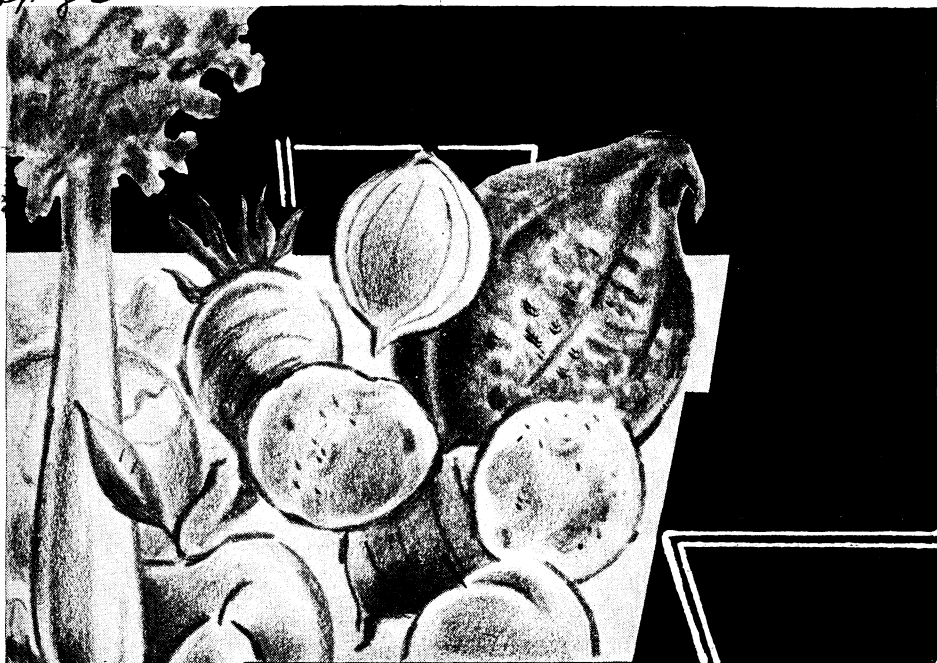


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# Home Storage of

## VEGETABLES and FRUITS

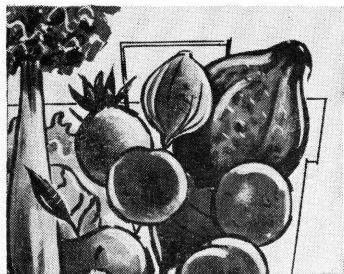
Farmers' Bulletin No. 1939  
U.S. Department of Agriculture

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Revised June 1960  
Washington, D.C.

# Home Storage of



## VEGETABLES and FRUITS

By Lacy P. McColloch, plant pathologist

Market Quality Research Division, Agricultural Marketing Service<sup>1</sup>

Home storage enables the farmer or gardener to enjoy fresh produce from his own garden long after harvesttime. "Home storage," as used in this bulletin, means the storing of fresh fruits and vegetables in home facilities such as cellars, basements, and outdoor pits without artificial refrigeration.

The article "Storing Perishable Foods at Home," on pages 477-482 of "Food—The Yearbook of Agriculture 1959," gives information on handling and storage of vegetables and fruits, as well as other foods, in home refrigerators.

Home storage may appeal to farmers because the farm provides a wide variety of practical storage facilities. Also, many farm families

like to be self-sufficient in providing their own fresh produce. Gardeners who enjoy growing plants and who appreciate the high quality of fruits and vegetables grown in a well-managed garden may also be interested in knowing about home storage.

Those who store home-produced commodities may at times find it advantageous to buy and store such items as apples, pears, potatoes, and sweetpotatoes to supplement those they produce themselves.

The aim of this publication is to point out the requirements for successful storage, to describe the facilities needed, and to discuss briefly how to handle the produce and operate the storage facilities.

### General Points on Storage

Fruits and vegetables from late fall gardens require special care in being stored. Important points for the farmer or gardener to keep in mind are:

1. Plant late in the season for good quality vegetables for winter storage.

2. Select varieties suitable for storing, and harvest the crops at the proper maturity.

3. Before storing products, discard all that show signs of decay or serious mechanical injury.

4. Store fruits and vegetables under conditions required by the in-

<sup>1</sup> This publication is an extensive revision of Farmers' Bulletin No. 1939. Earlier editions were prepared by James H. Beattie, Dean H. Rose, and R. C. Wright, all retired.

dividual products. (Storage requirements of the different fruits and vegetables are discussed later.)

5. If insulation is used, cover it on the inside with a moisture barrier, such as aluminum foil, laminated kraft paper, or polyethylene, to keep the insulation dry. The amount of insulation depends on the type of storage built and the climate.

6. Provide storage space that is sanitary and that will exclude rodents.

7. Open windows or ventilators at night and at other times when the outside temperature will cool but

not freeze the produce. Ventilation is needed to carry off odors and also to help maintain desirable temperature and humidity.

8. To prevent produce from shriveling or wilting, keep the moisture at levels needed by the commodities stored (table 1, p. 8).

9. Where possible, keep commodities that benefit from relatively low storage temperatures near 32° F., but avoid freezing (table 1). Higher temperatures shorten the storage life of the commodities.

10. Provide proper drainage for outdoor pits and cover the pits to prevent the produce from freezing.

## Facilities for Storage

A variety of facilities can be built or adapted for home storage. The type of storage built depends upon the climate and the choice of the individual. Elaborate facilities for home storage are not practical unless outside temperatures during the winter average 30° F. or lower to permit proper cooling. The size of the storage space will vary according to family needs.

The principles for successful storage apply to all facilities. For example, the cooling of the storage space and maintenance of a desirable temperature depend upon the outside temperature, the manipulation of the ventilators, and the extent of insulation against undesirably high or low temperatures. (See "Regulating the Temperature," p. 6.) Proper drainage and the exclusion of light and rodents are also important.

### Storage in a Home Basement

A well-ventilated basement under a modern house with central heating can readily be adapted to home-storage needs. The furnace room is an excellent place to cure sweet-potatoes, pumpkins, and squashes. After curing, however, these commodities should be moved to a cooler

part of the basement. (See "Sweet-potatoes and Squashes.") Temperatures in ordinary basements vary in different parts of the country. In basements, temperatures ranging from 60° to 70° F. in winter, when the furnace is in operation, and 70° to 80° in summer are perhaps average. While too warm for most commodities, the regular basement is satisfactory the year around for holding potatoes, sweetpotatoes, and onions for short periods, and for ripening tomatoes.

If the basement is to be used for winter storage, a corner should be partitioned off and insulated so that the storage space can be kept sufficiently cold. The storage room should be located preferably on the north or east side, and should not have heating ducts or pipes running through it. At least one window is necessary for cooling and ventilating. Two or more windows are desirable, especially if the room is divided for separate storage of fruits and vegetables. The windows should be darkened to protect the produce from light. They should also be boxed or shaded in such a way as to prevent the entrance of light even when they are open.

Bins may be used for storing certain commodities, but crates and boxes are preferred, as it is possible to remove them for cleaning. Equipping the storage room with shelves and a slatted floor keeps the containers off the floor and provides free air circulation. It also permits the use of water or wet materials, such as dampened sawdust, on the floor to raise the humidity.

### **Storage Cellar Under Home Without Central Heat**

The old-fashioned cellar beneath a house without a central heating system has long been used successfully for winter storage of fruits and vegetables in the colder parts of the United States. The cellar usually has an outside entrance and a dirt floor. The outside doors serve as a means of ventilation and to regulate temperature. Some cellars have no windows, but if present they aid in ventilating and in temperature control. Windows are especially needed if the cellar has a partition to separate the fruit and vegetable compartments.

The precautions regarding light, drainage, and insulation described under "Storage in a Home Basement" also apply to the cellar under a house without central heat.

### **Outdoor Storage Facilities**

Outdoor storage facilities can be constructed above ground or partly or entirely below ground. Cellars constructed below ground are superior because they can maintain a desirable temperature longer and more uniformly than any other type of home storage.

Outdoor storage facilities may be attached to the house or located in the yard or under an outbuilding. They should be convenient to the kitchen, and have proper drainage and insulation.

### **Underground Cellars**

The structure of an underground cellar must be strong to support the weight of earth over the roof. Stone and masonry block in combination with concrete can be used, but a structure made entirely of reinforced concrete is best. A variety of plans can be developed. In the plan illustrated in figure 1, the cellar is attached to the house basement. This structure can also serve as a storm cellar or protective shelter against radioactive fallout in case of an emergency. (For further information, see your local civil defense organization.)

The floor plan and longitudinal section illustrated in figure 1 are identified as "Plan EX 5866." A more complete plan may be obtained through your county agent or from the Extension Service agricultural engineer at most State agricultural colleges.

If working drawings of this plan are not available in your State, write to the Agricultural Engineering Research Division, Agricultural Research Service, U.S. Department of Agriculture, Plant Industry Station, Beltsville, Md. The Department does not distribute drawings, but will direct you to a State that does distribute them.

The whole structure, with the exception of the door, is covered with earth to prevent freezing. The thickness of the covering varies according to geographical location. In northern sections of the country, 2 to 3 feet may be necessary. Straw or fodder may be used for additional insulation if necessary. Wire screen over the outside ends of air intakes and ventilators will keep out birds and small animals.

### **Partly Underground Cellars**

One type of cellar that can be used in certain northern sections of the country has walls of masonry that are partly below and partly

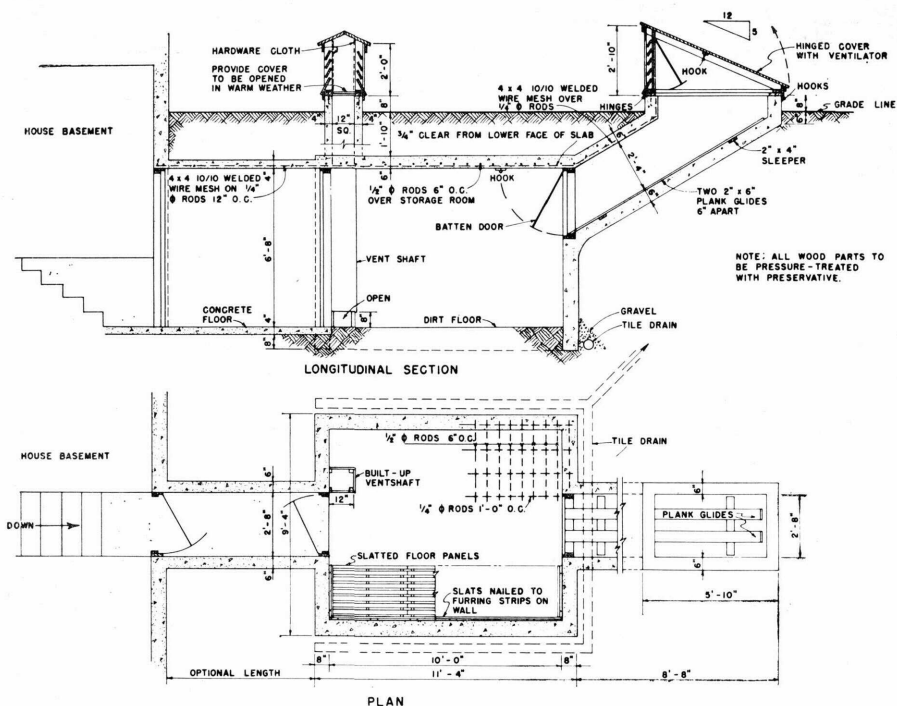
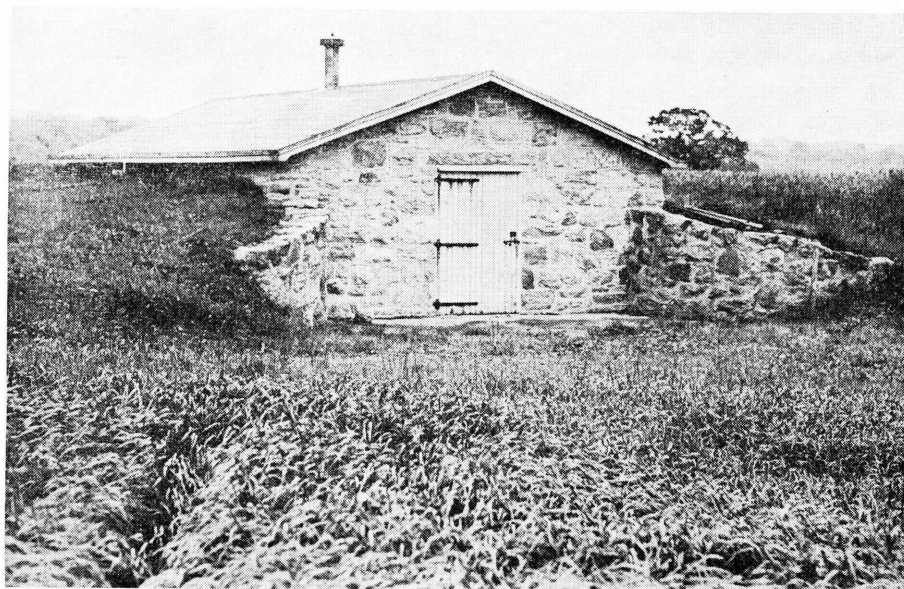


FIGURE 1.—Longitudinal section and floor plan (EX 5866) of concrete storage cellar that can also serve as a storm and fallout shelter.



NEG. 24532

FIGURE 2.—A partly underground storage cellar with stone walls and insulated frame roof.

above ground. Earth from the excavation is banked around the walls that are above the normal ground level and one end is left exposed for the door (fig. 2). As in other storage houses, an air inlet and a ventilator should be provided for each compartment, if there are more than one. Proper provision for ventilation is illustrated in figure 1. The double door is insulated.

### Storage Above Ground

Aboveground storages can be built of masonry or lumber, but must be well insulated. Even masonry walls, regardless of thickness, have little insulating value. The following discussion is applicable where the climate is consistently cold, but where the average temperature does not drop below freezing. Even in these climates the minimum temperature may drop to zero or below, and supplemental heat may be needed on very cold nights. Thermostatically controlled heat can be used if electricity is available. Only a small amount of heat is necessary to prevent subfreezing temperatures, and the storage temperature should be watched closely when low temperatures are predicted.

Hollow-masonry construction such as cinder block provides the simplest means of installing insulation. Vermiculite, or some other dry granular material, can be put in the vertical channels formed by the alinement of the blocks as each course of block is laid. If cinder block is used, the inside and outside surfaces should be scrubbed with a cement grout to make them less porous. After the walls have been scrubbed with cement grout, the inside of the walls should be painted with aluminum paint to serve as a moisture barrier. Tar paper should be placed between the ceiling and joists as a moisture barrier, and at least 12 inches of dry sawdust or other granular material should be

spread in the attic above the ceiling.

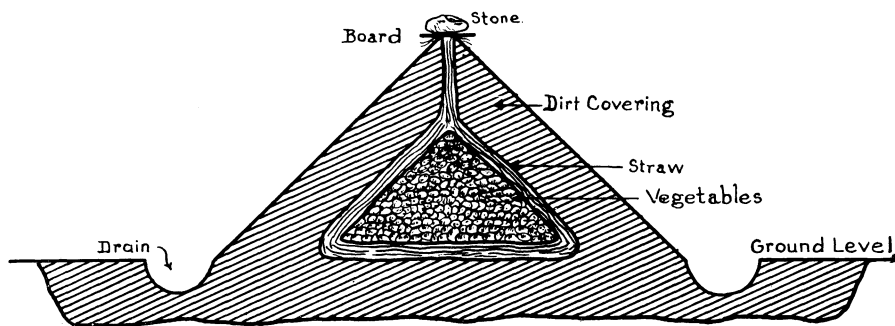
A frame building can be built of 2- by 4-inch studding and rafters. Walls can be made tight by sheathing both the inside and outside of the frame with matched lumber. The space between the inside and outside sheathing should be insulated with loose fill or mineral wool blanket. Laminated kraft paper with asphalt between the layers, aluminum foil, or polyethylene should be placed between the insulation and inside sheathing as a moisture barrier. Building paper over the sheathing in the roof and outside walls is of great assistance in making the structure tight. The interior can then be painted with aluminum paint or whitewashed.

Ventilation for any aboveground storage building can be provided by the same type of roof flue and floor inlet that is recommended for concrete cellars (fig. 1).

### Storage in Pits

Cone-shaped outdoor pits are often used for keeping such vegetables as potatoes, carrots, beets, turnips, salsify, parsnips, and cabbage, and are sometimes used for winter apples and pears (fig. 3). The conical pit may be built on the surface of the ground, or in an excavation 6 to 8 inches deep in a well-drained location. The pit should be constructed preferably as follows: Spread a layer of straw, leaves, or other similar material on the ground, and stack the produce on the litter in a conical pile. Cover the produce with more litter; cover the entire pile with 3 or 4 inches of soil; and firm the soil with the back of a shovel to make it waterproof. More soil may be needed as winter approaches. Dig a shallow drainage ditch around the pit to carry away water.

The amount of ventilation necessary will depend on the size of the pit. Small pits containing only a few bushels of vegetables will re-



NEG. 50367

FIGURE 3.—Cross section of a storage pit containing potatoes. During severely cold weather the soil covering may be supplemented by straw or similar material.

ceive sufficient ventilation if the straw between the vegetables and soil is allowed to extend through the soil at the apex of the pile. Cover the apex with a board or piece of sheet metal, holding it in place with a stone, to protect the produce from rain. For ventilation in larger pits place two or three pieces of rough boards or stakes up through the center of the pile of vegetables to form a flue. Cap this flue with two pieces of board nailed together at right angles.

It is difficult to get produce out of conical pits in cold weather, and when a pit is opened it is desirable to remove its entire contents at once.

For these reasons it is advisable to construct a number of small pits rather than one large one, and to place a small quantity of several kinds of vegetables in the same pit. This makes it necessary to open only one pit to get a variety of produce. When several crops are stored in the same pit, it is a good plan to separate them with straw or leaves.

Another type of pit consists simply of a barrel covered with successive layers of straw and earth (fig. 4).

Pits should be made in a different place every year to avoid decay from contaminated material remaining in an old pit.

## Maintaining Proper Storage Conditions

### Keeping the Storage Space Clean

Basement storage rooms and outdoor storage cellars should be kept clean. Decaying material should be removed as soon as it is discovered. At least once a year, remove all containers from the storage space for cleaning and sunning. Clean and whitewash the walls and ceiling thoroughly.

### Regulating the Temperature

Home storage is not practical for most fruits and vegetables unless the temperature can be kept below 40° F. Long-term storage for products requiring low temperatures can be achieved only if the storage temperature can be kept at about 32°. While inability to maintain a temperature near 32° does not prevent the use of home storage, it does shorten the storage life of the



NEG. 46276

FIGURE 4.—Home storage pit made by covering a barrel with straw and earth.

products. Reliable thermometers are essential to careful regulation of the temperature. A thermometer, preferably one that records minimum and maximum temperatures, should be placed in the coldest location in the room or cellar, and another outside.

The temperature of the storage room or cellar is regulated by opening and closing doors, windows, or other openings used as ventilators. With the first cool nights the ventilators should be opened at night to promote cooling, and closed in the early morning. Although the desired temperature may not be reached until late fall or early winter, the cool storage will be more desirable than fluctuating outdoor temperatures for the crops that benefit from low temperature, but that require harvesting before freezing weather. Because of differences in climate, ventilating needs must be worked out for each area on an individual basis.

Outdoor temperatures well below 32° F. are necessary to cool the storage air to 32° and maintain that temperature. Once cooled to 32° the temperature will rise again if the ventilators are closed, even though the outside temperature is about 25°. Of course, the ventilators should be closed tightly if the outdoor temperature is higher than that of the storage air. The amount of ventilation needed will depend upon outdoor temperatures. Close observation is necessary, and in most sections daily manipulation of ventilators is needed.

The only danger from overventilating during subfreezing weather is freezing injury to the produce if storage temperatures drop too low (table 1). In an insulated storage cellar partly above ground, at Beltsville, Md., for example, it was found that full ventilation both day and night was necessary to maintain 32° F. inside if outdoor temperatures ranged between 18° and 30° during

TABLE 1.—Freezing points, recommended storage conditions, and length of storage period of various fruits and vegetables

| Commodity                   | Freezing point | Place to store                                  | Storage conditions   |                   | Length of storage period      |
|-----------------------------|----------------|-------------------------------------------------|----------------------|-------------------|-------------------------------|
|                             |                |                                                 | Temperature          | Humidity          |                               |
| Vegetables:                 | ° F.           |                                                 | ° F.                 |                   |                               |
| Dry beans and peas          | 30. 4          | Any cool, dry place.                            | 32° to 40°           | Dry               | As long as desired.           |
| Late cabbage                | 30. 3          | Pit, trench, or outdoor cellar                  | Near 32° as possible | Moderately moist. | Through late fall and winter. |
| Cauliflower                 | 31. 6          | Storage cellar                                  | do                   | do                | 6 to 8 weeks.                 |
| Late celery                 | 31. 9          | Pit or trench; roots in soil in storage cellar. | do                   | do                | Through late fall and winter. |
| Endive                      | 30. 6          | Roots in soil in storage cellar                 | do                   | do                | 2 to 3 months.                |
| Onions                      | 30. 4          | Any cool, dry place.                            | do                   | Dry               | Through fall and winter.      |
| Parsnips                    | 30. 7          | Where they grew, or in storage cellar.          | do                   | Moist             | Do.                           |
| Peppers                     | 30. 9          | Unheated basement or room                       | 45° to 50°           | Moderately moist. | 2 to 3 weeks.                 |
| Potatoes                    | 30. 5          | Pit or in storage cellar                        | 35° to 40°           | do                | Through fall and winter.      |
| Pumpkins and squashes       | 29. 7          | Home cellar or basement                         | 55°                  | Moderately dry.   | Do.                           |
| Root crops (miscellaneous). | 31. 0          | Pit or in storage cellar                        | Near 32° as possible | Moist             | Do.                           |
| Sweetpotatoes               | 29. 0          | Home cellar or basement                         | 55° to 60°           | Moderately dry.   | Do.                           |
| Tomatoes (mature green)     | 29. 8          | do                                              | 55° to 70°           | do                | 4 to 6 weeks.                 |
| Fruits:                     |                |                                                 |                      |                   |                               |
| Apples                      | 29. 0          | Fruit storage cellar                            | Near 32° as possible | Moderately moist. | Through fall and winter.      |
| Grapefruit                  | 28. 1          | do                                              | do                   | do                | 4 to 6 weeks.                 |
| Grapes                      | 30. 5          | do                                              | do                   | do                | 1 to 2 months.                |
| Oranges                     | 29. 2          | do                                              | do                   | do                | 4 to 6 weeks.                 |
| Pears                       |                | do                                              | do                   | do                | See text.                     |

the day and dipped to 10° at night. If the minimum temperature at night, under conditions of normal air movement, was 8° for 5 or 6 hours, the storage-air temperature dropped to 30°. During a night of high wind velocity, however, a minimum of 12° cooled the cellar air to 30°.

Certain commodities such as sweetpotatoes, squashes, and tomatoes are injured by holding at low but nonfreezing temperatures. Temperature requirements for each crop and points at which the commodities freeze are shown in table 1.

### **Maintaining Proper Moisture**

Without proper moisture in the air the stored produce will shrivel, lose quality, and eventually become worthless. Fruits and vegetables vary in rate of moisture loss and for that reason the humidity requirements for each crop are discussed in later sections and are summarized in table 1.

Two principal means of maintaining proper humidity are as follows: (1) The use of water to raise the humidity of the storage air, and (2) the use of ventilated polyethylene bags and box liners.

Moisture can be added to the storage air by sprinkling the floor frequently, by placing large pans of water below the fresh-air intake vents, by covering the floor with wet materials such as straw or odorless sawdust, or by a combination of these. The methods mentioned, however, will not prevent shriveling of root crops. The use of polyethylene bags and box liners is the simplest and most effective means of controlling moisture loss in root crops and in certain other commodities. Bags can be tied and box liners folded over at the top, but neither should be sealed. A few holes of 1/4- to 3/8-inch diameter should be cut in the sides to permit ventilation.

## **Handling the Produce**

Produce intended for storage should be handled carefully at all times to avoid bruises and skin breaks. Special attention should be given to containers for harvesting and storing fruits and vegetables. Use only those containers with smooth inner surfaces. Protruding wire staples in baskets and hampers are especially damaging. Lightweight tub buckets and plastic-coated stave baskets (egg baskets) are good containers for use in harvesting. If the soil is sandy, the containers should be rinsed frequently to reduce skin breaks caused by particles of sand. The standard apple box and lug boxes used for shipping tomatoes, grapes, and nectarines are excellent storage containers. Slatted crates can readily be built from melon crates.

Remove all crushed, cut, or decaying specimens. If damaged

or infected produce is placed in storage, serious losses from decay are likely to occur.

Produce should have as little field heat as possible when put in storage. Harvest during early-morning hours or allow the produce to cool outside overnight to reduce temperatures in produce before storing.

Waxing vegetables for home storage is not recommended, although it has been done for several years on certain fresh products to improve appearance for sales purposes and to reduce moisture loss.

Apples and pears absorb odors readily and should be stored apart from vegetables. The flavor of celery is likewise spoiled if it is stored with cabbage or turnips. Storage requirements for each commodity are discussed in later sections and are summarized in table 1.

## Storage of Vegetables

A greater variety of vegetables than of fruits can be stored at home. The storage requirements of vegetables vary greatly, but there are natural groups which can be stored together, as indicated in table 1.

The secret of successful storage is to provide each commodity with the temperature, humidity, and ventilation needed to properly control moisture loss, maintain flavor, and hold decay to a minimum.

Conditions under which individual vegetables keep best are discussed in the following pages.

### Dry Beans and Peas

All kinds of dry beans and peas including lima beans and soybeans may be kept for home use by picking the pods as soon as they are mature and spreading them in a warm, dry place until they are thoroughly dry. If desired, the plants can be pulled and cured like hay after most of the pods are ripe. The beans then should be shelled and given one of the following treatments to protect them from destruction by moths and weevils:

(1) Refrigeration at 0° F. or below for 3 or 4 days is effective. The beans may be stored in the freezer if space is available. If they are removed from the freezer, however, they should not be stored in tight containers until the moisture from condensation has had a chance to evaporate.

(2) Subjection to oven heat of 180° F. for 15 minutes will kill all insect life present. As an added precaution, the beans should be allowed to remain in the oven for an hour after the heat has been turned off.

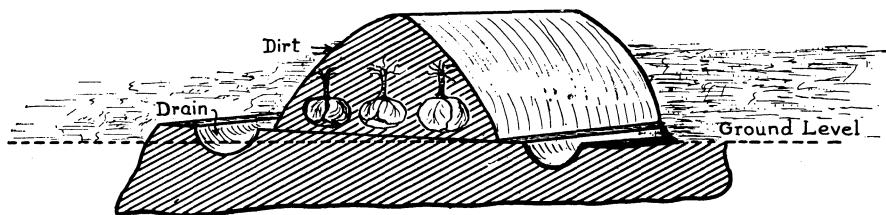
(3) Fumigation with carbon tetrachloride in plastic bags, metal drums, or glass jars is also effective. Two ounces of carbon tetrachloride for each 100 pounds of beans, or

one-eighth teaspoon per pound, is sufficient. Sprinkle the carbon tetrachloride over a cloth to increase the evaporation surface, and place the cloth in the container. Close the container tightly. Do the fumigating outdoors or in a well-ventilated room, and avoid breathing vapors of the fumigant or spilling the liquid on the skin. The fumigant will not injure the germination or palatability of the beans. After 48 hours the beans should be aerated. Air or cool the beans, as the occasion demands, in an insect-free area, and then place them in tight containers, such as plastic bags, glass jars, or cans, to prevent reinfestation by insects. Store the containers in a dry place.

### Late Cabbage

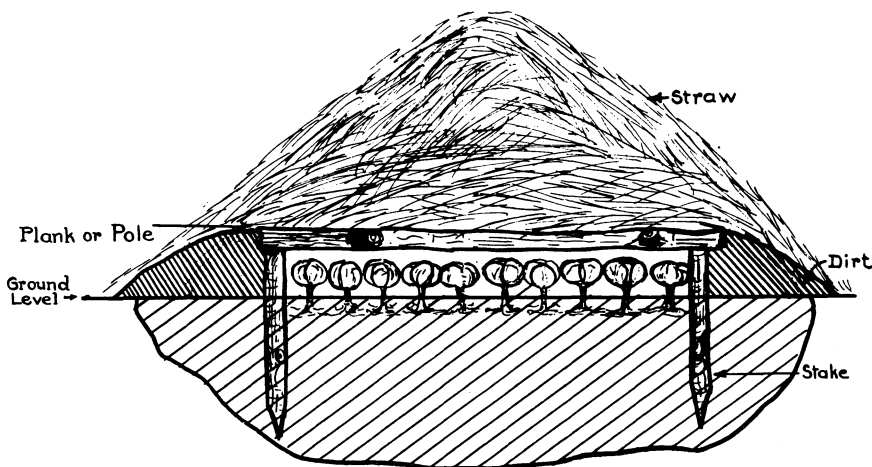
Heads of late cabbage may be stored in ventilated containers in outdoor storage cellars, or they may be placed in conical pits or long pits (fig. 5). The advantage of long pits over conical pits is that only a few heads may be removed from a long pit without disturbing the rest of the pit. When cabbage is stored in pits, it should be pulled out by the roots and the entire plant placed head down and covered with soil.

Another good way to store cabbage is to put it in a pit made of stakes and poles covered with straw (fig. 6). The plants should be pulled by the roots and set side by side, with the roots in shallow trenches. A frame about 2 feet high should be erected around the bed after the trenches have been filled with cabbages and the soil has been packed around the roots. The frame may be made of boards, poles, or of stakes driven into the ground. Soil should be banked around the frame, and poles should be placed across the top to hold the covering of straw, hay, or corn fodder.



HORT. 50368

FIGURE 5.—Cabbage stored in a long pit. This type of pit must be well drained. The soil covering for cabbage does not have to be so thick as the covering for vegetables that are more easily injured by frost.



HORT. 50369

FIGURE 6.—Cross section of a cabbage storage pit made of stakes and poles covered with straw.

Heads of cabbage may be laid in rows on shelves in an outdoor storage cellar but not in a storage room in the basement of a dwelling, as the odor is likely to penetrate through the house.

### Late Celery

Celery plants of late-maturing varieties may be stored for a month or more in the garden. A few inches of soil should be banked around the base of the plant at the end of the season, and the banking should be built up to the top of the plants before severe freezing is likely to occur. As the weather becomes colder, the ridge should be covered with straw or corn fodder held in place with boards.

Another method of storing celery is to dig a pit 10 to 12 inches wide, about 24 inches deep, and any desired length (fig. 7). Fully grown plants with considerable soil adhering to the roots should be closely packed in the trench. Celery should be watered as it is placed in the trench, and the trench should be left open long enough for the tops to dry off. Unless the soil is very dry at the time of storing or extended warm weather follows, it will not be necessary to water again. A covering for the trench should be started by setting a 12-inch board on edge beside the trench and banking the board with earth. A sloping roof of boards, poles, or cornstalks, from which the tops have been removed, should then be placed across the pit



HORT. 1365

FIGURE 7.—Trenches for storing celery. Plants are packed closely in the trenches, and a sloping roof is built for protection.

with one end resting on the upright board and the other end on the ground. A light covering of straw or other material that will pack closely should be spread over the roof, and the covering should be increased as the weather becomes colder. Celery stored in this manner will keep until late winter.

The unused pit of a permanent hotbed may be used as a storage place for celery by removing surplus earth and substituting a covering of boards for the sash. Celery should be packed in the hotbed in the same way that is described above for storing in a trench (fig. 8).

Celery may be stored on the floor of a storage room in the basement of a dwelling or in an outdoor storage cellar. For this type of storage the plants should be taken up just before freezing occurs, with considerable soil adhering to the roots. They should be set on the floor with the roots down and packed together

as closely as possible. If moderately moist, the celery will keep well for 1 to 2 months under the conditions found in most storage cellars. Celery should not be stored in a cellar with turnips or cabbage, as the celery will absorb the odor of these vegetables, and its flavor will be ruined.

### Endive

Endive placed in the storage cellar under the conditions described for cellar storage of celery will keep for 2 to 3 months. The leaves should be tied together to assist blanching.

### Onions

To keep well, onions must be mature and thoroughly dry. Onions with thick necks and those that have been injured will not keep and should be used immediately. Sound onions should be stored in well-



HORT. 50241

FIGURE 8.—Celery stored in a hotbed pit.

ventilated containers such as slatted crates or open-mesh bags. Good ventilation is essential. For proper ventilation half-filled bags should be hung on overhead hooks, and partly filled crates should be stacked on crossbars. A dry, well-ventilated place such as an attic or unheated room furnishes good storage space for onions; cellars are not recommended. Slight freezing does no harm, provided onions are not handled while frozen.

The home gardener will usually find that onions grown from sets are difficult to keep. A procedure recommended for storing onions grown from sets is to place them in a single layer, necks down, on poultry netting that is suspended in a cold, but nonfreezing place.

### **Parsnips, Salsify, and Horseradish**

Parsnips, salsify, and horseradish can be left undug in the garden.

Near-freezing weather for several weeks actually improves the flavor of parsnips. All of these crops can withstand freezing, but alternate freezing and thawing damages the roots. If they are to be left in the ground, they should be mulched lightly until outside temperatures are consistently low. The mulch should be removed to permit thorough freezing of the roots, and then they should be mulched deep enough to keep them frozen. These crops may be stored in the same manner as other root crops (p. 15).

### **Peppers**

Mature-green bell peppers can be kept in home storage for 2 or 3 weeks if properly handled. The firm, dark-green pods are best for storage. The pods should be gathered just before frost; they should be washed and sorted in groups according to maturity and firmness of pod. Moisture and temperature

requirements are very exacting for successful storage. A polyethylene liner with twelve to fifteen ¼-inch holes placed in a container such as a lug box is an excellent way to maintain high humidity. The temperature should be between 45° and 50° F. Serious decay can occur at 40° or lower in 3 weeks.

Hot varieties of peppers are easiest to store after they are dry. The plants can be pulled or the pods can be harvested and strung on strings to dry. When dry they can be stored in a cool, dry place such as that used for onions.

## Potatoes

Potatoes are such an important staple in our diet that they are usually grown and stored by home gardeners in greater quantity than other vegetables. The surplus at harvest requires proper handling to avoid extensive losses, especially in potatoes harvested during hot weather.

Early- and late-crop potatoes should be handled somewhat differently because of differences in temperatures at harvest time and because of the difference in length of storage. In either crop mature potatoes should be carefully dug and promptly removed from the garden, in order to avoid sun and wind injury, and prepared for storage. Only sound potatoes free of serious cuts and bruises should be stored. If late blight is present, digging should be delayed until the vines are dead and dry in order to reduce tuber infection. Diseased tubers should be sorted out and enough suspected ones cut to establish judgment.

Because high outside temperatures usually prevail when early-crop potatoes are dug, cool storage conditions are difficult to maintain. Every effort should be made to hold the tuber temperature down near 70° F. Excessive heat can be

avoided by early-morning digging. Potatoes actually benefit from holding 1 to 2 weeks at temperatures of 60° to 75° in moist air. This combination of temperature and humidity permits healing of skinned areas and of small cracks, and thus excludes decay. Decay is not likely to be a problem as long as storage temperatures can be held about 70° to 75°. Losses become serious, however, at temperatures of 80° or above. Potatoes remain dormant for about 2 months after harvest, and a storage temperature of 60°, if obtainable, would be ideal for a period of 4 to 6 weeks. Such a temperature, however, is usually not feasible during hot weather.

Spreading freshly harvested potatoes in windy or sunny locations to lose moisture prevents healing of wounds, and causes drying and discoloration of damaged tissues. Coating potatoes with hydrated lime is also a poor practice.

In the absence of cool storage cellars, early-crop potatoes, in many areas, can be left in the ground until fall and dug as needed. During late cultivation, soil should be thrown to the plants to form ridges. Potatoes handled in this way are protected from light, which causes greening, and the ridges afford good drainage. Holding potatoes undug is not advisable in areas with high temperatures and heavy rainfall because of decay.

Late-crop potatoes are better suited for long-term storage. The weather is usually cool at digging time, and storage temperatures are more easily controlled than during hot weather. The same precautions on care in digging and handling apply to the late crop as to the early one. The potatoes should be cured by holding in moist air at 60° to 75° F. for 1 to 2 weeks. Wounds do not heal at temperatures of 50° or below. After curing, and as soon as outdoor temperatures permit, the storage tem-

perature should be reduced to about 35° to 40° for winter storage.

Potatoes may be stored for several months in basement cellars, in outdoor cellars, or in conical pits. Potatoes require a moderate humidity, but moisture should not be allowed to collect on them. They should be stored in the dark to prevent greening of the skin, and ventilation should be provided to control the storage temperature.

Potatoes stored at temperatures of about 35° F. for several months tend to become sweet. This condition can usually be corrected before using the potatoes by holding them at a temperature of about 70° for a week or two.

### **Pumpkins and Squashes**

With proper care hard-rind varieties of winter pumpkins and squashes can be kept for several months in home storage. Only well-matured fruits that are free of insect and mechanical injuries should be stored. They keep best if a portion of the stem is left on in separating them from the vines. They should be harvested before frost.

Fruits for long-term storage benefit by a 10-day curing period at 80° to 85° F. If these temperatures are unavailable, the pumpkins and squashes should be placed near the furnace for curing. Curing hardens the rind and heals the surface cuts. Bruised areas and pickle-worm injuries, however, cannot be healed.

At the end of the curing period the fruits should be carefully moved to a dry, cool, well-ventilated place. All pumpkins and squashes are subject to chilling injury if held continuously at temperatures of 50° F. or below. At temperatures above 60° the fruits gradually lose moisture and become stringy. The most satisfactory temperature range, therefore, for long storage is about 55° to 60°.

Acorn squashes cannot be stored satisfactorily for more than 2 months. If cured for 10 days or if held at temperatures of 55° F. or above for more than 6 to 8 weeks, they turn orange colored, lose moisture, and become stringy. The dark-green color of this variety at harvest is an indication of succulence and quality. Dry storage at 45° to 50° is needed to retain the quality. The fruits can be kept in excellent condition at 45° and 50° for 35 to 40 days.

Damp places such as root cellars should not be used for the storage of pumpkins and squashes.

### **Root Crops (Miscellaneous)**

Root crops, such as beets, carrots, celeriac, kohlrabi, rutabagas, turnips, and winter radishes, should not be stored until late fall. These crops can withstand the autumn frosts and are better off in the garden until the nights are cold enough to permit proper storage temperatures. Root crops should be lifted when the soil is as dry as possible and immediately prepared for storage. The tops should be cut about one-half inch above the crown. If desired, the roots can be washed, provided the surface moisture is evaporated before they are stored. They should not be exposed to drying winds and should be cool when stored.

Root crops keep best at temperatures between 32° and 40° F., and require high moisture to prevent shriveling. Continued storage at 45° permits the roots to sprout new tops and to become woody.

Turnips and rutabagas give off odors and should not be stored in the home cellar or basement. They can be stored with other root crops and vegetables in the outdoor cellar or in a pit. Turnips may be left in the garden longer than most other crops. They can withstand hard frosts, but are injured by alternate freezing and thawing.

All other root crops can be stored together in the storage room or cellar. In order to supply moisture to retain crispness for a long period, bed the roots in layers of moist sand, peat, or sphagnum moss. Polyethylene bags and box liners with about four  $\frac{1}{4}$ -inch holes are useful for keeping roots crisp and are simpler to use than bedding. Roots can be stored in crates or boxes in moist air, but they gradually lose moisture and quality unless polyethylene liners are used.

Conical pits (p. 5) make excellent storage space for root crops in areas where they can be protected from freezing. Roots can be washed provided the surface water is evaporated before they are stored.

### **Sweetpotatoes**

Sweetpotatoes that are well matured, carefully handled, and properly cured can be kept until April or May at temperatures of 55° to 60° F. Because the roots are easily bruised and cut, they should be handled carefully at all times. Mechanical injury can be held to a minimum by handling sweetpotatoes as little as possible. Handling can be reduced by placing the roots directly in storage containers at harvest.

Freshly dug sweetpotatoes should be cured for about 10 days under moist conditions at 80° to 85° F. In the absence of better facilities the roots can be cured near the furnace. The storage crates should be stacked and covered with paper or heavy cloth to maintain a high humidity during curing. If the temperatures near the furnace are 65° to 75°, the curing should cover a period of 2 or 3 weeks, because the healing of wounds is slower at temperatures below 80°. At the end of the curing period the crates should be carefully moved to a cooler part of the basement or house where a temperature of about 55° to 60° can be maintained.

In houses without central heating, sweetpotatoes can be kept behind the cookstove or around a warm chimney. If handled in this way the roots should be wrapped in paper, to slow down temperature changes, and stored in boxes or barrels.

Sweetpotatoes are subject to chilling injury and should not be stored at temperatures of 50° or below.

Pits and mounds are not recommended for the storage of sweetpotatoes even in the warmer climates because the dampness encourages decay.

### **Tomatoes**

The supply of fresh tomatoes, if properly handled, can be extended in the fall about 4 to 6 weeks. Tomatoes taken from nearly spent vines are inclined to be of poorer quality and are more likely to decay than fruits from vines in the prime of production. Therefore, a crop should be planted late for this purpose. The duration of successful holding depends upon maturity, soundness, moisture, and holding temperature.

Tomatoes should be harvested just before the first killing frost. If, however, an unexpected frost occurs, tomatoes not damaged by freezing can be salvaged and ripened. In localities where the temperature is likely to range above 32° but not above 50° F., tomatoes should be harvested within 4 or 5 days after the onset of such temperatures to avoid chilling injury.

Fruit-laden vines can be pulled and hung up or clusters can be clipped from the vines but these methods of harvesting have no special merit. The most practical way to handle tomatoes is to pick the fruits and remove the stems to avoid their puncturing other fruits.

Fruits should be gathered, washed, and permitted to dry. Wiping the soil from tomatoes is

not recommended because it causes sand scarring, which may lead to decay. Tomatoes showing color should be gathered first and stored in separate containers from the green fruits. This reduces bruising injury and segregates the fruits that can be used first. The green fruits should be placed about one or two layers deep in shallow boxes or trays for ripening.

The most mature green tomatoes reach an eating-ripe stage at 65° to 70° F. in about 14 days. Ripening can be slowed down by holding the fruit at 55°; tomatoes should not be held below 50° for more than a few days. At 55° mature-green tomatoes require about 25 to 28 days to become ripe. Less mature fruits will require longer to ripen. An airy cellar or outbuilding where the temperature can be maintained

at about 55° to 58° is satisfactory for holding tomatoes. A room with moderately moist air is best. Too much dampness encourages decay, whereas if the room is too dry, the fruits, especially the more immature ones, will shrivel before they are ripe. Wrapping the fruits helps to slow moisture loss, but is not completely effective in a dry room. Polyethylene-film bags and box liners, if perforated, are excellent to prevent shriveling, but may increase decay.

Frequent observations should be made on temperature and moisture conditions. The tomatoes should be sorted at 7- to 10-day intervals to observe ripening and to remove the decayed ones. Handling and use can be facilitated at the first sorting by separating fruits that show color from those that are still green.

## Storage of Fruits

In general, fruits that can be stored keep longest at temperatures of 31° to 32° F. Only those fruits that mature late in the fall or that can be purchased on the market during the winter can be considered for home storage.

If a large quantity of fruits is stored each year, special storage facilities should be provided. Apples, grapes, and perhaps other fruits absorb odors from potatoes and certain other vegetables, and their flavor is impaired. Storing fruits and vegetables together, therefore, is not recommended.

### Apples

The length of time that apples can be kept depends on the variety, the maturity and soundness at harvest, and the storage temperature. For long-term storage, the temperature should be maintained as close to 32° F. as possible. The rate of ripening or softening of apples at a given temperature after harvest de-

pends on the variety. In general, apples ripen about four times as fast at 50° as at 32° and become overripe rapidly at 70° or above.

Apples can be successfully stored at home if the weather turns cold soon after harvest. In many sections, however, the temperatures remain moderate for a month or more after the normal harvest date of many varieties. Varieties such as Grimes Golden and Jonathan that mature in September cannot be kept long. Golden Delicious, Delicious, and Stayman will become overripe in 3 to 4 weeks if temperatures are not below 50°. Storage can be prolonged, however, by storing late-maturing varieties such as Yellow Newtown (Albamarle Pippin), Winesap, Arkansas (Mammoth Black Twig), and York Imperial.

The best storage facilities are cellars that can be cooled by frosty night air in the fall and eventually maintained at low temperatures (preferably 31°–32° F.) until early spring. Apples can be stored by

various methods so long as they are protected against freezing (28° to 30°) and shriveling. For example, when the days and nights are cold, apples can be stored in insulated boxes in outbuildings, in hay in the barn, or in strawlined pits or sunken barrels. These methods of storage, however, will not protect the fruit against freezing if the temperatures remain below 10°. If apples are stored in pits, the fruits should be covered with straw and then paper to keep them dry.

Apples should be mature but hard when picked, and red apples should be well colored. They should be free from insect and mechanical injuries. Fruits having glassy spots in the flesh, known as "water core," should not be stored.

Apples require moderately moist air to prevent shriveling. Perforated polyethylene bags and box liners are useful to prevent shriveling of all varieties, especially Grimes Golden and Golden Delicious. The film should not be sealed or tied and should have about ten to twelve ¼-inch holes to permit proper aeration and to maintain a desirable humidity. If the humidity is too high, decay is encouraged, especially if the temperature is much above 32°.

Home storage affords a real opportunity to have good eating apples. For best results each variety should be ripened and eaten at its peak of quality. Avoid storing apples too long. Store late keepers for late use.

## Citrus Fruits

Citrus fruits can be purchased to advantage at wholesale prices and may therefore be a desirable addition to the home storage. The fruits are available during the season when home storage can be used,

and they can be stored in the fruit cellar for short periods, where the temperature should be kept as close to 32° F. as possible, but not freezing.

## Grapes

In northern sections where the crop matures as outside temperatures are approaching 32° F., it is possible to keep grapes for a month or two, provided they are free of decay and are fully ripe. They should be stored in a cold, moderately moist place. Grapes absorb undesirable odors and should be stored alone or in the fruit cellar. Among the varieties produced in the East, Catawbas have the best keeping quality, but other varieties can be kept satisfactorily under the conditions just described.

## Pears

For proper flavor and texture, pears must be ripened after harvest. Pears should be picked when fully mature, but still hard and green. The change in skin color from deep to pale green is a guide to proper maturity. Bartlett and Kieffer pears are usually ripened immediately after harvest at 60° to 65° F. and are canned or preserved. Two or three weeks are required for a variety such as Kieffer to ripen. Bartlett pears ripen faster than the Kieffer variety.

Pears for long-term storage should be mature green and be held as near 32° F. as possible. They can be stored with apples or stored under similar conditions. The fruits should be free of defects and be cool when placed in storage.

If pears are stored too long or at too high a temperature or if the temperature for ripening is too high (75° F. or above), they break down without ripening.

## Summary of Storage Recommendations

Following is a brief summary of recommendations. Most of these have been discussed in greater detail in the text.

Fruits and vegetables should not be stored together because certain ones absorb undesirable odors.

All of the fruits recommended for home storage can be stored together and keep best at 32° F.

Bell p e p p e r s, pumpkins, squashes, sweetpotatoes, and tomatoes are injured by low but non-freezing temperatures and should be stored as recommended.

Cabbage, turnips, and rutabagas should be stored separately because of the undesirable odors given off. All other vegetables that keep best near 32° F. can be stored together, but care should be taken to provide the proper moisture for each product as recommended. Table 1 is a general guide for storing fruits and vegetables.

Dairy products and eggs readily absorb odors and should not be stored in the same space as fruits and vegetables.

### Other Publications of the U.S. Department of Agriculture Relating to Home Storage of Vegetables and Fruits

Storing Perishable Foods at Home. The Yearbook of Agriculture, 1959. (For sale by the Superintendent of Documents, Washington 25, D.C., for \$2.25 a copy.)

\*Use of Concrete on the Farm. Farmers' Bulletin No. 1772.

\*White Potato Storages for New Jersey, Long Island, and Southeastern Pennsylvania. Marketing Research Report No. 70.

\*Storage of Sweetpotatoes. Farmers' Bulletin No. 1442.

\*Free copies are available from the Office of Information, U.S. Department of Agriculture, Washington 25, D.C.

