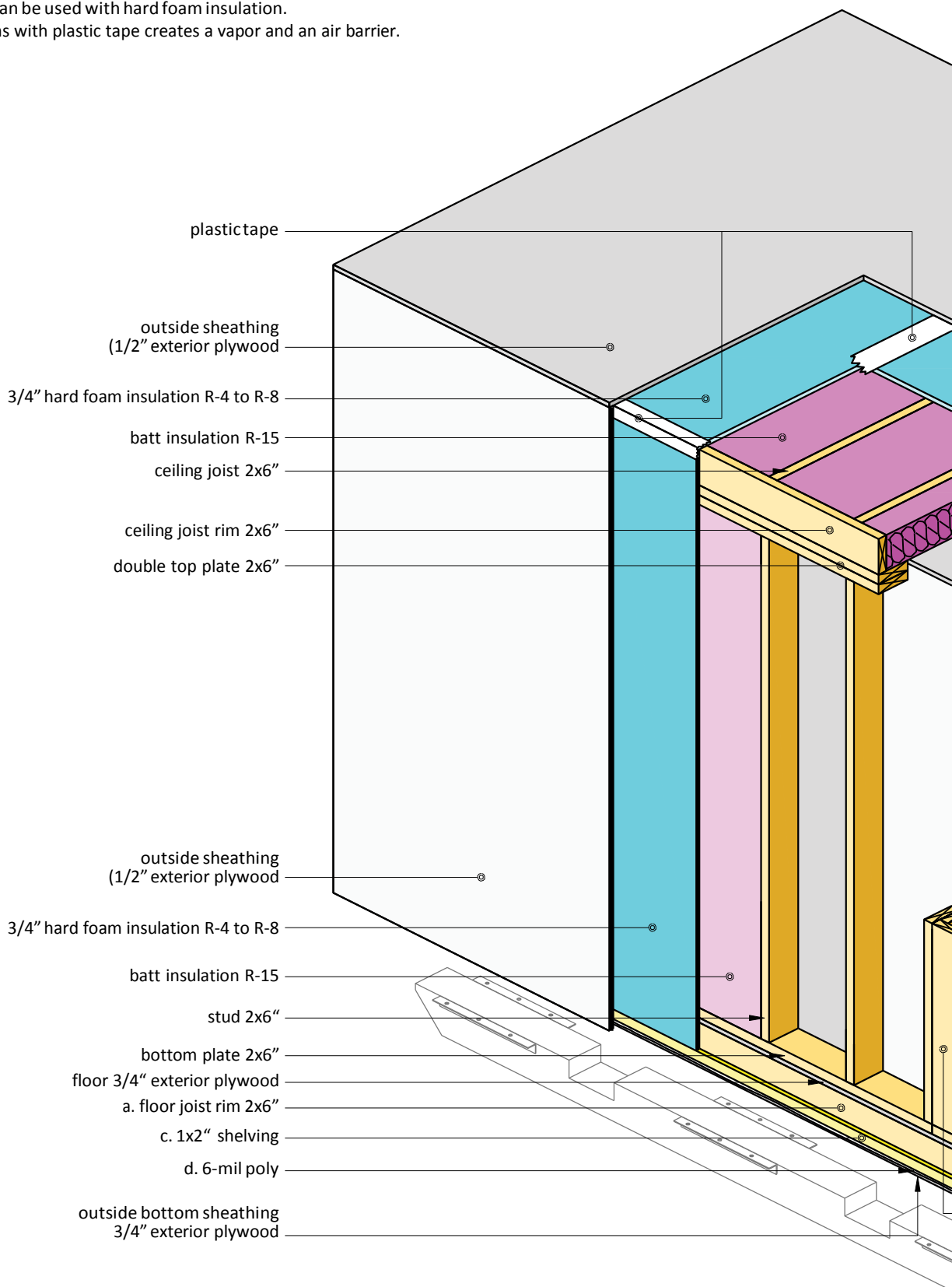
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Note: Layered sectional schematic of a cold storage room, 8'x8'x10'; 2x6" frame 16" on center (size can vary)

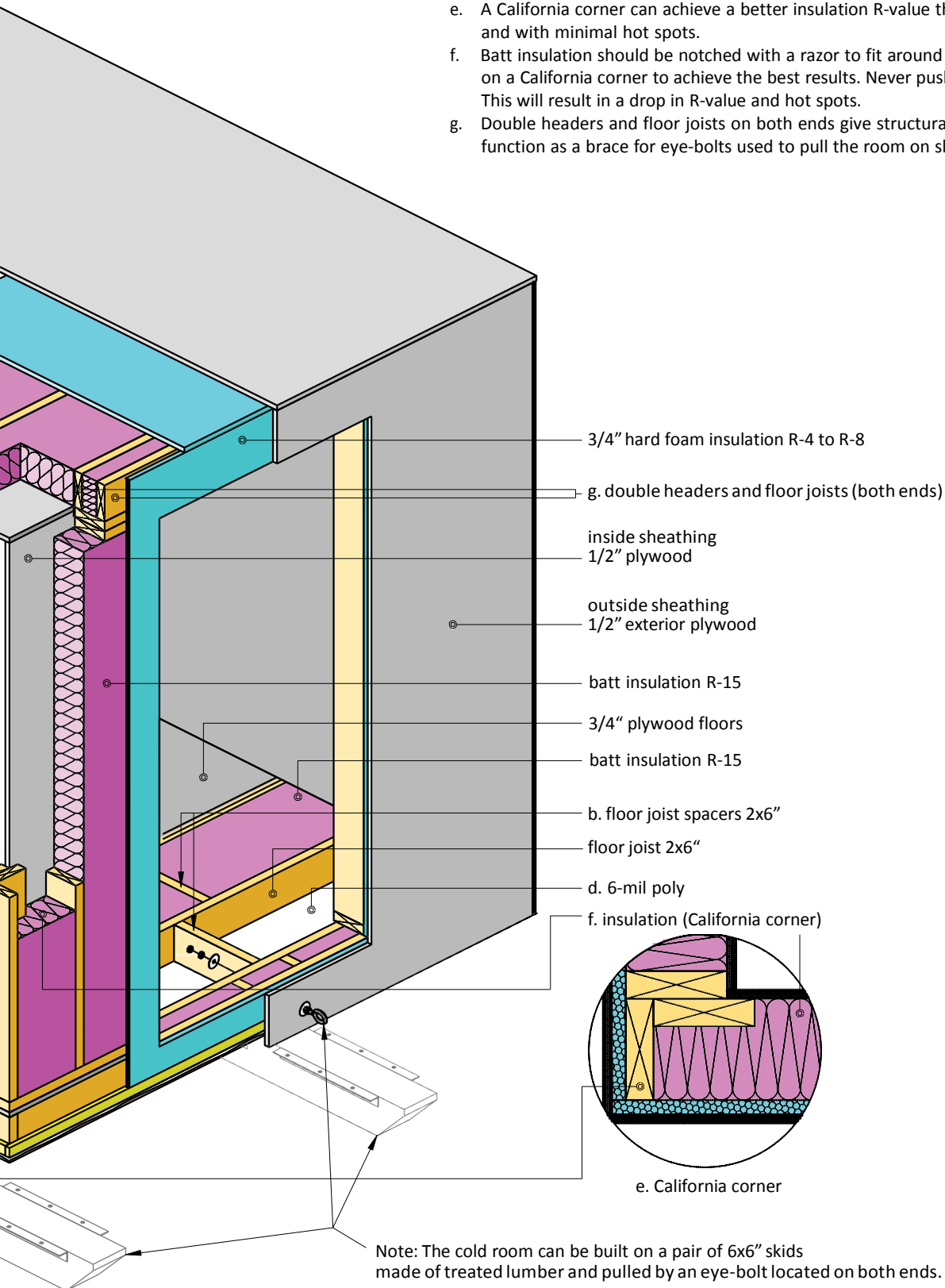
When faced batt insulation is used, facing must be placed toward the outside wall.

Open-faced batt insulation can be used with hard foam insulation.

Sealing the foam at the seams with plastic tape creates a vapor and an air barrier.



- a. Floor joist rim, rim, and joist are 2x6" and framed 16" on center.
- b. Place spacers between the floor joists for support.
- c. Use 1x2" shelving to trim the floor joist rim supporting the hard foam insulation.
- d. 6-mil poly is applied on top of outside bottom sheathing and below floor insulation. Allow a generous overhang. This creates an airspace and vapor barrier substituting for the barrier the hard foam insulation creates. Foam was not used under the floor because foam compresses under weight.
- e. A California corner can achieve a better insulation R-value than conventional corners, and with minimal hot spots.
- f. Batt insulation should be notched with a razor to fit around inside corner board on a California corner to achieve the best results. Never push insulation into corners. This will result in a drop in R-value and hot spots.
- g. Double headers and floor joists on both ends give structural strength and function as a brace for eye-bolts used to pull the room on skids.



about the same cost. Since this is a cooler, sealing for vapor barriers is to the outside (the hotter side) of the constructed walls.

Although the cold room was constructed with exterior-grade plywood and paint, it was designed to be used under roof cover such as in a barn. A roof was added to the demonstration unit later so that it could be left outside exposed to the weather for periods of time without leakage into the walls, which will damage the insulation. The roof was specially designed to withstand damage during transport. A simpler roof and siding designed to shed water could be added to this unit if it is needed to serve as a stand-alone outside building.

The demonstration unit was mounted on skids made out of 6 x 6 treated lumber so that it could be dragged around and to make the base sturdier for lifting the unit for transport. A cold room could be built in place without the skids if it is not going to be moved. In that case, a proper foundation should be used. If the floor is built out of wood, it should not sit directly on the ground. Note that it is a good idea to insulate the floor, even when a concrete floor is used, because there are significant thermal losses through the floor in a cooler. Also, consideration should be given to including a drain in the floor, as vegetables to be stored are sometimes brought in wet.

A drawing showing construction details is included to aid in building the cold room. Detailed construction plans and a materials list with costs are available online at the Department of Biosystems and Agricultural Engineering Web site at http://www.bae.uky.edu/ext/Specialty_Crops/. It should be noted that the costs are as of June 2009 and are from a major building supply chain. The costs will vary depending on suppliers and will change over time.

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Storing Fresh Produce

Refrigerators should maintain a temperature of 41 °F, or less, but temperatures inside a refrigerator can range from colder (32 °F) to warmer (41 °F), depending on the location. Colder temperatures are found in the back and warmer temperatures in the front, near the door. Some kinds of produce should be stored at warmer temperatures near the door for best quality. Location of fruits and vegetables is important because fruits, in general, produce ethylene gas, which fosters natural ripening, but it also can cause most vegetables and a few non-ethylene producing fruits to deteriorate more quickly and develop undesirable characteristics. Ideally, ethylene-producing fruits should be stored in the refrigerator as far from ethylene-sensitive fruits and vegetables as possible.

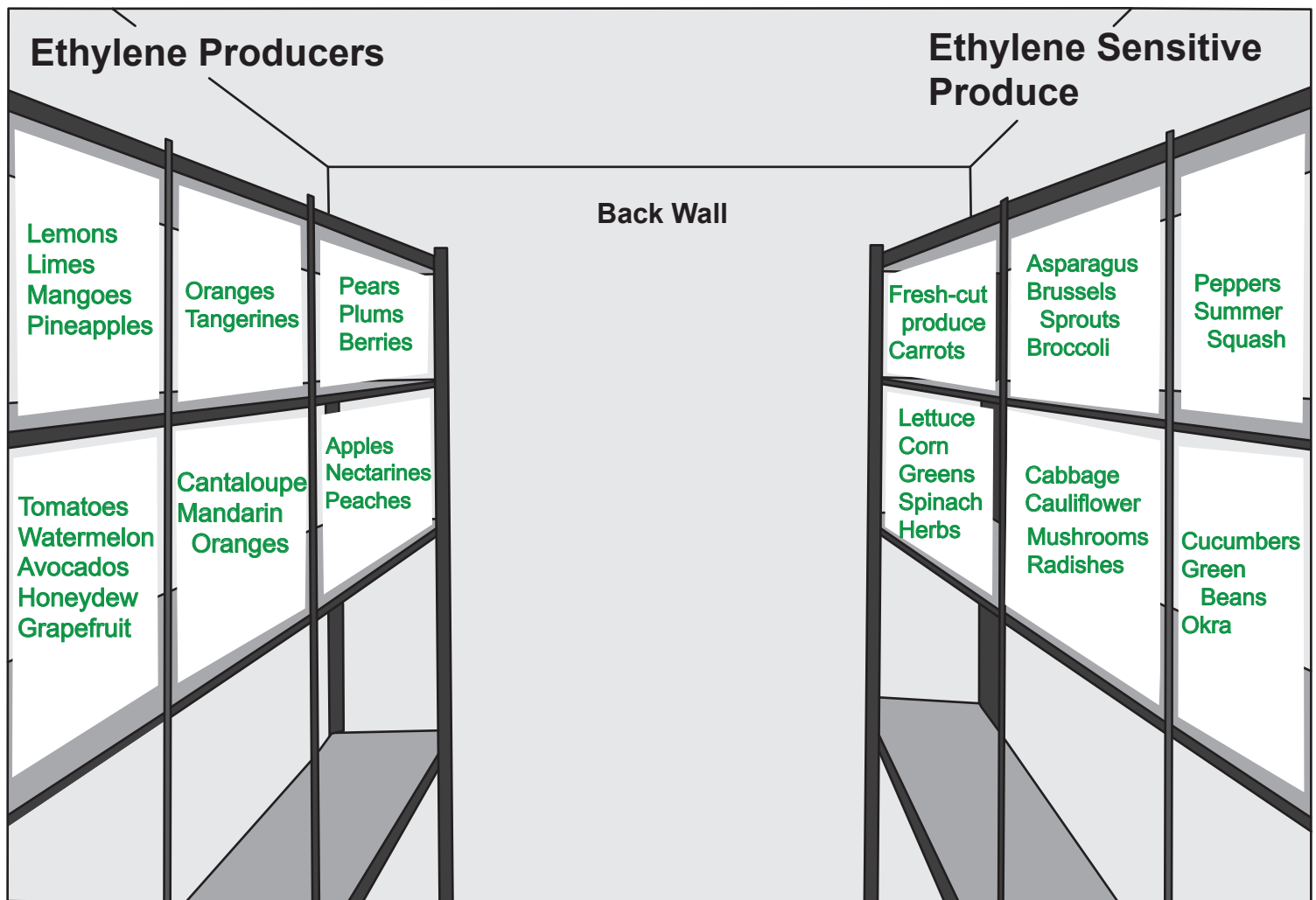
These items should not be refrigerated. Store ideally between 60 °F and 70 °F.

Bananas

Sweet Potatoes

Potatoes

Dry Onions



Walk-in Refrigerator

Produce Pack Guide

INFO SHEET

CROP TYPE	WEIGHT/UNITS	MATERIALS
Apples	<ul style="list-style-type: none"> • 1 bu. cartons (weight depends on variety) • 40-lb. cartons w/ 8 5-lb. bags • 36-lb. cartons w/ 12 3-lb. bags • 3,5,6,7,8 or 10-lb. PETE/cello bags • 600-lb tote bin / 300-lb. half tote bin (w/ bags) 	<ul style="list-style-type: none"> • Packed on soft fiberboard trays or soft polystyrene • Vented cartons
Apricots	<ul style="list-style-type: none"> • 8-12 pint carton 	<ul style="list-style-type: none"> • Tray-packed in single or double layers, or volume filled
Artichokes	<ul style="list-style-type: none"> • Classified by the number that fit into a standard carton of about 23 lb. eg. size 18 buds (18 buds per carton or >18s) 	<ul style="list-style-type: none"> • Cartons • Package icing (2.2-lb. of ice per 4-lb. of product) or top-icing
Arugula	<ul style="list-style-type: none"> • Bunched should be packaged with 24-30 bunches per box. A bunch is 3/4-lb. on average • 1/9 bu. box is used • Loose should be packaged in 12 4-oz. bags per box 	<ul style="list-style-type: none"> • Fiberboard cartons lined with perforated polyethylene bags, small sealed plastic bags, clamshell containers, or trays
Asparagus	<ul style="list-style-type: none"> • Make 12 oz. or 16 oz. bunches or pack 10-lb. loose • 1/2 bu. box or crate 	<ul style="list-style-type: none"> • Box or asparagus crate with butt end down • Package icing (2.2-lb. of ice per 4-lb. of product)
Atemoya	<ul style="list-style-type: none"> • Single layer 10-lb. (4.5kg) or 20-lb. (9kg) pack 	<ul style="list-style-type: none"> • Fiberboard boxes with foam sleeves or paper wrapping
Avocado	<ul style="list-style-type: none"> • California avocados are packed in single-layer 12.5-lb. (5.67kg) flats or trays • 2-layer 25-lb. (11.34kg) lugs and 25-lb. (11.34kg) volume-fill boxes 	<ul style="list-style-type: none"> • Flats, trays, lugs or volume-fill boxes
Beans (Snap)	<ul style="list-style-type: none"> • Pack 15-lb. in 1/2 bu. produce box • 26-31 lbs. in bu. crate, basket or box 	<ul style="list-style-type: none"> • Produce box, crate, basket
Beans (Lima)	<ul style="list-style-type: none"> • Pack 15 lb. in 1/2 bu. produce box • 26-31 lbs. in bu. crate, basket or box 	<ul style="list-style-type: none"> • Produce box, crate, basket
CROP TYPE	WEIGHT/UNITS	MATERIALS

Beets	<ul style="list-style-type: none"> • Topped beets can be packed loose in 1/2 bu. boxes or 25-lb. bags • Bunched beets (5-8 per bunch) should be packed in a 1 1/9 bu. box or crate with 12 to 24 bunches per box 	<ul style="list-style-type: none"> • Produce box, bags, crate • Top-icing
Blackberries	<ul style="list-style-type: none"> • 1-pint, 2-pint, or 1-quart vented plastic clamshell containers, packed in units of 12 per carton 	<ul style="list-style-type: none"> • Vented plastic clamshell containers • Cartons
Blueberries	<ul style="list-style-type: none"> • 1-or 2-pint vented polyethylene or polystyrene clamshell containers, 12 units to a tray 	<ul style="list-style-type: none"> • Vented polyethylene or polystyrene clamshell containers • Trays
Broccoli	<ul style="list-style-type: none"> • Pack 10, 12, 14, 16 or 18 in 1 1/9 bu. produce box • Weight should be 23-lb. • Leave 6 in. of stem on 	<ul style="list-style-type: none"> • Produce box, carton • Inject liquid ice into the waxed cartons
Brussels Sprouts	<ul style="list-style-type: none"> • 25-lb. (11kg) packed in a carton 	<ul style="list-style-type: none"> • Plastic liners are often used in cartons with loose sprouts to reduce moisture loss. • Polyethylene bags are sometimes used in place of the plastic containers for consumer units.
Cabbage	<ul style="list-style-type: none"> • Pack 45-50-lbs. in 1 3/4 or 1 7/8 bu. waxed cabbage containers, cabbage bags or boxes. • Can also pack in bulk bins filled by count 	<ul style="list-style-type: none"> • Shipped in wax-coated corrugated cardboard cartons and wire-bound crates of various sizes • Water loss can be reduced and storage-life extended if heads are stored in perforated polyethylene bags
Cantaloupes	<ul style="list-style-type: none"> • Pack 9, 12 or 15 in flat melon boxes • Can also pack in bulk bins filled by count 	<ul style="list-style-type: none"> • Flat melon box, bulk bin
Carrots (bunched)	<ul style="list-style-type: none"> • Tie in bunches of 6 to 8 • Pack in 1 1/9 bu. produce boxes 	<ul style="list-style-type: none"> • Produce boxes • Top-ice after cooling
Carrots (loose)	<ul style="list-style-type: none"> • 25-lb. in 5/9 bu. waxed carton with perforated polyethylene liner • 50 lb. in 1 1/9 bu. carton 	<ul style="list-style-type: none"> • Waxed carton with perforated polyethylene liner • Top-ice after cooling
Cauliflower	<ul style="list-style-type: none"> • Pack 9, 12 or 15 trimmed heads (leaves trimmed just above top of the head) in a cauliflower box 	<ul style="list-style-type: none"> • Produce boxes • Top-ice
CROP TYPE	WEIGHT/UNITS	MATERIALS

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Celeriac	<ul style="list-style-type: none"> • 1 1/9 bu. box, 24 to a box 	<ul style="list-style-type: none"> • Produce boxes • Boxes should be unlined
Celery	<ul style="list-style-type: none"> • 60-lb. cartons with 48 stalks • Celery hearts - (8, 10, or 12" in length) - 18 or 28-lb. cartons 	<ul style="list-style-type: none"> • Cartons
Chard	<ul style="list-style-type: none"> • Pack 20-25-lbs. in bu. crates or cartons • 12-24 bunches per crate or carton 	<ul style="list-style-type: none"> • Crates or cartons • Plastic films covering packaging reduces water loss • Top-ice, package ice (2.2-lb. of ice per 4-lb. of product), liquid ice
Cherimoya	<ul style="list-style-type: none"> • Carton size 9- and 18-lb. (4 and 8kg) with 12 to 24 count 	<ul style="list-style-type: none"> • Cartons
Cherries	<ul style="list-style-type: none"> • Pack in 10-20-lb. cartons 	<ul style="list-style-type: none"> • Cartons
Collards & Kale	<ul style="list-style-type: none"> • Pack 20-25-lbs. in bu. crates or cartons • 12-24 bunches per crate or carton 	<ul style="list-style-type: none"> • Crates or cartons • Using plastic films to cover packaging reduces water loss • Top-ice, package ice (2.2-lb. of ice per 4-lb. of product), liquid ice
Corn (sweet)	<ul style="list-style-type: none"> • Pack 5 doz. ears in corn bag, box, or crate • Can also pack in bulk bins filled by count 	<ul style="list-style-type: none"> • Corn bag, box, crate or bulk bin • Package ice (2.2-lb. of ice per 4-lb. of product) and top-ice after cooling • Injection of slush ice into cartons
Cranberries	<ul style="list-style-type: none"> • Cartons containing 24 12-oz. polybags • Use 20, 25, and 30-lb. cartons 	<ul style="list-style-type: none"> • Cartons w/ polybags • Wood totes, for bulk sales
Cucumbers	<ul style="list-style-type: none"> • 20-lb. in 5/9 bu. cartons • 40-lb. in 1/2 bu. or 1 1/9 bu. cartons or crates • 24-count cartons 	<ul style="list-style-type: none"> • Cartons or crates
Dates	<ul style="list-style-type: none"> • 15-lb. (6.8kg) flats of fiberboard or wood • 5 or 10-lb. (2.3 or 4.5kg) cartons 	<ul style="list-style-type: none"> • Fiberboard or wood flats • Cartons
Eggplant	<ul style="list-style-type: none"> • Pack in 1/2 bu. or 1 1/9 bu. produce boxes. • Count for standard eggplant should be 22-28 in 1 1/9 bu. produce box • Smaller specialty eggplant should be packed in 1/2 bu. produce boxes 	<ul style="list-style-type: none"> • Produce boxes
Elderberries	<ul style="list-style-type: none"> • 1-pint, 2-pint, or 1-quart vented plastic clamshell containers, packed in units of 12 per carton 	<ul style="list-style-type: none"> • Vented plastic clamshell containers • Cartons
CROP TYPE	WEIGHT/UNITS	MATERIALS

Endive & Escarole	<ul style="list-style-type: none"> • Pack in 1/2 bu. or 1 1/9 bu. produce boxes, cartons or crates 	<ul style="list-style-type: none"> • Produce boxes, cartons or crates • Packed ice in cartons (2.2-lb. of ice per 4-lb. of product)
Figs	<ul style="list-style-type: none"> • Pack in a one-layer box because fully mature fresh figs are soft, easily bruised, and highly perishable 	<ul style="list-style-type: none"> • One-layer box
Garlic	<ul style="list-style-type: none"> • Packed loose: 5, 10, 22, 30-lb. cartons • Smaller bags or trays for retail 	<ul style="list-style-type: none"> • Cartons, bags or trays
Ginger	<ul style="list-style-type: none"> • Sold in full telescoping 30-lb. (13.6kg), 20-lb. (6.8kg) fiberboard cartons or 5-lb. (1.7kg) cartons with film bags 	<ul style="list-style-type: none"> • Fiberboard cartons • w/ film bags
Gooseberries & Currants	<ul style="list-style-type: none"> • Trays holding 12 half-pint containers 	<ul style="list-style-type: none"> • Vented clamshell containers
Grapefruit	<ul style="list-style-type: none"> • Range from size 23 (23 fruit/carton) through to 56 (56 fruit/carton) • Commonly packed, stored and shipped in 4/5 bu. cardboard cartons 	<ul style="list-style-type: none"> • Cardboard cartons
Grapes	<ul style="list-style-type: none"> • No standard packaging 	<ul style="list-style-type: none"> • Lugs • Quart-sized ventilated plastic containers • 2-lb. plastic slit bags
Guavas	<ul style="list-style-type: none"> • Shipped in 10-lb. (4.5kg) single-layer cartons with foam sleeves or wrapping to prevent injury 	<ul style="list-style-type: none"> • MAP in polyethylene bags and use of wax coatings delays ripening/softening • Skin blackening is a problem when some wax coatings are applied
Herbs	<ul style="list-style-type: none"> • Pack in bunches 12 or 24 to 1/2 bu. box 	<ul style="list-style-type: none"> • Pack in plastic bags or clamshells, then pack in corrugated cartons • Perforated polyethylene liners will prevent dehydration and maintain quality. Use waxed boxes, lined with plastic • Some herbs (parsley) are top-iced
Honeydew	<ul style="list-style-type: none"> • The number of fruit (based on a uniform fruit diameter and weight) per box to achieve a standard weight of 30-lb. (13.6kg) 	<ul style="list-style-type: none"> • Produce box

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Horseradish	<ul style="list-style-type: none"> • 44-55-lb. (20-25kg) sacks • 2.2-lb. (1kg) packages • For storage: 33-lb. (15kg) polyethylene-lined crates • For storage: 660-1,100-lb. (300-500kg) containers 	<ul style="list-style-type: none"> • Sacks, packages, polyethylene lined crates, containers
Jicama	<ul style="list-style-type: none"> • Wooden crates of 20+ lbs. (9+kg) • Carton boxes of about 10-lb. (4.5kg) for export 	<ul style="list-style-type: none"> • Wooden crates • Carton boxes
Kohlrabi	<ul style="list-style-type: none"> • 1-1/9 bu. box – 24 bunches • With tops: bunched like beets, with 3-5 kohlrabi per bunch 	<ul style="list-style-type: none"> • Produce boxes • Package icing (2.2-lb. of ice per 4-lb. of product)
Leeks	<ul style="list-style-type: none"> • 10-lb. 1/3 bu. cartons or wire-bound crates • 12-count leafy greens carton 	<ul style="list-style-type: none"> • Cartons or wire-bound crates • Crushed ice
Lemons	<ul style="list-style-type: none"> • Common packaging specifications are 40-lb. (18.2kg) cartons, 10-lb. (4.6kg) mini-pack cartons, 8-lb. (3.6kg) consumer cartons, as well as 2, 3, and 5-lb. (0.9, 1.4 and 2.3kg) bags 	<ul style="list-style-type: none"> • Cartons, mini-pack cartons, consumer cartons, bags • Boxes or cartons tightly packed and well filled
Lettuce	<ul style="list-style-type: none"> • Pack in 1 1/9 bu. boxes with uniform counts of 12 to 24 in every box 	<ul style="list-style-type: none"> • Crisphead: 24-count cartons • Leaf lettuce: 20-25-lb. cartons • Butterhead/Boston: 20-lb. cartons • Bibb/greenhouse-grown: 10-lb. cartons
Limes	<ul style="list-style-type: none"> • 10-lb. (4.5kg), 20-lb. (9.1kg) and 40-lb. (18.2kg) cartons 	<ul style="list-style-type: none"> • Boxes or cartons tightly packed and well filled
Longons	<ul style="list-style-type: none"> • 10-lb. (4.5kg) or 5-lb. (2.25kg) crates 	<ul style="list-style-type: none"> • One-piece fiberboard crates with plastic lines, if not already packed in polystyrene containers
Lychee (Litchi)	<ul style="list-style-type: none"> • 10-lb. (4.5kg) or 5-lb. (2.25kg) crates • 0.5 pint (0.12L) styrene containers 	<ul style="list-style-type: none"> • One-piece fiberboard crates with plastic lines, if not already packed in polystyrene containers
Mangoes	<ul style="list-style-type: none"> • Sold in 35-lb. (16kg) cartons, 14-lb. (6kg) flat single-layer cartons and 10-lb. (4.5kg) single-piece fiberboard boxes with various counts 	<ul style="list-style-type: none"> • Cartons, single-piece fiberboard boxes

CROP TYPE	WEIGHT/UNITS	MATERIALS
Mushrooms	<ul style="list-style-type: none"> • Pack in trays or cartons 	<ul style="list-style-type: none"> • Pack in trays or cartons with a perforated polyethylene film over-wrap to reduce moisture loss • It is important to avoid water condensation inside packages
Nectarines	<ul style="list-style-type: none"> • 2-layer tray boxes (yellow-fleshed) • 1-layer tray boxes (white-fleshed) 	<ul style="list-style-type: none"> • Tray boxes
Nopales	<ul style="list-style-type: none"> • Loose packed in 10-20 lb. (4.5-9.0kg) cartons or boxes based on size and quality 	<ul style="list-style-type: none"> • Cartons or produce boxes
Okra	<ul style="list-style-type: none"> • 1-lb. clamshell boxes • Bulk weight or volume-filled 25-lb. bins 	<ul style="list-style-type: none"> • Clamshell boxes • Bulk bins
Onions (Scallions)	<ul style="list-style-type: none"> • Tie 6 to 9 in a bunch and pack 24 bunches in a 1/2 bu. box or 40 to 48 in a 1 1/9 bu. box 	<ul style="list-style-type: none"> • Produce boxes • Top-ice
Onions (dry)	<ul style="list-style-type: none"> • Cure, grade and pack in 25 or 50 lb. bags 	<ul style="list-style-type: none"> • Bags
Oranges	<ul style="list-style-type: none"> • Standard packed sizes used in California include 24, 32, 36, 40, 48, 56, 72, 88, 113, 138, 163, 180, 210, 245, and 270 fruit per 28.5L container. 	<ul style="list-style-type: none"> • Well-vented polyethylene and plastic mesh bags of various sizes • Carton design should include at least 5% side venting, designed to line up with adjacent carton vents to allow airflow through the entire load
Papayas	<ul style="list-style-type: none"> • 10-lb. (4.5kg) cartons are common, although larger 22-lb. (10kg) cartons are also used • Count size ranges from 6 to 18, depending upon fruit and carton size 	<ul style="list-style-type: none"> • Cartons • Foam mesh sleeves, foam padding on the bottom of cartons or paper wrapping to prevent abrasion injury in fruit with areas of green skin
Parsnips	<ul style="list-style-type: none"> • 25-lb. 5/9 bu. waxed carton with perforated polyethylene liner 	<ul style="list-style-type: none"> • Waxed carton with perforated polyethylene liner
Peaches	<ul style="list-style-type: none"> • 2-layer tray boxes • 10 bu. bulk box • 1 bu. or 1/2 bu. box • White-flesh and tree-ripened: 1-layer tray boxes 	<ul style="list-style-type: none"> • Tray boxes
Pears	<ul style="list-style-type: none"> • 20-30-lb. box 	<ul style="list-style-type: none"> • Tray boxes

CROP TYPE	WEIGHT/UNITS	MATERIALS
Peas (hull)	<ul style="list-style-type: none"> • Pack 15-lb. in pea box • 1/2 bu. box • 30-lb. in bu. or 1 1/9 bu. boxes or baskets 	<ul style="list-style-type: none"> • Boxes or baskets • Top-ice
Peas (sugar & snap)	<ul style="list-style-type: none"> • Pack in 10-lb. in 1/2 bu. produce box 	<ul style="list-style-type: none"> • Produce boxes • Top-ice
Peppers	<ul style="list-style-type: none"> • Small size: 90 to 1 1/9 bu. box • Medium: 75 to 85 per box • Large: 60 to 70 per box • Extra large 45 to 55 per box • Bell peppers should be packed in 1 1/9 bu. boxes while specialty peppers are usually packed in 1/2 bu. boxes 	<ul style="list-style-type: none"> • Produce boxes
Plums	<ul style="list-style-type: none"> • 28-lb. volume-filled containers • 1/2 bu. box 	<ul style="list-style-type: none"> • Tray boxes
Pomegranates	<ul style="list-style-type: none"> • Small: 150-200g, 65-74mm diameter, 25-34 fruit/5kg carton • Medium: 201-300g, 75-84mm diameter, 17-25 fruit/5kg carton • Large: 301-400g, 85-94mm diameter, 13-17 fruit/5kg carton • Extra Large: 401-500g, 94-104mm diameter, 10-13 fruit/5kg carton 	<ul style="list-style-type: none"> • Generally packed into 2-layer tray packs or bulk cartons
Potatoes	<ul style="list-style-type: none"> • Bulk 50-lb 1 1/9 bu. carton • Bulk 25-lb 5/9 bu. carton • "Count" 50-lb. boxes • 5 or 10-lb. plastic or paper bags • 2-lb. net bags B-sized tubers 	<ul style="list-style-type: none"> • Cartons, boxes or plastic or paper bags
Prickly Pear	<ul style="list-style-type: none"> • Packed according to color, size and condition in 10-lb. (4 1/2 kg) cartons, or may be packed in single or double layer tray cartons 	<ul style="list-style-type: none"> • Cartons • Single or double layered cartons • Large fruit may be wrapped in tissue paper to reduce scuffing and other physical injury • Fruit may also be packaged in cartons with perforated plastic liners to reduce water loss under dry storage conditions
Pumpkins	<ul style="list-style-type: none"> • Pack bulk by the count or weight • 800-900-lb. bulk containers 	<ul style="list-style-type: none"> • Bulk containers

CROP TYPE	WEIGHT/UNITS	MATERIALS
Radishes	<ul style="list-style-type: none"> Tie 8 to 12 in a bunch so that 20 bunches fill a 1/2 bu. or 40 bunches a 1 1/9 bu. box 	<ul style="list-style-type: none"> Produce boxes
Raspberries	<ul style="list-style-type: none"> Trays holding 12 pint or half pint containers 	<ul style="list-style-type: none"> Vented clam shell containers
Rhubarb	<ul style="list-style-type: none"> Pack 15 1-lb. bunches in a bu. box 	<ul style="list-style-type: none"> Produce boxes
Rutabaga	<ul style="list-style-type: none"> 25-lb. 5/9 bu. cartons with perforated polyethylene liners 	<ul style="list-style-type: none"> Cartons with perforated polyethylene liners
Spinach	<ul style="list-style-type: none"> Pack 5-lb. in 1/2 bu. box or 13-lbs. in 1 1/9 bu. box 	<ul style="list-style-type: none"> Produce boxes Top-ice, liquid icing, package icing (2.2-lb. of ice per 4-lb. of product)
Sprouts	<ul style="list-style-type: none"> Alfalfa: 4-6 oz. containers with 12 containers/case Mung bean: 4-6 oz. containers in 5-lb. open flats 	<ul style="list-style-type: none"> Containers
Squash (Summer – Zucchini)	<ul style="list-style-type: none"> Grade for size and quality and pack in 1/2 bu. boxes 	<ul style="list-style-type: none"> Produce boxes Pack like sardines, with stem-end facing the carton walls to avoid damage
Squash (Winter)	<ul style="list-style-type: none"> Grade for size and quality. Pack in 1 1/9 bu. box 	<ul style="list-style-type: none"> Produce boxes
Strawberries	<ul style="list-style-type: none"> Pint or quart 	<ul style="list-style-type: none"> Pint or quart open mesh baskets, or clear clamshell containers, held in corrugated fiberboard tray
Sweet Potatoes	<ul style="list-style-type: none"> Grade for size and quality and pack in 1/2 bu. or 1 1/9 bu. boxes 	<ul style="list-style-type: none"> Produce boxes
Tangerines	<ul style="list-style-type: none"> 4/5 bu. cartons are used for shipping and storage. Marketable tangerines range from size 56 (56 fruit/carton) to size 210 (210 fruit/carton) 	<ul style="list-style-type: none"> Cartons
Tomatillos	<ul style="list-style-type: none"> Packed in 10-lb. (4.5kg) cartons 	<ul style="list-style-type: none"> Cartons
Tomatoes	<ul style="list-style-type: none"> Pack in 25-lb. tomato or 1/2 bu. produce boxes Cherry tomatoes are packed in 12 pt. flats 	<ul style="list-style-type: none"> Produce boxes or pint flats

CROP TYPE	WEIGHT/UNITS	MATERIALS
Turnips	<ul style="list-style-type: none"> • Pack in 25 or 50-lb. plastic bags • 1/2 bu. boxes • 1-lb. bags, packed 12 per carton 	<ul style="list-style-type: none"> • Bags, boxes, cartons
Watermelons	<ul style="list-style-type: none"> • 700 lb. corrugated bins (not for thin-skinned melons) • 50-60 lb. cartons 	<ul style="list-style-type: none"> • Cartons should have specially designed inserts to help support the weight of the fruit • Only brand new cartons should be used

This information was adapted from *Wholesale Success: The Guide to Selling, Postharvest Handling, and Packing Produce*, FamilyFarmed.org, 2010.

Was this Info Sheet helpful to you? Do you have suggestions for how we could improve it? We want to hear from you!

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