

Harvesting and storing vegetables

by Richard Jauron

Harvesting vegetables at the right stage of maturity results in high quality, nutritious products. If properly harvested and stored, some vegetables will keep most of their original flavor and food value for months. Temperature and relative humidity are the keys to successful vegetable storage. This publication will help you harvest and store your vegetables at their peak flavor. See Table 1 for optimal storage conditions for each crop.

Asparagus

Cut or break stems at the soil line when shoots are 6 to 8 inches tall and before tips start to open. Discontinue harvest by early June in southern Iowa and June 15 in northern Iowa for best flavor and plant health. Eat or process asparagus within a few hours after harvest for the highest quality.

Beans (green or wax, snap)

Harvest when pods are almost full-sized but before seeds begin to bulge. Pick often to keep plants bearing longer.

Beans (broad, green shell, lima)

Pick when seeds and pods reach full size but before pods turn yellow. Store in pods.

Beans (dry)

Pick when seeds are dry and mature on the plant. Protect beans from moth or weevil damage by freezing at 0° F for 3 to 4 days or by heating in an oven at 180° for 15 to 20 minutes. Store in a sealed glass jar.

Beets

Use as greens when the leaves are 4 to 6 inches tall; as tops and small beets when roots are 1 to 1½ inches in diameter; and as roots only when they are 1½ to 3 inches in diameter. Remove tops to ¼ to ½ inch and store.

Black-eyed pea or cowpea

Pick when seeds are near full sized but still bright green. Harvest as mature or dry seeds when seeds are full size and dry.

Broccoli

Cut when flower heads are blue-green and 6 to 7 inches across but before small yellow flower buds start to open. The stem below the flower head and small leaves is also very nutritious. Tender side shoots (1 to 3 inches across) should develop after the central head is removed.

Brussels sprouts

Harvest individual sprouts or buds from the base of the plant as they become solid. Buds should be 1 to 1½ inches in diameter and still tender and green. Remove buds higher up on the plant as they become firm. Do not strip the lower leaves from the plant since they are necessary for further growth. Brussels sprouts' flavor is improved by light frost.

Cabbage

Cut when heads become large and solid. Remove the loose cover leaves and store.

Large heads are prone to splitting if not harvested promptly. Splitting is caused by excessive water uptake; the resulting pressure splits the heads. Splitting of large heads can be reduced by pulling the plants upward and gently twisting. This procedure breaks some of the plant's roots, reducing water intake. Splitting also can be reduced by planting cultivars that hold well, such as 'Stonehead' and 'Dynamo'.

Table 1. Recommended storage temperatures, relative humidities, and storage life for fresh vegetables.*

Vegetable	Temperature		Relative Humidity (percent)	Approximate Length of Storage Period	Suggested Methods for Extended Preservation
	°F	°C			
Asparagus	32-35	(0-2)	95-100	2-3 weeks	Freeze or can
Beans					
green or snap	40-45	(4-7)	95	7-10 days	Freeze or can
lima or broad	37-41	(3-5)	95	5-7 days	Freeze or can
Beets, topped	32	(0)	98-100	4-6 months	Freeze, can, or pickle
Broccoli	32	(0)	95-100	10-14 days	Freeze or can
Brussel sprouts	32	(0)	95-100	3-5 weeks	Freeze or can
Cabbage					
early	32	(0)	98-100	3-6 weeks	Sauerkraut
late	32	(0)	98-100	5-6 months	Sauerkraut
Carrots, mature	32	(0)	98-100	7-9 months	Freeze, can, or pickle
Cauliflower	32	(0)	95-98	3-4 weeks	Freeze or can
Celery	32	(0)	98-100	2-3 months	
Cucumbers	50-55	(10-13)	95	10-14 days	
Eggplants	46-54	(8-12)	90-95	7 days	Can
Garlic, dry	32	(0)	65-70	6-7 months	
Kohlrabi	32	(0)	98-100	2-3 months	Freeze
Leek, green	32	(0)	95-100	2-3 months	
Lettuce	32	(0)	98-100	2-3 weeks	
Melons					
muskmelon (full-slip)	32-36	(0-2)	95	5-14 days	Freeze
watermelon	50-60	(10-15)	90	2-3 weeks	Freeze
Okra	45-50	(7-10)	90-95	7-10 days	Can, freeze, or pickle
Onion					
green	32	(0)	95-100	3-4 weeks	
dry	32	(0)	65-70	1-8 months	
Parsnips	32	(0)	98-100	4-6 months	Can or freeze
Peas, green	32	(0)	95-98	1-2 weeks	Freeze or can
Pepper, sweet	45-55	(7-13)	90-95	2-3 weeks	Freeze
Potatoes	38-40	(3-4)	90-95	5-10 months	Can
Pumpkins	50-55	(10-13)	50-70	2-3 months	
Radishes, spring	32	(0)	95-100	3-4 weeks	
Rhubarb	32	(0)	95-100	2-4 weeks	Freeze
Spinach	32	(0)	95-100	10-14 days	Freeze or can
Squash					
summer	41-50	(5-10)	95	7-14 days	Can or freeze
winter	50	(10)	70	1-6 months	Can or freeze
Sweet corn	32	(0)	95	5-8 days	Freeze or can
Sweet potatoes	55-60	(13-16)	85-90	4-7 months	Can or freeze
Swiss chard	32	(0)	95-100	10-14 days	Freeze or can
Tomatoes					
ripe	46-50	(8-10)	90-95	4-7 days	Can or freeze
mature green	55-70	(13-21)	90-95	1-3 weeks	Pickle
Turnips	32	(0)	95	4-5 months	

*Based on information from United States Department of Agriculture Publication No. 66, *The Commercial Storage of Fruits, Vegetables, and Florist and Nursery Stocks*.

Cantaloupe

See Muskmelon.

Carrots

Dig when roots are $\frac{3}{4}$ inch or more across. Remove tops to $\frac{1}{4}$ to $\frac{1}{2}$ inch. If they are to be stored, plant for a late harvest and leave them in the ground until just before heavy frost.

Cauliflower

Harvest when heads are full sized (6 to 8 inches across) but still compact and smooth. Overmature heads will begin to open up and become "ricey." Heads exposed to sunlight are cream colored. To obtain white heads, blanch the heads when approximately 2 to 3 inches in diameter. Using twine or cloth strips, loosely tie the inner leaves over the heads. Or, cover the heads with large cabbage leaves.

Celery

Harvest when 12 to 15 inches tall. For immediate use, harvest when smaller or cut a few leaves as the plant grows. If left in the garden until early winter, pile straw and soil around the plants to protect against freezing.

Cucumbers

Pick when fruits are $1\frac{1}{2}$ to 3 inches long for pickling and 3 to 4 inches long for dills. Slicing cucumbers should be 6 to 9 inches long and $1\frac{1}{2}$ to 2 inches in diameter but still bright green and firm. Remove fruit by pulling up and giving a quick snap. Promptly harvest fruits when they reach the desired size. Overmature cucumbers left on the vine inhibit additional fruit production.

Eggplant

Harvest any time after fruits are 2 inches across until they are 4 to 6 inches in diameter but still firm and shiny. Light thumb pressure will leave a dent at the proper harvest stage. Old fruit is dull, seedy, and tough. Store with an inch of stem on fruit.

Garlic

Pull when tops become dry and begin to fall over or just before first frost if not mature. Cure the bulbs in a warm, well-ventilated place for 10 days. Then remove the tops about 1 inch above the bulb and trim roots close to bulb.

Kohlrabi

Has mildest flavor when thickened stems are 2 to 3 inches in diameter. Store with leaves and roots removed.

Leek

Pull when less than 1 inch in diameter for use in salads. Use large ones in stews and soups.

Lettuce

Leaf lettuce is crispest when outer leaves are 4 to 6 inches long. Harvest largest plants and allow small ones in between to develop.

Harvest head lettuce when heads are full size and moderately firm but before seed stalks form. Outer leaves may be removed from leaf or head lettuce when leaves are 4 to 6 inches. New inner leaves will provide continuous harvest. Hot weather causes bitter flavor and seed stalk formation.

Muskmelon or cantaloupe

Muskmelon is most tasty when fully ripe. Fruit is nearly ripe when the base of the fruit stem starts to separate from the fruit. It is fully ripe when a crack appears completely around the base of the fruit stem allowing easy separation from the fruit. At the same time, the skin between the netting will turn from green to yellow and the fruit begins to give off a muskmelon aroma. Place refrigerated melons in sealed plastic bags to prevent the musky aroma from flavoring other foods.

Okra

Cut when pods are 3 inches long but are still bright green (or purple on some cultivars). Use quickly as okra deteriorates rapidly after harvest. Continue removing all pods to keep plant producing.

Onion (green)

Any standard variety of onion can be used as a green onion when the bulbs are small. Harvest when 6 to 8 inches tall. Onion greens are nutritious and can be chopped into salads.

Shallots are a multiplier type of onion that divide into clumps of small bulbs. Harvest shallots as green onions in summer or as dry onions in fall when the tops fall over.

Onion (dry)

Onions grown from seeds and plants usually store better than those from sets. Harvest when tops fall over and begin to dry. Pull with tops on and dry them in a protected place for 3 to 4 days, then cut tops 1 inch above the bulb and place in mesh bags for further curing. Cure

for 2 to 3 weeks at room temperature until the neck tightens up and outer scales begin to rustle. Then store onions in a well-ventilated place.

Use 'Bermuda' and 'Sweet Spanish' onions soon after harvest because they store only 1 to 2 months. Globe-type onions keep up to 8 months in storage.

Parsnips

Dig from late fall until early spring. Parsnips need some frost to give the characteristic sweet nutlike flavor. If the roots are to be left in the soil during winter, cover after early frosts with a layer of straw and 3 to 5 inches of soil to prevent winter injury.

Peas

Peas are tender and flavorful if picked when pods are well filled but not hard and starchy. Pick often and don't miss any—overripe pods retard production. Store peas in the shell.

Harvest edible podded snow or sugar peas when pods reach nearly full size (about 3 inches) and while the seeds are still small. If seeds only are to be eaten, harvest when seeds are fully developed but pods are still fresh and bright green.

Snap peas, another edible podded pea, are best picked when the seeds are nearly full size.

Pepper, sweet

Harvest when fruits are large, firm, crisp, and dark green. Fully ripe peppers are slightly sweeter and may be red, orange, yellow, or other colors.

Potatoes

Potatoes can be harvested when the tubers are small and immature ("new" potatoes) or when the crop is fully mature. New potatoes are harvested when the vines are lush and green. The small, immature potatoes have thin skins and do not store well. Refrigerate new potatoes and use as soon as possible.

Potatoes grown for fall and winter use should be carefully dug after the plants have died (turned brown) and the crop is fully mature. To check crop maturity, dig up one or two hills after the plants have died. If the skin is thin and rubs off easily, the potatoes are not fully mature and will not store well. Allow the crop to mature in the soil for several more days before harvesting the

rest of the hills. When harvesting, avoid cutting or bruising the potatoes. Use damaged tubers as soon as possible.

Before placing the potatoes in storage, cure the tubers at a temperature of 45 to 60° F and relative humidity of 85 to 95 percent for 2 weeks. Curing promotes healing of minor cuts and bruises and thickening of the skin.

Once cured, sort through the potatoes and discard any soft or shriveled tubers. These potatoes may spoil in storage and destroy much of the crop. Potatoes should be stored in a dark location with a temperature of 38 to 40° F and a relative humidity of 90 to 95 percent. Potatoes will sprout if temperatures are too warm, while they will taste sweet if temperatures are too cool. Do not allow potatoes to freeze.

Pumpkins

See Squash (winter).

Radishes

Pull when roots are 1 to 1½ inches in diameter, remove tops, and store up to 15 days. Large winter radishes store 2 to 4 months.

Rhubarb

When stalks are 10 to 15 inches long, grasp the stalk below the leaf blade and pull upward and slightly to one side to harvest. Discard leaf portion—eating this material can cause illness. Harvest only for 8 to 10 weeks ending in mid-June.

Spinach

Harvest when larger leaves are 6 to 8 inches long. Early spring plantings go to seed as days get longer. Early August seedings do not go to seed during the shorter days of fall.

Squash (summer)

Harvest long fruited cultivars when they are about 2 inches in diameter and 6 to 12 inches long. Flat or scalloped types are best when 3 to 5 inches in diameter. The rind should be easy to puncture with a fingernail and seeds should be soft and edible. However, such surface punctures are likely to result in brown or discolored blemishes. Some professional growers require pickers to wear gloves to avoid surface injuries.

Squash (winter) and pumpkins

Mature winter squash have hard skins (rinds) that cannot be punctured with the thumbnail. Additionally, most mature winter squash have dull-looking surfaces. Pumpkins should be uniformly orange. When harvesting, leave a 1-inch stem on the winter squash and a 3- to 4-inch stem on pumpkins.

Store winter squash and pumpkins in single layers to allow air circulation and reduce fruit rots. Acorn squash can be stored for 5 to 8 weeks. Butternut squash and pumpkins will keep 2 to 3 months. Hubbard squash can be stored for 3 to 6 months.

Sweet corn

Harvest sweet corn at the milk stage. At this stage the silks are brown and dry at the ear tip. When punctured with a thumbnail, the soft kernels produce a milky juice. Overmature corn is tough and doughy. An immature ear will not be completely filled to the tip and the kernels produce a clear, watery liquid when punctured.

Sweet corn remains in the milk stage for a short time. As the sweet corn approaches maturity, check it frequently to ensure high quality.

Harvest sweet corn by grasping the ear at its base and then twisting downward. Use or refrigerate immediately as quality declines rapidly after harvest.

Sweet potatoes

Harvest late in fall before frost. Dig carefully to avoid cuts, bruises, and broken roots. Sweet potatoes do not store well unless the growing season is long and the roots are large. Use small, younger roots soon after harvest.

When mature, a broken or cut surface dries on exposure to air, while an immature one remains moist and turns dark in color. If vines are damaged by frost, harvest immediately to prevent entrance of decay organisms from dead stems.

Sweet potatoes must be cured after harvest for good storage. Cure for 1 week at 85° F and 90 to 95 percent relative humidity and then store at 55–60° F. Increase curing time if temperatures are lower.

Swiss chard

Use outer, older leaves as they become 8 to 10 inches long but are still young and tender. New leaves growing from the center of the plant produce a continuous harvest. Cut carefully to avoid injury to the center bud.

Tomatoes

For fully ripe tomatoes, leave completely red fruits on plants for an additional 5 to 8 days. Pick only ripe but firm tomatoes for juice or canning to ensure proper acidity, full flavor, and good color. Overripe tomatoes may be lower in acidity and not be safe to can. Ripe tomatoes should be stored at 46–50° F and 90 to 95 percent relative humidity. Harvest green tomatoes before frost and keep at 55–70° F to ripen.

A few green tomatoes can easily be ripened on the kitchen counter. Ripen large numbers by wrapping individual fruits in newspaper. Place the wrapped tomatoes in single layers in boxes or on shelves. Check ripening every few days. Light is not necessary for ripening of immature tomatoes.

Turnips

Dig when fruits are 2 to 2½ inches in diameter but before heavy frosts. Store with tops for 4 to 5 months.

Watermelon

Harvest when fruits are full sized, dull in appearance, and the bottom part (portion touching the soil) turns from greenish white to cream. Leave 2 inches of stem on the watermelon for storage.

Storing vegetables

Many fresh vegetables can be successfully stored in your home. Refrigeration is helpful but not necessary. Basements, cellars, outbuildings, and pits can be used for storage if they are vented to the outside.

Store only healthy, fresh produce that is free from disease, insect, and mechanical damage. Use any damaged ones immediately. Select late ripening cultivars with late planting dates and harvest as late as possible. (See Table 1 for the best vegetable storage conditions.)

For best results, store fruits (apples, pears, etc.) and vegetables separately. For the most part, fruits and vegetables have different storage requirements. Additionally, some fruits may adversely affect the storage of vegetables and vice versa. For example, ripening apples,

pears, and other fruits release ethylene gas that may shorten the storage life of winter squash and pumpkins. When stored together, cabbage may affect the flavor of apples and pears.

Storage conditions

Temperature control

Accurate temperature control is necessary for long-term storage of vegetables. Two thermometers are needed. One is placed in the coldest part of the storage area and the other outdoors. Early in fall open the vent whenever the outside temperature is lower than the inside temperature and close it when the outside temperature is higher. This means daily opening and closing of the vents to cool the storage area in fall. When the weather gets cold, only a small opening is needed.

Be careful produce doesn't freeze during extremely cold weather. For most vegetables, the ideal storage temperature is 32–40° F. A lower temperature could result in injury. Vegetables stored at higher than 40° F could rot.

Humidity control

Stored vegetables quickly shrivel and lose quality without proper moisture. Most storage areas must have the humidity raised to reach the ideal 90 to 95 percent relative humidity that most vegetables need. A simple humidity gauge from most hardware stores is the best way to measure the relative humidity.

Sprinkling the floor with water or using a humidifier will raise the humidity. Large pans of water or a floor covering of wet straw or sawdust will also work. However, the easiest and most effective way to control moisture loss and prevent shrinkage is to place vegetables in polyethylene bags or to line storage boxes with polyethylene. Make several ¼- to ½-inch holes in the sides of the bags and liners to permit ventilation. Three or four ¼-inch holes per pound of vegetables results in a high relative humidity of 90 to 98 percent. When moisture collects on the inside of the bag, the relative humidity is 98 to 100 and a few more holes should be punched to reduce it slightly.

If stored vegetables shrink and shrivel, the humidity must be raised. Excessive spoilage or decay indicates the humidity is too high or that the vegetables have been stored too long.

Waxing

Wax or wax emulsion has been used commercially for many years to improve vegetable storage. Waxing reduces moisture loss and thus retards shriveling. On some vegetables, waxing simply improves appearance. Because the wax thickness is critical and difficult for the home gardener to control, waxing is not recommended for home use. Coatings that are too thin may give little, if any, protection against water loss; a thick coat may increase decay and breakdown. Storing vegetables in perforated plastic bags will accomplish the same purpose with less effort.

Sanitation of storage room

Storage facilities must be kept clean or vegetables deteriorate. Watch vegetables carefully to avoid losses from decay, growth, or excessive shriveling. Remove decaying vegetables at once to prevent rot from spreading. At least once a year remove all containers from your storeroom, clean them with a disinfectant, and air them in the sun. Thoroughly wash walls, ceilings, and floors of the storeroom before putting the containers back into storage.

Storage structures

Refrigerator

A second refrigerator is useful for storing small to moderate amounts of vegetables. However, a properly regulated basement storage area is more economical to use and holds much larger quantities of vegetables. Most refrigerated vegetables store best if kept in perforated plastic bags.

House basement

A basement under a house with central heating may be used for ripening tomatoes and short-term storage of potatoes, sweet potatoes, onions, pumpkins, and winter squashes. However, it is necessary to provide a separate room for long-term storage of most vegetables in a basement with a furnace.

Locate this room in the northwest corner of your basement. Insulate inner walls and ceiling to prevent entrance of heat or chilling of the floor above the room. If possible, do not have heating pipes or ducts running through the room.

The room should have at least one window or vent to allow outside air to cool the room. Bring cool outside air into the storage room through a cold air intake with

a ventilating flue extending down to the floor. Another part of the window near the ceiling can serve as the warm air outlet (Figure 1). Cover openings to the outside with screen to keep mice out. Shade the window or vents so the room will be kept dark for storage of potatoes.

If large amounts of fruit are to be stored, add a partition and separate vent to avoid injury to the vegetables from gases given off by ripening fruit.

Equip the room with shelves so produce will be kept off the floor to increase air circulation.

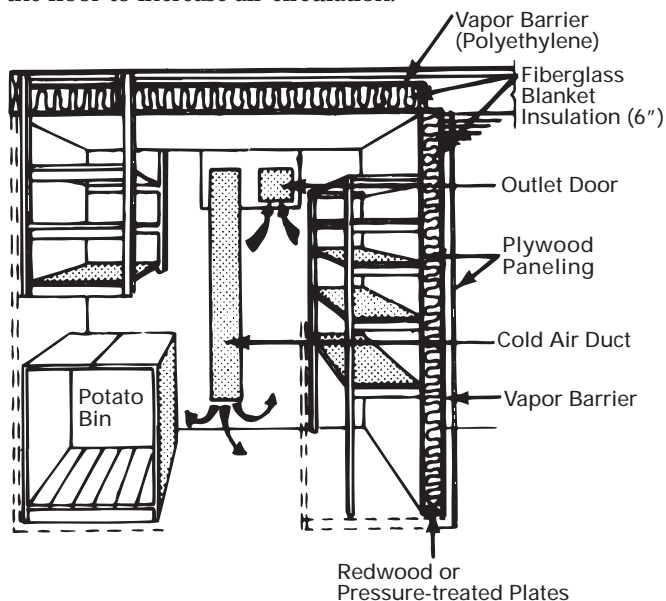


Figure 1. Overall view into storage room

(Courtesy University of Wisconsin)

Outdoor buildings and cellars

Outdoor buildings are a difficult place to store vegetables. However, if they are well insulated, have adequate ventilation, and a source of supplemental heat, they will work satisfactorily.

Outdoor cellars, properly constructed, are excellent for storing many vegetables, especially the root crops, potatoes, kohlrabi, and cabbage. Outdoor cellars should have at least one vent to the outside to provide cooling and ventilation during the fall.

If you do not already have an outdoor cellar for vegetable storage, it is probably not a good investment to build one. A well-constructed and managed basement storage room is not only more convenient and just as good but more economical.

Temporary mounds or pits

Cone-shaped mounds or pits can be constructed to store potatoes, root vegetables, and cabbage through most of the winter. While not very convenient, they are an economical way to store fresh vegetables.

For storage until early winter, dig a hole 10 to 24 inches deep and several feet in diameter in a well-drained location where surface water runoff will not be a problem. Storage through the winter requires the pit to be 3 to 4 feet deep. Place the pit where it will receive winter sunlight to prevent freezing of the vegetables.

Add a layer of straw to the surface of the ground and stack the vegetables on the straw in a cone-shaped pile. Never store fruits and vegetables in the same pit. Place a 12-inch layer of straw over the vegetables and then add an 8- to 12-inch layer of soil over the entire pile. Use an additional layer of straw and soil for storage through the winter. Pack the outer layer of soil with the back of a shovel to make the pit waterproof. Finish by digging a shallow drainage ditch around the pit to allow water to drain away from the stored vegetables.

With small pits, provide ventilation by extending the straw layer to the top of the pile. Cover the opening with a piece of screen and a stone to prevent rodent damage. In late fall, when the soil starts to freeze, cover the opening with two pieces of board nailed together at right angles.

Pits are difficult to open in cold weather. Once a pit is opened, its entire contents should be removed to prevent freezing of the remaining vegetables. Therefore, it is advisable to make several small pits, each containing a mixture of vegetables. This makes it easy to open only one pit to get a variety of vegetables.

Tile storage

Another method of outdoor storage is a buried drain tile. Root crops, potatoes, and other vegetables that require cool, moist storage are well adapted to tile storage.

Tile size may vary from 18 to 30 inches inside diameter and 2 to 3 feet in length. Concrete or clay tiles are best because they are more durable than wood and conduct less heat than steel. Locate the tile in a convenient, well-drained place, away from possible overflow water and downspouts. Dig a hole just large enough in diameter to let the tile fit snugly. The hole should be 6 inches deeper

than the length of the tile. Place three or four standard size bricks on end, flat side to the wall, for a base (see Figure 2). This will leave 8 inches of exposed soil below the tile to supply moisture to the vegetables. Lower the tile into the hole and mound the soil up to the top edge of the tile. Add a 2- to 3-inch layer of coarse gravel or sand to the bottom for drainage.

Chill the ground around the tile by removing the lid in the evening and replacing it every morning for a week. Then water the tile and drainage material in the bottom and cover for several days to raise the humidity. The vegetables should be thoroughly cooled in the refrigerator or in outside air before being packed for storage. Adding warm vegetables to the tile will raise the temperature in the storage area.

Place vegetables in bushel baskets, mesh bags, or other ventilated containers. Vegetables kept in containers will store better and be easier to remove than if they are solid packed in the tile.

Covering the tile with a layer of hardware cloth or wire screen prevents rodents and provides ventilation. Spread several inches of straw, chopped cornstalks, or other coarse mulch over the screen. Cover entire pile with a waterproof cover.

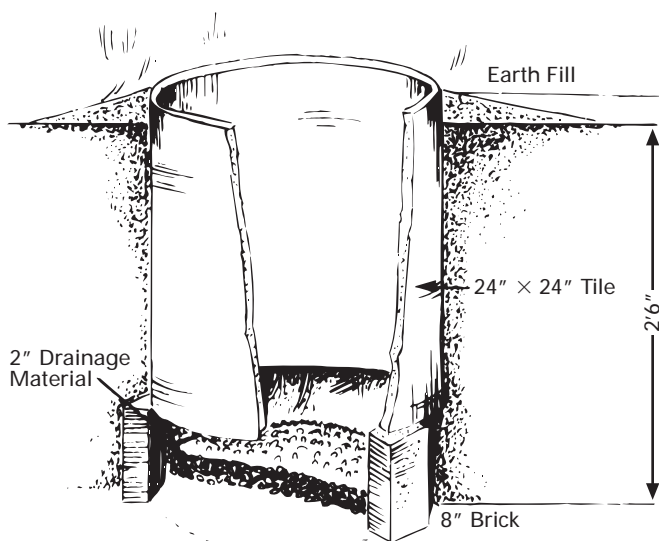


Figure 2. A 24" × 24" tile will store about 6½ bushels.
(Courtesy University of Wisconsin)

When the average outdoor temperature is less than 32° F the tile will have to be protected from cold temperatures. Place a layer of insulation, such as fiberglass, over the vegetables and then place a weatherproof cover, such as wood, over the top of the tile. Increase the mulch to 2 feet or more in depth and several feet in diameter over the cover. This will help prevent freezing of the vegetables during winter. Finally, cover mulch with a waterproof cover.

Vegetables can be stored until May in a tile storage. The tile may be opened any time. A long handled hook made from heavy wire makes removal of baskets or bags easier.

For more information

For more information on selection, planting, cultural practices, and environmental quality, contact your Iowa State University Extension office or visit these Web sites:

ISU Extension publications

<http://www.extension.iastate.edu/pubs/>

ISU Food Safety (home food preservation)

<http://www.extension.iastate.edu/foodsafety>

ISU Horticulture

<http://www.hort.iastate.edu/>

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... and justice for all

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