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AGRICULTURAL EXPERIMENT STATION
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Circular of Information No. 104

December 6, 1934

VEGETABLES IN COLD STORAGE

by

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Various vegetables have from time to time been placed in the cold storage plant of the Department of Horticulture for marketing later on in the fall season. Observations have been made of the shrinkage and condition of those crops during the storage period.

The following details regarding each crop are derived from these observations, which should be of interest to dealers and handlers of vegetables having cold storage facilities and who are in the habit of holding vegetables in storage for some length of time.

Materials and Methods. In the case of each vegetable which was stored harvesting was done when the crop was in the proper state of development and care was taken to keep each product from being bruised or injured. Fresh vegetables only were used and they were put into storage as soon as possible after harvesting.

The cold storage plant was operated at a range of temperature varying from 38 to 42 degrees. During some periods of the night when the plant was not operated, the temperature may have been a few degrees above 42°F. At no time, however, were the vegetables stored in danger of being frozen due to temperatures being below 32°. The average relative humidity was about 90 per cent.

Peppers. The fruits were green and solid when stored in early October and were kept in storage for 27 days. The average temperature maintained in the storage room was from 38 to 42 degrees F. For the first two weeks the loss in weight of the fruits was 5 per cent. During the second two weeks there was an additional loss of 2 to 6 per cent, making the average total shrinkage in weight for almost a month's storage about 9 per cent. A few fruits were a little wrinkled due to shrinkage, but all were salable. Peppers will keep well for at least one month in cold storage if the fruits are solid and carefully handled when placed in the storage room.

Celery. The lots of celery were divided into those which had the leaves or the tops of the celery partly trimmed, while other bunches were untrimmed. Still other lots were washed or unwashed respectively. The unwashed celery is here called "rough".

The period of storage was 14 days. The average loss in weight of the rough trimmed was 10 per cent, that of the rough untrimmed 19 per cent. Some bunches of the rough trimmed celery showed as little loss as 7 per cent. Again, some of the rough untrimmed lost only 10 per cent. The leaf trimming toward the top of the plant evidently reduced the total amount of shrinkage. There was a noticeable evidence of less wilting of the several bunches which were trimmed.

In the celery which was washed and trimmed or untrimmed, as the case might be, the average loss of the celery which was washed and trimmed was 9 per cent, the lowest and highest losses being 5 and 15 per cent respectively. The celery which was washed but untrimmed lost an average of 15 per cent with variations between 10 and 21 per cent. There was a general disposition on the part of the washed and trimmed bunches to be less wilted at the end of the storage period than the washed and untrimmed celery.

Eggplant. This vegetable requires extreme care in being handled for storage due to the readiness with which it is bruised. Eggplants are more difficult to keep for any length of time in cold storage than most vegetables due to the presence of rots and molds which soon begin to decay specimens that may have been only slightly bruised. If the fruits are placed on dry sawdust or excelsior, they will have a tendency to be less bruised and should keep longer. The storage loss during 26 days was not great, averaging 4.5 to 5 per cent. After the two weeks all the fruits were still in good condition and marketable. One fruit was slightly soft, but it was still edible. The loss in weight was uniformly between 2.5 and 3 per cent. During the next 12 days all the fruits were in good condition but one which had two bruises. The total shrinkage loss for the 27 days was 4.6 to 5.6 per cent. In lot No. 2 of egg plant the shrinkage varied from 4.5 to 6.0 per cent. The specimens were in good condition and evidently the soundest fruits at the beginning of the storage period showed the least shrinkage.

Cauliflower. Success in keeping cauliflower in cold storage for any length of time depends largely on the maturity and character of the head. There is a general disposition for the cauliflower leaves or "jacket" surrounding the head to turn yellow and drop off during storage even though the "curd" still remains in good condition. Cauliflower heads should be in a proper state of development for storage, preferably immature rather than over-mature. The heads should be compact, fresh, sound, and free from bruises and blemishes. If in such condition they will keep well for over two weeks. The average shrinkage loss during such a period varied from 5 to 7 per cent. During a storage period of 18 days the shrinkage was from 9 to 13 per cent, but the heads kept nicely for that period of time although there was a noticeable change in the color of the jacket leaves.

Cantaloupes. Fruits in a proper degree of maturity and which are firm and sound are capable of remaining in good edible condition for three weeks according to trials made. Under the same conditions, however, some fruits became too soft for sale after ten days, while other fruits were firm and in fine condition. The salability of melons after a period of storage is dependent upon their maturity and freedom from bruises when first handled. During a period of 21 days the average loss was uniformly 6 to 7 per cent with most of the specimens firm and salable. These figures were confirmed by several lots of melons stored at different times. Successful storage of cantaloupes then involves careful handling to prevent bruises which may develop later into rot. There is comparatively little loss due to shrinkage in weight.

Tomatoes. Field grown tomatoes which are handled with care keep well in cold storage and lose but little weight. The average shrinkage loss was 2 per cent during a period of 26 days. There is but little disposition for any coloration of fruit during this time. Care must be taken after storage to keep the fruits from being exposed to high temperatures, otherwise they will "sweat" readily and quickly break down.

Cabbage. The period of storage during which observations with cabbage were made varied from 24 to 48 days. For the first half of the storage there was a shrinkage loss of 4 to $4\frac{1}{2}$ per cent and up to 48 days an average loss of 10 to 11 per cent, the variation being from 6 to 20 per cent. Solidity of heads to be stored is essential. They should also be carefully handled even though they are solid.

Root Crops. As a general rule, carrots, beets, and other roots do not adapt themselves to cold storage, at least at the temperatures maintained in these tests. They should be kept preferably under conditions where there is more moisture coming directly in contact with the roots themselves, such as in outdoor earth storage, or in a root collar in which they can be buried in moist sand or soil. There was a wide variation between the moisture loss of individual roots. Tests made with carrots showed as high a loss after three weeks as 22 per cent. Some roots were unmarketable after two weeks and showed a loss of 18 per cent. In order to keep roots free from heavy shrinkage it is necessary to have the temperature uniformly at 32°F. or slightly below this figure.

Summary

1. Vegetables may be kept successfully in cold storage for varying periods of time depending on the kind of product stored, the temperatures maintained in the storage place, and the condition of the product when put away.
2. The tests mentioned in this circular involved the storage of eight vegetables which were kept in a storage room having a temperature of 38 to 42° F. and a humidity of 85 to 90 per cent.
3. In storing vegetables at these temperatures there is a certain moisture loss resulting in more or less shrinkage and also losses due to rots and molds which attack specimens which are bruised or blemished.
4. Specimens of vegetables which are in the proper state of development, and which are sound and free from blemishes and bruises, keep the longest in cold storage and have the least total shrinkage. It is undesirable to attempt to successfully store unsound specimens. It was apparent in these tests that the most profitable specimens to be held in storage were first-grade, carefully handled products in good condition and free from defects. With these specimens the shrinkage was smaller and the period of possible holding was considerably longer than otherwise.

COMPARATIVE LOSS IN WEIGHT OF VEGETABLES
HELD IN COLD STORAGE

Percent
loss

