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CHAPTER 48

CITRUS FRUIT STORAGE

Harvesting and Packing; Coloring or Sweating; Lemon Storage; Temperature and Humidity Control; Air Cleaning and Ventilation; Air Distribution; Grapefruit Storage; Refrigeration of California Navel and Valencia Oranges; Storage of Packed Oranges; Limiting Storage Factors; Precooling; Equipment Selection; Air Distribution; Load Calculations; Transportation

THIS chapter applies specifically to California and Arizona citrus fruit. In general, it applies also to citrus fruit from Florida and Texas. However, there are some problems connected with the latter which require special treatment and, therefore, the reader should consult competent authorities (in the various states) such as the State Agricultural Experiment Station, or the U. S. Department of Agriculture.

HARVESTING AND PACKING-HOUSE HANDLING

Proper picking and handling of citrus fruits in the orchard and packing-house involve many operations that have been continually improved for more than 50 years. The packing-sheds of the early days have been replaced by well designed and substantially constructed packing plants. These are now equipped with modern machinery for handling the fruit in a careful and economical manner. The art of good handling has gradually changed from a strictly laborious task to one involving scientific knowledge and technical skill. In general all citrus fruits require the greatest care in handling to prevent mechanical injury, excessive deterioration, and decay.

Picking

In California citrus fruits are harvested throughout the year. Picking is largely in the hands of the packing associations, and is performed by trained crews. It has been found that the associations can organize and perform the work efficiently, and also adapt picking policies to the market situation better than the growers.

Special wooden field boxes with tight bottoms are provided to prevent the entrance of orchard dirt. These are kept in repair and free of rot residues, dirt, litter, splinters and protruding nails. Canvas picking sacks of the closed-mouth type, holding approximately a half box of fruit, are now commonly used. Clippers of special design are used and ladders are provided for picking fruit beyond reach. Gloves are required during picking to avoid finger nail injuries to the tender rind.

Picking is discontinued when trees are wet to avoid green-spotting due to oil liberated from the rind. Whenever possible, picking should be discontinued for a period of several days following severe hail or wind storms, or after excessive frost or heat damage has occurred, to allow healing of injuries and to give time for evidence of damage to appear so that when picking is resumed better grade separation is possible.

The fruit is cut from the stem just above the button. When lemons are picked two cuts are required; one with a short length of stem attached, the second close to the button. Much attention is paid to the quality of work performed and inspection is maintained to avoid long stems, clipper cutting

of the rind, and pulling. Cutting of the lemon button should be avoided.

Lemons are picked by the aid of rings designed for the purpose of selecting fruit of proper size. The rings are usually of nickeld steel with a smaller loop of the same material added to help in holding. They are held in the palm of the left hand, the middle finger being thrust through the supporting loop, and are tried on lemons that appear to be of proper size. If the lemon has grown to sufficient size so that the ring will not slip over, it is taken from the tree.

In Florida, and to some extent in California and Arizona, bulk handling of citrus fruit using field carts, bins or baskets is gradually replacing field boxes because of the economy of operation. Savings of 5 to 7 cents per box for field operations and 2 to 3 cents per box for packing-house operations are not unusual. Changeover costs are amortized by savings in 5 to 10 years under normal conditions.

Packing-House Handling

In the packing-house, citrus fruits are prepared for shipment by a number of carefully directed operations which are varied to suit the variety or quality of the fruit and market requirements. The general aim is to keep deterioration and decay to the minimum and prepare the fruit in an attractive manner. Wherever necessary throughout the packing-house, gloves are worn to protect the fruit. All parts of the packing-house are kept clean and sanitary. Mold spores and wet rots are not allowed to contaminate work room floors, storage rooms, or equipment; all decaying fruit is hauled promptly to a disposal point far removed from the packing-house.

After the fruit is received at the packing-house, it is washed by means of a mechanical washer. Each washer is provided with a soaking tank from 20 to 30 ft long through which the fruit is floated before passing into the washer itself. All decay that has developed in the field boxes since picking is removed before the fruit enters the soaking tank. Some tanks have submersers 10 to 15 ft long to immerse the fruit during the soaking period. It has been found that complete immersion is necessary both to facilitate cleaning and to give the maximum mold control treatment. A solution of soap for cleaning purposes, and usually also a mold retardant to control decay, are used in these tanks. Sometimes a separate tank immediately following the washer is used for the mold control treatment. If fruit is smudge-stained due to orchard heating, kerosene or a solvent emulsion is added. A wash water temperature from 115 to 120 F is maintained to assist in cleaning and to aid in the control of many diseases, particularly brown rot. To avoid liberating oil from the rind and causing green-spotting and decay, it is usually necessary to hold lemons on the packing-house floor for 24 to 72 hr prior to washing. The washer itself