

Harvesting  
*and*  
Handling  
**CULTIVATED  
CRANBERRIES**

U. S. DEPARTMENT  
OF AGRICULTURE  
FARMERS'  
BULLETIN No. 1882

**C**ULTIVATED cranberry harvesting, storage, preparation for market, and distribution are described in this bulletin as carried on in best commercial practice.

Special emphasis is laid on the effect of different practices on the reduction of losses due to spoilage of berries between harvest and consumption.

This bulletin supersedes Farmers' Bulletin 1402, Cranberry Harvesting and Handling.

are often picked during warm weather and need to be cooled promptly. The rooms are held at a temperature of 39° to 40° F., with the air well humidified and circulated. The fruit is not sorted before storage. Three seasons of operations have demonstrated a marked reduction in shrinkage from shriveling and in rot development in storage; both the tender varieties and the early picked fruit can be held in prime condition for either the Thanksgiving or the Christmas market.

The value of cold storage at the bog will undoubtedly prove greater in the districts where temperatures may be high during the picking season than in the cooler regions. It is not possible to cool stored cranberries by ventilation alone much below the mean prevailing outdoor shade temperatures.

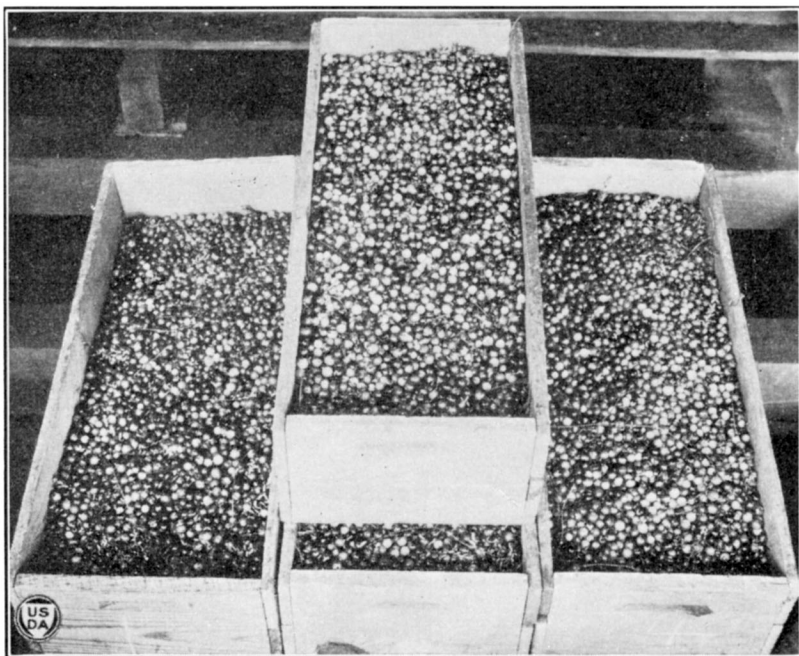


FIGURE 12.—Type of storage crate used for cranberries by some New Jersey growers.

Berries to be canned are sometimes held for a year or more by being frozen quickly and stored at a temperature of 12° to 18° F. They suffer practically no deterioration and are canned immediately after being thawed. This lengthens the operating season of the canneries and enables them to apply part of a large crop to consumption the following year, when the crop is likely to be much smaller.

#### Ventilation

Experiments have shown that cranberries may actually be smothered by being stored in too close containers, especially at high temperatures; also that partial smothering may result in increased loss

consin, and the Pacific Northwest). For the most part these differences have arisen because of local climatic and other environmental conditions. A detailed first-hand study of successfully-operated bogs in the chosen locality is recommended as an essential first step in starting a new cranberry development.

### TIME OF PICKING

The cranberry harvest usually starts the first week in September and extends through October in the milder cranberry regions. The three main factors that determine the time of picking are fruit maturity, size of the crop, and the relation of weather to harvesting operations.

Cranberry varieties differ from one another in the date of ripening and in the degree of maturity at which the fruit should be picked for the best results in storage. For example, the Early Black, which is one of the first varieties to ripen in the regions where it is grown, becomes overripe in storage and deteriorates in keeping quality if picked too mature. The Howes variety is one of the latest to ripen and keeps better the later it is picked, but at the same time colors satisfactorily in storage if picked slightly underripe. The McFarlin, important in Wisconsin and the Pacific coast sections, is a late-ripening variety that must be fully colored when picked, as it usually fails to take on additional color in storage. The Searls, an important midseason variety in Wisconsin, colors fairly well in storage, but keeps better if allowed to mature fully on the vines. Other less important varieties have similar characteristics that govern the optimum picking stage of maturity.

In Massachusetts and Wisconsin, and to a lesser extent in New Jersey and Pacific coast section, the approach of freezing weather definitely limits the time available for harvesting the crop. In addition, damaging frosts may occur occasionally in Massachusetts and frequently in Wisconsin during September, and they sometimes occur before the end of the harvest season in the other two cranberry sections. Even a small percentage of frosted berries in the crop may cause great trouble and expense, as the frosted berries not only must be separated from the sound ones, but, unless this is done immediately after the crop is gathered, the sound berries become sticky and dirty and their value is greatly impaired. Frozen mature berries, however, are acceptable at canning factories if harvested and delivered promptly.

On many cranberry bogs frost damage is prevented by means of flooding, the water being raised in the vines as high as may be necessary to ward off the impending frost. The United States Weather Bureau, and in Massachusetts and New Jersey the State Cranberry Experiment Stations, furnish special frost warnings for the cranberry regions. Even so, the grower is not relieved of the responsibility of making a careful study of frost conditions on his own property.

Acute danger of frost on exposed areas, scarcity of labor, or extended periods of rain during the harvest period may at times make it impracticable to harvest all the berries at just the proper stage of maturity.



## METHODS OF HARVESTING

### HAND PICKING AND SCOOPING

Cranberries were first gathered by hand. In the Pacific coast cranberry section the greater part of the crop is still hand-picked, whereas in New Jersey approximately one-fourth of the crop is harvested in this manner.

Picking tools have been developed and harvesting consequently made easier and more rapid, until now in Massachusetts and Wisconsin hand picking is rarely practiced except in the case of young vines and on small areas.

The advantages of hand picking are that when carefully done fewer berries are left in the bog and the vines are torn up less than when "scoops" or "rakes" (tools for mechanical picking) are used.



FIGURE 1.—Harvesting cranberries with scoops of the eastern type.

A recent 4-year comparison of the two methods in New Jersey showed that an average of 11 percent of the berries were missed in hand picking as against 17 to 20 percent in different scooping methods. Under some conditions, as high as 30 percent were missed by the scoopers. During the same period, the productivity of the scooped plots decreased 6 percent as compared with the hand-picked plots. These figures, although applying specifically to New Jersey conditions, nevertheless serve to emphasize the seriousness of the losses incurred in both methods of harvesting. Despite its greater harvest loss, scooping has largely displaced hand picking because it requires less labor and the berries can be harvested in a shorter time at a lower cost. The illustration on the title page shows hand pickers at work and figure 1 scooping as practiced in Massachusetts.

Figures 2 and 3 illustrate the commonest types of scoops used at the present time in eastern cranberry sections and in Wisconsin,

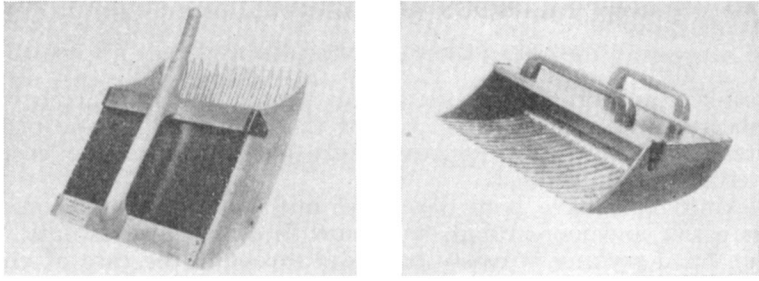


FIGURE 2.—Cranberry scoops used in eastern cranberry sections.

respectively. The “eastern” scoop is properly used from the kneeling position, the teeth being pushed forward into the vines and the berries stripped from them by rocking the scoop backward on its rounded bottom. The Wisconsin scoop, or rake, is used from the standing position, being pulled from right to left in a long stroke, with the teeth dipping into the vines at a slightly forward angle. In both methods the vines are drawn in one definite direction and should be scooped in the same way year after year in order to train the vines to lie in this direction and to prevent tangling.

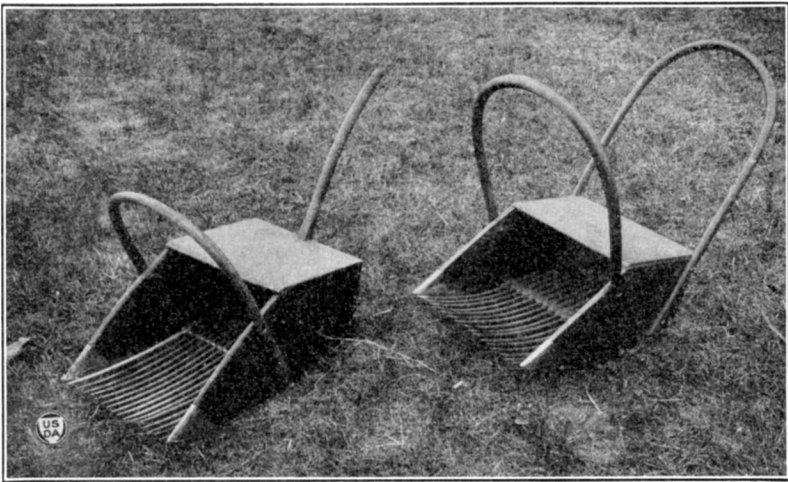


FIGURE 3.—Cranberry rakes used in Wisconsin.

So many factors enter into the cost of harvesting a particular crop, such as prevailing wage rates, individual efficiency of pickers, condition of vines, size of crop, general management, etc., that figures on the cost of harvesting can only serve as a very rough estimate at best. In Massachusetts, for example, a foreman, 15 scoopers, and 2 helpers may be considered an average harvesting crew for a 15-acre bog, and with a normal crop the harvesting cost may be expected to amount to about 70 cents per barrel. In contrast to this, hand picking may cost \$2.50 or more per barrel in the Pacific coast cranberry section. Scoopers pick from two to many times as many berries

per day as hand pickers. Hand pickers are almost invariably paid by the measure, scoopers more frequently by the hour.

As ordinarily harvested, cranberries should be picked only when the vines are perfectly dry. Experiments have shown that they generally do not keep well if picked wet. In Massachusetts, picking is not started in the morning until after the dew has dried from the vines.

#### WATER RAKING

Water raking is practiced only in Wisconsin, where the prevailing low humidity and drying winds make it possible to dry the berries in a short time. In this method of harvesting, a shallow flood is put on the bog, and the berries are raked off as they float on or near the surface of the water (fig. 4). A modified form of the Wisconsin rake is used for picking.

Water raking almost completely eliminates harvesting losses and at the same time reduces vine injury to a minimum. Under favorable drying conditions the crop can be harvested more rapidly than by any other method, although it is doubtful whether the total

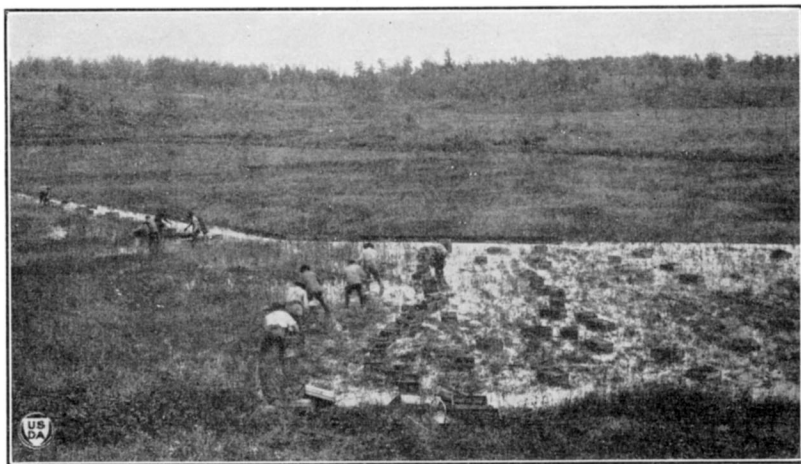


FIGURE 4.—Water raking cranberries in Wisconsin.

harvest cost is less than dry scooping because of the extra handling and equipment required. The chief disadvantage of the method is its effect on keeping quality. All carefully controlled experiments made so far have shown that water raking has led to an increase in the amount of rot as compared with dry raking. Nevertheless, considerably more than half of the Wisconsin crop is now water-raked, and its increasing use indicates that the growers have found that the advantages of water raking under Wisconsin conditions outweigh its admitted disadvantages.

Small flooding sections are a distinct advantage in water raking, as the berries then need be kept in water only a short time. The sections should never be larger than can be harvested in one day by a picking crew of the size ordinarily employed. Only cool water should be used. Experiments have shown that well-colored berries

keep better than immature ones when water-raked. Drying should be under the direction of a competent assistant, as it is extremely important to have the berries thoroughly dry when placed in the storage house, and those lots that are slow in drying because of unfavorable weather or other conditions should be kept separate in order that they may be watched for possibly impaired keeping quality.

Two systems of drying are in current use. In one, the berries are spread thinly in drying crates just as they come from the bog, the crates are stacked loosely in an exposed position, and the berries are left undisturbed until dry. In the other, most of the vines and trash are removed from the berries before drying by means of wire screens or revolving canvas belts. The berries dry much more rapidly with the debris removed but are subjected to additional handling at increased labor cost. The crate most commonly used for drying berries is 2 feet square and 4 inches deep and has two sides and the bottom made of lath (fig. 5). Cleats on the bottom edges hold the crates apart when they are stacked for drying. The drying crate also serves for storing the berries.

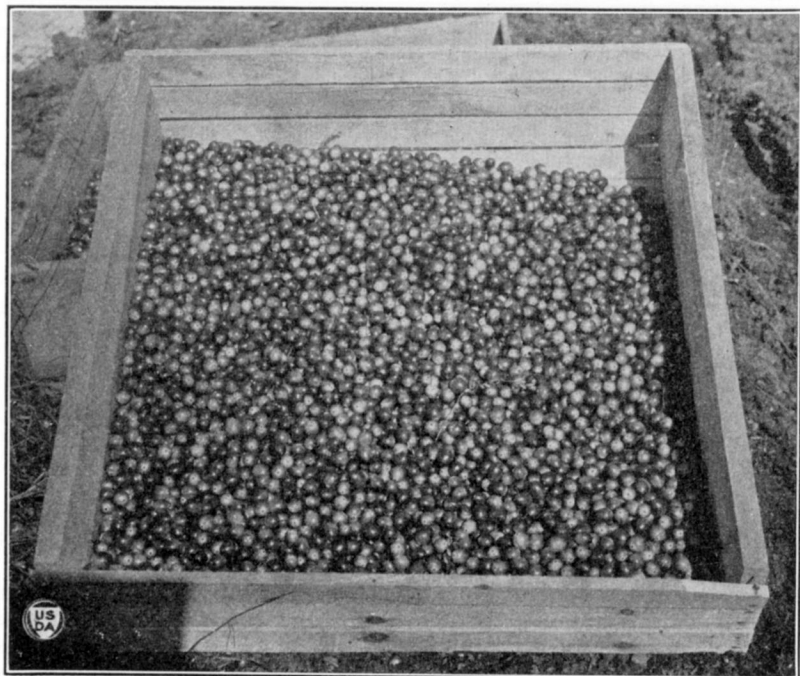


FIGURE 5.—The Wisconsin drying and storage crate.

#### POWER PICKING MACHINES

Many attempts have been made to develop a power picking machine. The most successful one so far developed, illustrated in figure 6, was invented in Massachusetts, and has been in use on a few bogs there for about 15 years. It is still in the experimental stage. Some bog owners who have used this machine claim that it is capable

of picking cranberries as cleanly and with as little injury to the fruit as a high-grade scooper and that it leaves the vines in better condition than any other dry-picking process.

#### GATHERING BERRIES LEFT BY PICKERS

On page 2 the statement was made that from 10 to 30 percent of the berries may be missed by the pickers when the bog is dry-picked. It is possible to salvage many of these berries by flooding the bog after picking and scooping up the so-called "floaters" that rise to the surface. Such fruit will not keep well in storage or shipment, but, when properly cleaned and used immediately it is not of inferior quality. Prior to 1930, dropped berries were not commonly recovered except when market conditions were exceptionally favorable. The recent rise of the cranberry canning industry has provided an outlet for their immediate disposal, and the salvage of floaters has become a general practice on New Jersey bogs where sufficient water is available for flooding. Special procedures have been developed to increase the efficiency of the practice.

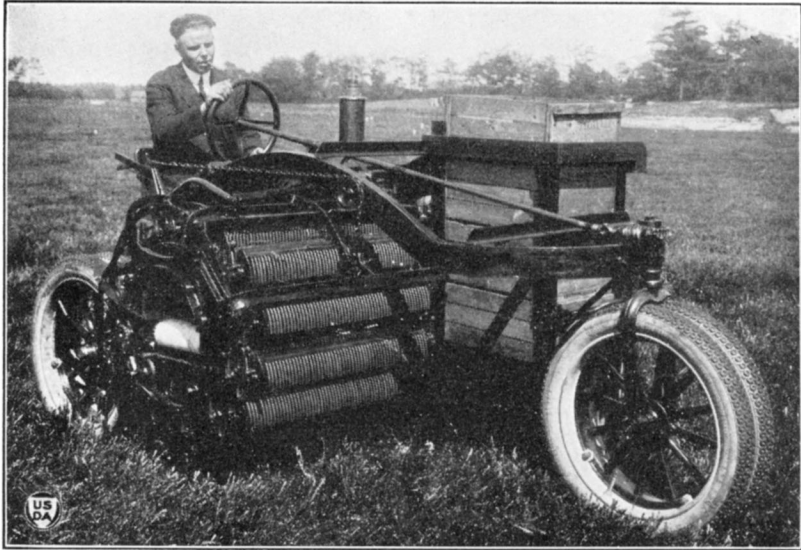


FIGURE 6.—Cranberry power picking machine.

Part of the dropped berries rise to the top of the water as soon as the bog is flooded. Many others can be loosened by agitation or movement of the water, which is accomplished by various methods. Flat-bottomed boats are commonly used, either pushed by hand with a rocking motion of the ends, or propelled by shallow-draft paddle wheels or by air propellers mounted above the decks. One type of boat has two large, horizontal boards which are forced alternately up and down in the water. The boats are moved back and forth over all parts of the bog. Limited investigations indicate that from 50 to 90 percent of the dropped berries can be raised by these methods.

The floating berries, mixed with leaves and other debris raised from the floor of the bog, are carried to shore by the wind and are

dipped from the water with large, long-handled skimmers. They are placed in boxes and hauled to the sorting house or cleaning machine, where they must be cleaned and dried as soon as possible. One method is to run the wet berries through separating machines, over the belt where they are hand-sorted, and finally over a wide, slow-moving, perforated delivery belt, where a blast of warm, dry air removes the water and leaves them in shape for the cannery. Other growers use a special cleaning machine which consists essentially of a wide canvas belt running upward at an angle of  $45^{\circ}$  and over triangular pulleys, which give it a flapping motion. The wet mass is poured into a hopper, from which it runs onto the belt near its lower end. Loosened by the motion of the belt, the berries roll down to the boxes at the base, and the debris is carried up and dropped over the upper end of the belt. The clean berries are then placed in shallow trays for drying, after which they are sorted in the usual way and disposed of at once.

#### TRANSFERRING BERRIES FROM BOG TO STORAGE HOUSE

Scooped berries are usually picked in lug boxes similar to those shown in figure 7. The filled boxes must be carried from the bog directly over the vines. When the distance to the nearest roadway is too great for carrying the boxes by hand, wheelbarrows or various

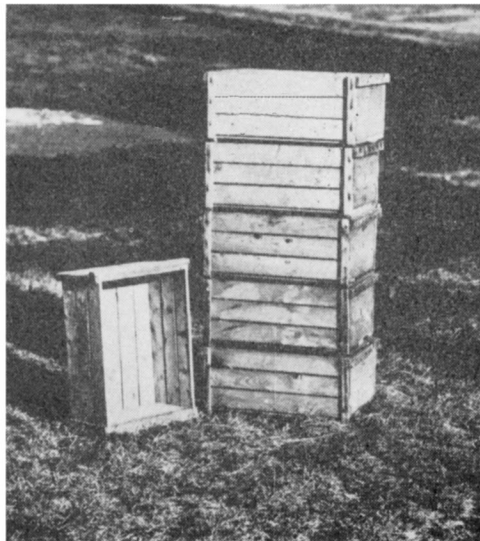


FIGURE 7.—Common type of box used in Massachusetts for picking and storing cranberries. Its usual dimensions are about  $19\frac{1}{4}$  by  $14\frac{1}{2}$  by  $8\frac{1}{2}$  inches, inside measurements.

types of carts are employed, preferably fitted with pneumatic tires to reduce injury to vines (fig. 8). Scooped berries are usually stored in the boxes in which they were picked. Hand-picked berries are generally gathered in smaller measuring boxes, one of about 1-peck capacity being commonly used, from which the berries are emptied into storage crates, preferably after removal from the bog.

Water-raked berries are picked in boxes similar to that illustrated in figure 9, and, after being carried or hauled on flat-bottomed boats



to the dam or roadway, are there transferred to drying crates (fig. 5) or are taken to an upland field for drying. As the berries are spread thinly to hasten drying, they must be handled once more when the boxes are filled for storage.

Trucks are being increasingly used to haul the filled storage boxes to the storage house, although wagons, cars on tracks (fig. 10), and even boats in some cases, are still employed.



FIGURE 8.—Pneumatic-tired wheelbarrow for taking filled boxes of cranberries to the road.

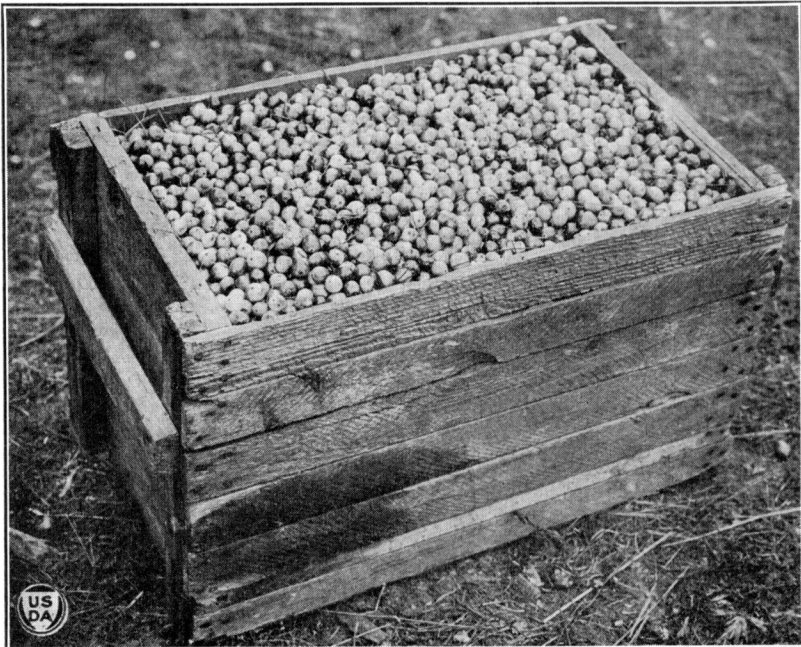


FIGURE 9.—Common type of cranberry picking box used in Wisconsin. Its size is usually about  $18\frac{1}{2}$  by  $11\frac{1}{4}$  by 13 inches, inside measurements.



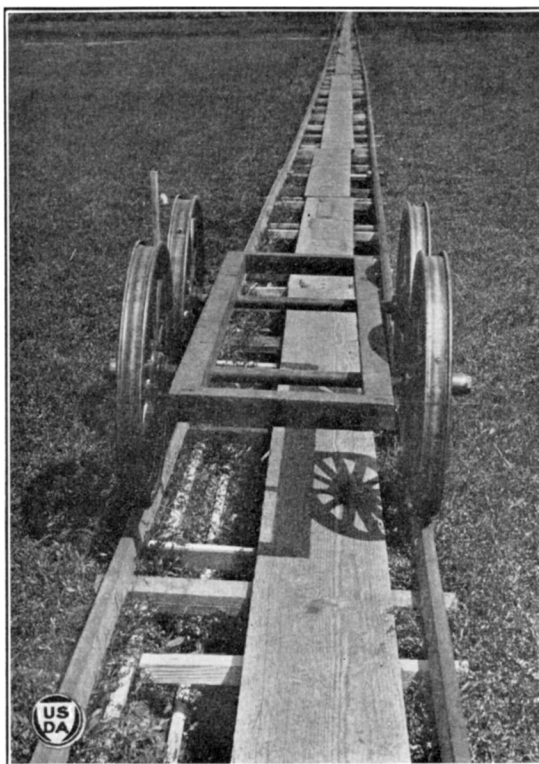


FIGURE 10.—Track with car to take boxes of cranberries from the bog to the storage house, Ilwaco, Wash.

Constant care should be taken not to injure the vines more than can be helped while removing harvested berries from the bog, and the cranberries should be handled carefully to avoid unnecessary bruising and should never be left exposed to the sun. They should be taken to the storage house as quickly as possible after they are picked, especially on hot, clear days, when the freshly picked berries will be even warmer than the surrounding air.

## STORAGE

### THE STORAGE PROBLEM

Most cranberries are held in storage at the bogs for periods varying from a few weeks to several months. Like other fresh fruits, the harvested berries are living organisms and can be kept in good condition only as long as normal living activities continue. The berries are also subject to decay by fungi, to freezing, and to shrinkage resulting from evaporation and respiration. The storage problem is to provide an environment that will delay the natural decline of the fruit as long as possible and reduce the losses from decay to a minimum. In general, the same measures favor both these ends.

### IMPORTANCE OF SPOILAGE IN STORAGE

The annual loss from cranberry fruit rots has been estimated to amount to at least 25 percent of the total crop. A large part of this loss from rot, practically all except that developing in New Jersey, occurs after the berries are picked.

Cranberries are cleaned just before they are shipped. In those lots of fruit having a high percentage of spoilage, not only is the direct loss in quantity of berries much larger, but the cost of the operation itself is greatly increased.

Even though the decayed berries may all be removed at packing time by the highly efficient methods in use, poor storage conditions may have weakened the fruit to such an extent that serious spoilage is likely to develop in transit and on the market. Such spoilage is more important than that which develops in the storage house, as it involves the further charges of rejections, adjustments, remilling, and most serious of all, the disastrous effect on the demand.

### RELATION OF FIELD CONDITIONS TO SPOILAGE IN STORAGE

Experience has abundantly proved that the crops from certain bogs, or even parts of the same bog, show, over a period of years, markedly better keeping quality than those from other locations. A somewhat comparable condition exists as regards the crops of different years. In certain seasons the keeping quality of the crops from an entire State is so good that storage and market losses are of minor importance even though the berries are not handled in the best possible manner, whereas in other seasons the berries give trouble in spite of the best care in handling and storing the crop. The causes of such variations in keeping quality are not well understood at the present time. They are obviously related to the complex environment in which the plants are growing, and to the effects of seasonal weather conditions both on the plants themselves and on the fungi that are responsible for subsequent rot in storage.

It is scarcely necessary to point out that efforts to control storage losses should be intensified on those bogs known to produce berries of consistently poor keeping quality. Whether or not special methods of control, such as those mentioned in the following section, are desirable as regular practices on bogs that as a rule produce berries of fair to good keeping quality can be determined on a cost-profit basis only after actual experience.

### REDUCTION OF LOSSES IN STORAGE

#### Field Practices That Affect Keeping Quality

The fungi that cause most of the decay of cranberries in storage are not common molds that attack ripe or injured fruit of other kinds, but are chiefly fungi peculiar to the cranberry and related plants, and that usually gain entrance to the fruit when it is on the vine. Naturally, then, there is a relation between keeping quality and field practices. The cultural practices that are generally recognized as influencing the keeping quality of cranberries are spraying, late holding of winter flowage, June reflows, and the use of fertilizers.

Repeated experiments and the experience of certain growers over a long period of years indicate that proper spraying with bordeaux mixture not only reduces field rot when present but improves the keeping quality of the berries provided they are harvested dry. In practice, however, spraying is largely confined to New Jersey, where field rot is most common, and to the Pacific coast section.

Although no controlled experiments have been made on this point, a definite relation between the amount of fruit rot and late holding of winter-flowage water seems to be well established for Massachusetts. In that section it is usual to remove the winter-flowage water during April. In bogs planted to early varieties that are subject to early rots, marked improvement in keeping quality often follows holding the winter-flowage water as late as May 15 or even June 1, 1 or occasionally 2 years out of 3. These observations apply only to Massachusetts. In New Jersey, where losses from decay are more serious than in other sections, it is customary to hold the winter-flood water until about May 10. The term "late holding" in that State is applied to maintaining the winter flowage on low-yielding bogs until July for the purpose of controlling certain bog weeds and insects and strengthening the vines by giving them a 1-year rest from fruit production. This practice does not seem to affect adversely the keeping quality of the fruit produced the following year.

Certain insects can be controlled inexpensively by applying a full flood, termed a "reflow," for a short time early in June, before the cranberry flowers open. Investigations indicate that this reflow aids the distribution of fungi and the infection of buds, and experience has shown that in New Jersey this method cannot be followed year after year without danger of increasing field and storage rots beyond control.

On certain soils now planted to cranberries the addition of fertilizer is necessary to produce satisfactory vine growth and yields. It is, however, agreed by all who have studied this problem that excessive applications of fertilizers, particularly those containing nitrogen, result in the production of fruit of poor keeping quality.

#### Careful Handling

Bruising tends to increase the amount of rot in a given lot of berries. The increase is, of course, greater in berries of the so-called "fancy" varieties and in those lots that are most subject to decay. The possibility of bruising enters into every operation from picking to packing the fruit, and precautions should be taken constantly to reduce it to a minimum.

#### Temperature Control

Storage tests and studies of the temperature relations of the rot fungi agree in showing that the higher the temperature to which cranberries are subjected the more rapid the break-down of the fruit and the greater the loss from decay. Although it is true that the end rot fungus,<sup>1</sup> which is the most important cause of cranberry

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<sup>1</sup> *Godronia cassandrae* Peck.

storage rot, is able to grow somewhat even at 32° F., there is decided advantage in keeping the fruit as cool as practicable throughout the entire process of harvesting, sorting, shipping, and selling provided the berry temperature does not go below its freezing point, which averages between 27° and 28°.

If cranberries could be picked on the cooler days and in the late afternoon in order to avoid very hot weather their keeping quality would be better, but the time of picking is determined chiefly by the practical necessity of getting the berries harvested in a relatively short time. The best that can be done usually is to cool the berries as promptly as possible and to keep them cool in storage.

Cooling after picking is greatly facilitated by protecting the berries from the sun from the time they are picked until they are hauled to storage and by the use of ventilated crates in storage. Further cooling of the berries after they are placed in the storage

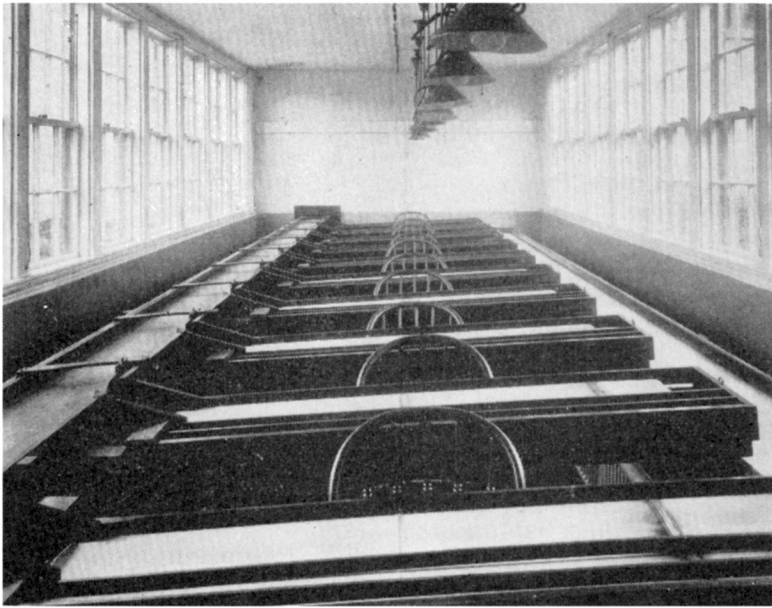


FIGURE 11.—A modern cranberry sorting room at Tremont, Mass. The berries enter the room on a belt at the left and leave on a belt at the right. The screeners pick over the fruit as it passes across the room on the short belts. Separating and packing machinery are in separate rooms at the rear and in front, respectively, of the sorting room.

house presents some difficulties because the berries are small and thus leave only small air spaces. The storage crates should be so piled as to permit free circulation of air. In general, the better the ventilation in the storage house the more rapidly the berries will cool.

The temperature of storage houses can be reduced somewhat during the fall months if care is taken to keep the doors, windows, or ventilators closed during warm days and open at night and on cool days. Although it is not practicable to maintain uniform tempera-

tures in cranberry storage houses, every effort should be made to keep the temperature as low as possible and especially to avoid so marked a rise in the temperature of the air surrounding cold berries as to cause a condensation of moisture on their surfaces. This wetting of berries in storage (usually referred to by the trade as "sweating") has long been known to increase the spoilage of cranberries.

To prevent sweating and warming of the berries it was formerly necessary to sort or screen them in cold rooms during the winter months. The introduction of moving belts for sorting, however, made possible the modern system in which a warm, well-lighted screen room is provided for the hand sorters. The berries are passed through it so quickly that they do not become appreciably warmed, and the separating machinery at one end of the belt and the packing at the other end are both outside this room and in much lower temperatures. Figure 11 shows a screening room. This plan is now generally followed in the construction of new houses, and many houses have been rebuilt to permit this arrangement.

### Cold Storage

Up to the present time the use of cold storage has been confined mostly to terminal storage of shipped berries during temporary gluts in the markets. In the past few years, however, experiments designed to examine the possibilities of bog cold storage have been carried out by both the Massachusetts Agricultural Experiment Station and the United States Department of Agriculture. Although the experiments have been made on only a small scale and much still remains to be learned, some of the fundamental temperature responses have been fairly well worked out and are presented here.

Fungus rots can be materially reduced by storage at lower temperatures. In tests with different varieties from different regions, the most favorable storage temperatures have been variously reported as 35°, 36°, and 40° F.

At temperatures below 35° F. fungus rots can be almost completely suppressed, but a low-temperature break-down may reach proportions equaling or exceeding the spoilage at higher temperatures, especially in lots stored as long as 4 months.

When exposed for a short time to higher temperatures corresponding to ordinary market conditions, berries removed from favorable low temperatures do not break down more rapidly than those stored in the usual manner.

If fruit is screened before storage, sufficient spoilage usually develops in 2 months even at the most favorable temperature to require its recleaning before it is sent to market.

The color and general appearance of ripe berries are best at 36° and 40°, whereas the color tends to become darker at higher temperatures. However, partly ripe berries colored up much better at 45° to 50° than at temperatures either above or below these.

It appears improbable that the fresh-fruit season can be extended much beyond its present limits by the use of cold storage.

One grower in New Jersey has installed at his bog a modern cold-storage system with a capacity of 8 carloads of fruit. Here he places his "fancy" varieties, and his early ripening berries, which

# HARVESTING AND HANDLING CULTIVATED CRANBERRIES

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## IMPORTANCE OF HARVESTING AND HANDLING METHODS

**P**ROPER harvesting and handling of the cranberry crop are essential if a first-quality product is to be placed on the market. Successful marketing of the cranberry crop depends first of all upon favorable consumer demand. It is generally agreed among cranberry-marketing agencies that the quality of the fruit placed on the markets is one of the principal factors affecting the demand. Consequently, both in producing and in harvesting and handling the crop, it is to the interest of the grower to utilize those methods that experience has proved are most likely to insure a high-quality pack. In most cases, methods that serve this end also tend to reduce losses while the berries are in the growers' hands.

This bulletin describes in some detail the methods and equipment now used in harvesting, storing, cleaning, and marketing cranberries. Such methods are, of course, gradually but constantly undergoing change for the dual purpose of improving the ultimate market quality of the fruit and reducing preventable losses. For this reason the relations existing between handling methods and market quality are stressed throughout the discussion, and attention is focused on the magnitude and sources of losses inherent in each operation. Where procedures are not standardized, the advantages and disadvantages of alternative methods are presented in detail.

The prospective grower is warned, however, that cranberry culture is not only a highly specialized industry in itself, but that there are many important differences between the methods followed in the four chief cranberry growing sections (Massachusetts, New Jersey, Wis-

from decay. Provision for ventilation should be incorporated at every stage of cranberry handling.

#### Storage Crates

Various types of storage crates are used in the different cranberry-growing regions. Figures 5, 7, and 12 show common types used in Wisconsin, Massachusetts, and New Jersey, respectively. The Wisconsin type is used to some extent in the Pacific coast section. Half-barrel shipping boxes are sometimes used for storage purposes. All types of storage crates have the common feature of slatted bottoms or sides to allow for better ventilation of the berries.

#### Storage Houses

As is the case with so many cranberry problems, the construction of storage houses that will most adequately and economically meet the growers' needs varies greatly with local conditions. In the moderate climate of the Pacific coast cranberry section, the most cheaply constructed building that will keep out the rain serves admirably as a storage house. In Wisconsin, low temperatures frequently occur before the berries are shipped, and in the building of storage houses adequate provision must be made against freezing (fig. 13), but the

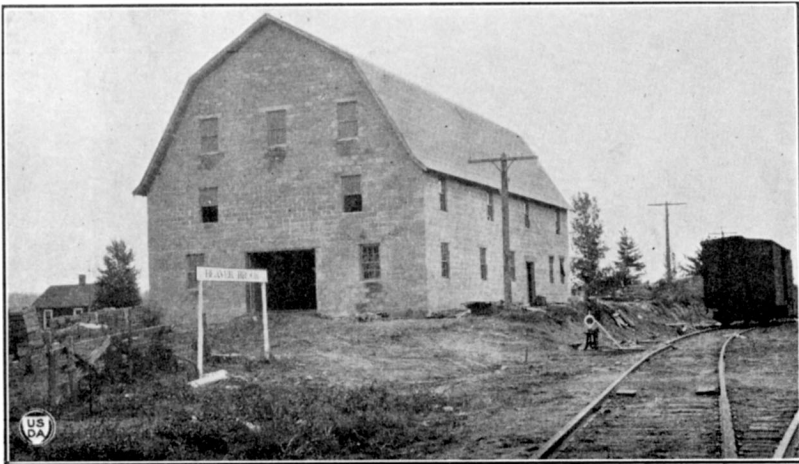


FIGURE 13.—Cement-block cranberry storage house, Beaver Brook, Wis.

need of special provision for ventilation is not so great as in warmer regions. In New Jersey, low temperatures occur only late in the storage season, and little special provision may be required to prevent freezing, except for late-held fruit. Because of high temperatures in September and October, however, adequate ventilation is of first importance, and the value of cold storage should be more thoroughly explored. In Massachusetts the designing of storage houses presents some of the problems of both Wisconsin and New Jersey. Temperatures during September are frequently high, necessitating provision for good ventilation. On the other hand, there



are frequently many berries in storage in December, when low temperatures are often encountered, and an adequately insulated house is necessary to prevent freezing. All things considered, these needs are best met by a well-constructed house that has thick walls and is provided with ventilators that can be opened or closed as the temperature demands (fig. 14).

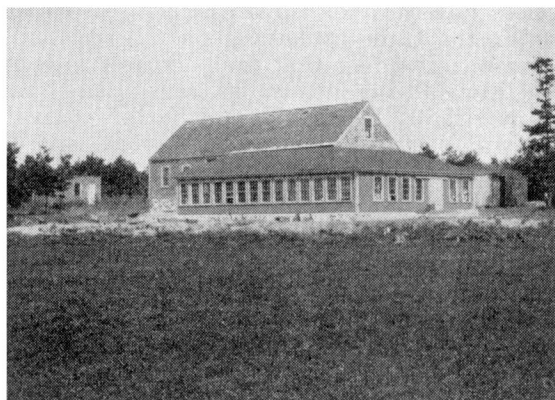


FIGURE 14.—A frame-construction cranberry storage house in Massachusetts. The sorting and packing rooms are shown in front of the main building in this view.

As already noted, a very desirable feature in the construction of any storage house is an arrangement that will permit the room in which the hand sorting of berries is done to be walled off from the storage space itself so that this room may be kept comfortably warm for work without raising the temperature of the berries in storage.

Storage-house capacity is determined to some extent by local marketing practices. In Wisconsin, for example, the shipping season begins some weeks after the harvest is completed; hence the storage house must be designed to hold the maximum crop produced on the marsh. In Massachusetts and New Jersey many berries are sent to fresh-fruit markets and to canneries before the end of the harvest season, so that storage houses need have a capacity of only about two-thirds of the maximum crop.

Before designing a new storage house, it is highly desirable for the cranberry grower to make a careful study of the houses currently in use, particularly those in his immediate vicinity.

## PREPARING CRANBERRIES FOR SHIPMENT

### SELECTION OF FRUIT

The separation of the fruit into distinct classes begins when it is placed in the storage house. The varieties should, of course, be kept separate and any mixed or poorly colored berries held and shipped separately.

On almost any large cranberry property in Massachusetts or New Jersey the fruit from certain sections frequently shows keeping

quality inferior to that of the general run of the crops. Experienced growers know these sections, and the berries from them are always stored and packed separately. Some growers even keep separate all berries harvested along ditches, the so-called "ditch rows," as they sometimes show inferior keeping quality.

It was formerly considered wise to market lots recognized to be of inferior keeping quality as soon as possible. This practice is open to question, however, for three distinct reasons: The bad impression made on the trade by having poor berries on the markets early in the season; the fact that temperatures late in the season are lower, which tends to reduce rot in transit; and the fact that if the berries are held late, those rot fungi that are active early in the storage season will often have done their work, and the resulting lot of cranberries, while smaller, will actually be of better shipping

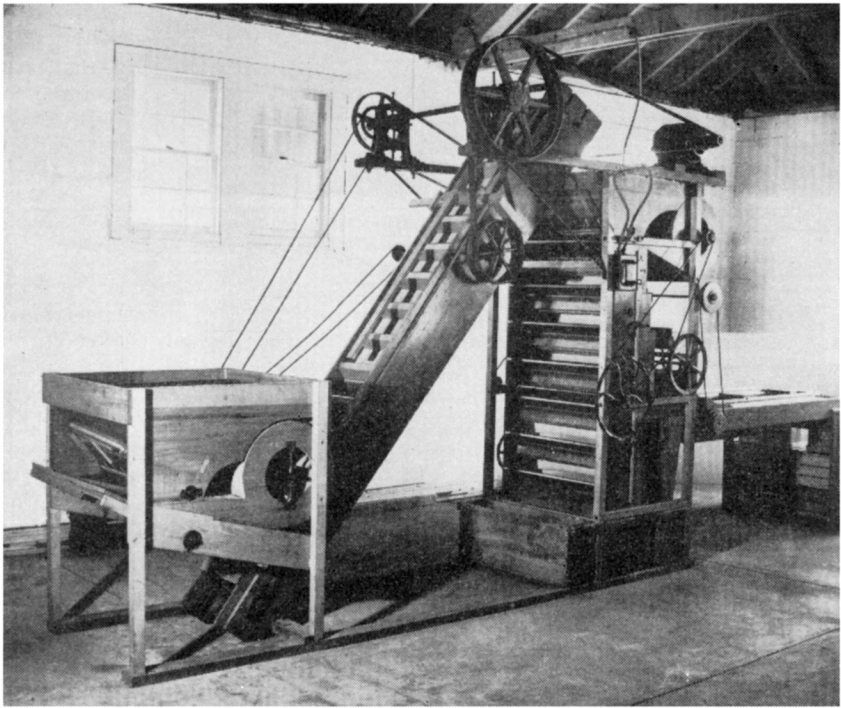


FIGURE 15.—A cranberry separator, with auxiliary blower and berry elevator in front.

quality than could have been packed early in the season. Loss from decayed berries is much less serious if taken by the grower in the form of shrinkage in storage than if it comes back to him in the form of claims for damages.

Berries known or suspected to be of poor keeping quality may be withheld from the fresh-fruit market and sent to canning factories before much spoilage develops.

## SEPARATING MACHINES

Berries as they come from the bog are mixed with vines, leaves, and weeds, as well as a few small or immature berries. Modern separating machines remove the trash completely, take out most of the soft berries, and grade out the small berries, which are henceforth known to the trade as "pie" berries and supply a distinct demand. With certain varieties in Wisconsin the berries are further separated into two grades on the basis of size.

Several types of separating machines operating upon somewhat different principles have been developed. Figure 15 shows the type of separator most generally used at present. Berries are poured over a wire screen at the top of a hopper, which holds back the

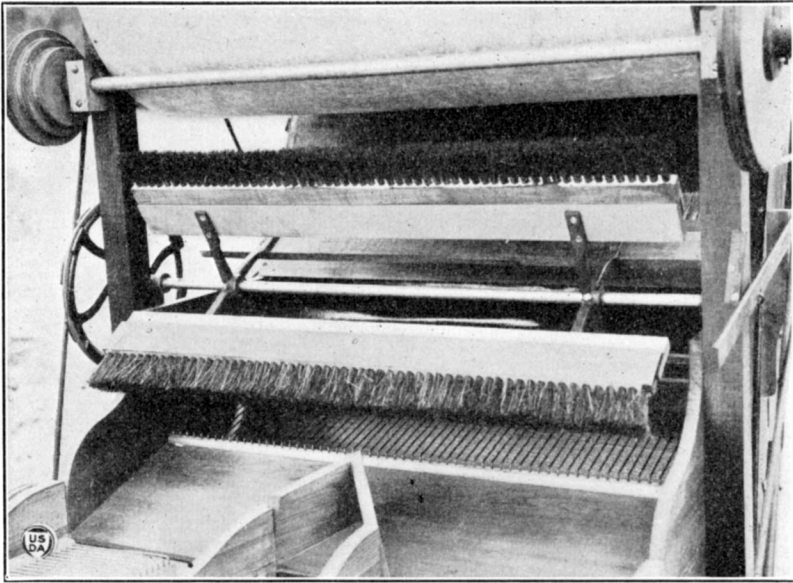


FIGURE 16.—Grading device for removing small or "pie" berries. The small berries fall between the wires. The revolving brushes keep the wires from clogging.

coarser vines and weeds. From the hopper the berries are passed before a blower, where all remaining leaves and rubbish are removed.

The blower may be mounted directly above the separator, or it may be placed on the floor nearby, as illustrated in figure 15, and the berries carried to the top of the separator by an elevator. In either case the berries are next dropped over a series of inclined bounding boards arranged step-fashion. Here the soft berries are removed, the separation being effected on the principle that sound berries bounce freely, jumping over a barrier, whereas the soft berries drop without bounding and are collected in boxes at the bottom of the machine. From the bounding boards the sound berries pass over a wire grader, as shown in figure 16, where the "pie" berries are graded out, and then go on to the moving belt for hand sorting.

## SCREENING EQUIPMENT

For many years the hand sorting of cranberries was done on wooden frames 6 to 8 feet in length, 3 or 4 feet wide at one end, and narrowing at the other to the width of a barrel top. The bottoms of these frames were composed of slats spaced about one-fourth inch apart, which resulted in their being universally referred to as "screens." The hand sorting of cranberries has thus come to be referred to as "screening," and the term is in general use throughout Massachusetts and New Jersey, although wooden screens have practically disappeared.

The hand sorting of cranberries is now almost universally done on moving belts, which carry the berries from the separator through a warm sorting room and on to the packing room. The screeners sit beside these belts and remove decayed or green berries (fig. 11). It is highly desirable to have the speed of both the separator and the screening belt under rigid control, as the amount of hand sorting required varies considerably with the condition of the berries.

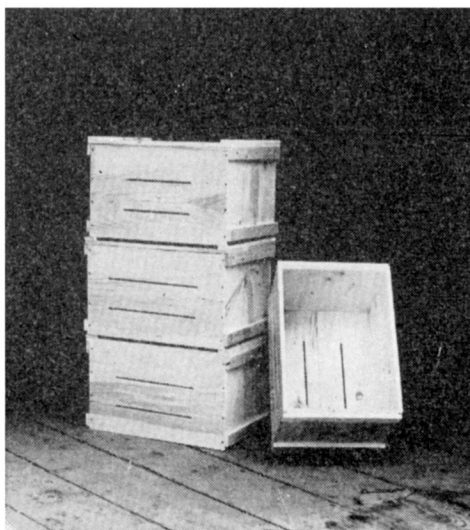


FIGURE 17.—Quarter-barrel boxes for shipping cranberries. Note slits for ventilation in sides and bottom.

There are in use in New Jersey several modifications of the delivery belt that carries the fruit from the hand sorters to the packing room. One example is a wide, slow-moving perforated belt so equipped that a current of dry air can be passed upward around the berries to remove any moisture. Another accessory is a series of soft brushes under which the fruit is carried by the moving belt and which remove any visible spray residue that may be present and leave the berries with a high polish.

### PACKAGES

The unit measure of cranberries is a standard barrel established by an act of Congress effective July 1, 1916. This law fixes such dimensions as to produce a barrel with a content of 5,826 cubic inches. The cranberry barrel is no longer manufactured, having been superseded by boxes that are both more attractive and more satisfactory for keeping cranberries. The trend has been toward smaller shipping packages. The first box was of one-half barrel capacity, but at

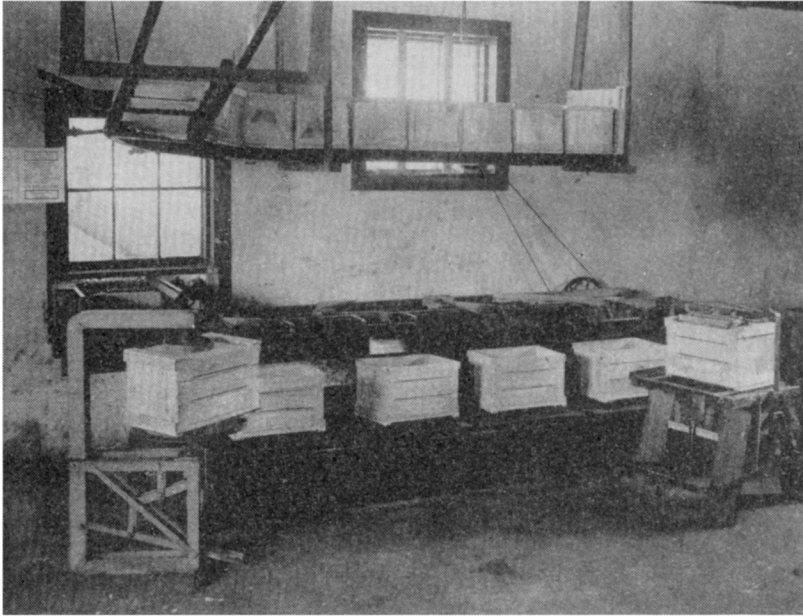


FIGURE 18.—A modern cranberry packing room at Tremont, Mass., showing the end of the belt coming from the sorting room, box-filling devices, standard shipping boxes, box shakers (small platforms on which boxes are placed during filling and which are constantly vibrating to shake down the pack), and two types of box headers.

present most of the crop is shipped in quarter-barrel boxes and an eighth-barrel box is used to some extent. Cranberry boxes are usually made of a good grade of white pine, and the tops, bottoms, and two sides have slits for ventilation (fig. 17).

### PACKING

It is of considerable importance to fill boxes tightly when packing for shipment. Almost invariably the first act of a consignee upon receipt of a lot of cranberries is to shake the boxes vigorously to detect whether any of them rattle. The significance of "rattling," of course, relates chiefly to shrinkage caused by the development of rot in the boxes; slack packing consequently arouses immediate prejudice in the mind of the consignee. Various mechanical shaking devices and box headers are used to insure a tight pack (fig. 18).

## BRANDS

Most cranberries, practically all the commercial crop except lots "mixed" as to variety or lots of poor color or doubtful carrying quality, are sold by brand. Although some growers still sell independently and have their own brands, the brand is usually established by a cooperative selling organization and is used by all its members.

In determining the brand of a given lot of cranberries, variety, size, color, and condition are considered. For example, a particular brand might indicate cranberries of the Early Black variety, at least 90 percent colored, not over 130 to the half-pint cup, and of a quality to pass inspection after being 15 days in transit to market. There would be several other brands for other grades of Early Blacks, and a similar series for other varieties.

In the case of the larger sales organizations the brand of each lot of fruit is determined by an inspector appointed and paid by the company. The official duties of inspectors are confined to determining brands, deciding on the lots best fitted for long shipments, checking up on packing operations, and reporting conditions to the company manager. In actual practice, however, these inspectors have served effectively to educate growers to better methods of handling and packing and to keep selling agents in touch with the growers. In many cases they have been the best means of contact between growers and State and Federal investigators, and in several instances they have initiated investigations and suggested improvements in practices.

## MARKETING THE CROP

### WHERE CRANBERRIES ARE SOLD

Although cranberries are produced commercially in only a few States and about two-thirds of the entire supply comes from eastern Massachusetts, they are sold throughout the United States. The Middle West and the Pacific Coast States have long consumed cranberries freely, and more recently the Southern States have bought increasing quantities. A carlot freight rate on cranberries shipped to the Southern States was first established in 1909, and since that time, partly as a result of national advertising, the demand from these States has steadily increased. Canada consumes regularly more cranberries than it produces, but European consumption is as yet small.

### THE MARKETING SEASON

Traditionally the cranberry is associated with Thanksgiving. Cranberry sauce is as truly a part of the American Thanksgiving dinner as plum pudding is part of an English Christmas dinner. As an inevitable result, the packing and shipping season rises to a peak in early November. A second peak, caused by the Christmas and New Year's demand, occurs early in December. Early in September there are heavy shipments of the Early Black variety, especially from Massachusetts, to supply the fall demand. In a normal year all berries are sold by February or early March.

## HOW CRANBERRIES ARE SOLD

### Agencies

Although some large cranberry growers still market their own crops and many owners of small bogs consign their crops to commission merchants, the bulk of the cranberry crop is sold through cooperative growers' organizations. The cranberry industry is outstanding in this respect in the United States, not only in the proportion of the crop so handled but in the long-continued stability of its sales organizations. The history of cooperative organizations for the sale of cranberries dates from before 1900 in Massachusetts, New Jersey, and Wisconsin. The conspicuous success of these sales organizations is no doubt due in part to the highly specialized nature of the cranberry industry, but it is also a result of the high character, loyalty, and integrity of the members.

The largest cooperative selling organization is the American Cranberry Exchange, with member companies in each of the three most important cranberry sections, Massachusetts, New Jersey, and Wisconsin. In both Massachusetts and New Jersey, however, there are other cooperative sales organizations competing with the Exchange, and in the Pacific coast cranberry section there is a similar organization.

### Plan of Distribution

The importance of quality in the successful marketing of cranberries is thoroughly appreciated by those who control the sales organizations. To an extent possibly unequaled in any other extensively grown fruit or vegetable crop in the United States, the marketing of cranberries is purposefully directed to reduce the losses from decay in transit and on the market.

For the long-distance shipments to western and southern points through the warm weather of September and October the very best berries of the Early Black variety from Massachusetts and New Jersey are selected. The large-sized (so-called "fancy") varieties, many of which are tender and of inferior keeping quality, are marketed chiefly during the early part of November, when the approaching Thanksgiving market guarantees their quick sale. The entire Wisconsin crop, much of which consists of large-sized varieties, is sold at this time. In general, the doubtful lots are sold on nearby large markets or sent to canneries. The late market is supplied almost exclusively with the Howes, which is the last important variety to ripen and has good keeping quality.

For many years the decision as to the fitness of a given lot of berries for long shipment was made by local inspectors largely on the basis of the appearance of the fruit at the time it was packed and on the known keeping record of berries from the particular bog. Although the inspectors and their associates have made an enviable record in handling the problem of selection, a well-recognized weakness of the system has been the untenable assumption that appearance of berries at the beginning of the shipping season can be taken as an indication of future storage and shipping behavior. To supply the need for a more accurate forecast of keeping quality, an incubator



test has been developed, in which representative samples of berries are subjected to a relatively high temperature for one week early in the fall. As used for several years in Massachusetts and Wisconsin, the incubator test seems to indicate weaker lots with a high degree of accuracy. The results of incubator tests are now regularly used in planning the distribution of the crops of these States.

### CANNING

The canning of cranberries has increased rapidly during recent years, until now approximately 25 percent of the crop is canned annually. This new industry offers a profitable outlet for the disposition of fruit of excellent eating quality but poor carrying quality. The advantages of keeping this "weak" fruit off the fresh-fruit market are obvious. In addition, canneries can make profitable use of "pie" berries, which are sound but small in size; of mature berries that have been frozen; and of lots of mixed varieties. Although these berries would not bring a high price on the market, they are of good quality for quick consumption or canning.

Several large canneries are controlled cooperatively by cranberry growers. At the time of the large crop of 1937, pressure on the fresh-fruit market was greatly relieved by the purchase of large quantities of cranberries by the canning industry for immediate and future use.

