PACKING SWEET CHERRIES TO REDUCE TRANSIT INJURY

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Modifications in the present "loose-pack" method of packing cherries show promise of improving the arrival condition of the fruit. Use of the recently developed "tight-fill pack" resulted in a reduction in fruit deterioration in both laboratory and transit tests. Cherries showed less transit injury when shipped in corrugated containers than in wooden containers; however, the use of corrugated containers for rail transit would require the development of new methods of temperature management. Results of container-design studies suggest that sweet cherries could be packed to a depth of six inches without damaging the fruit.

SWEET CHERRIES, being soft-fleshed and nearly tree-ripe at harvest, are susceptible to serious physical deterioration during handling. Since stems often serve to denote cherry freshness, their appearance is also important in marketing. To determine the possibilities of reducing deterioration, a study was made of physical injury occurring during transit and marketing, and of the effect of packing methods on the incidence of such injury.

The common "loose-pack" method consists of volume-filling fruit into the container to a standard weight, and applying a lid. Studies have suggested that fruit loosening, which can occur in such a package during transit, may result in vibration injury. This injury is often called "transit" or "roller" bruising. In preliminary tests with cherries, vibration injury was found to affect both the fruit and stems. Thus a packing method which would maintain fruit tightness could offer significant advantages.

Packing studies

Packing studies were begun with simulated transit tests to compare loose packing with tight-fill packing for ability to protect fruit from injury. Tight-fill packing consists of filling a container with fruit to a standard weight, settling the fruit by a very specific sequence of timed vibrations with top pressure, placing a pad over the fruit, and fastening the lid. The resulting slight pressure holds the fruit firmly in place during transit. (Detailed requirements of tight-fill packing of deciduous fruits are listed in other University of California publications.)

EFFECT OF PACKING METHODS AND CONTAINERS ON DAMAGE DURING TRANSIT—BING CHERRY TRIAL SHIPMENT, LODI TO PHILADELPHIA, 1966

Container treatment	Fruit injury		Stem injury	
	Damage score*			
Loose pack (Standard calex lug, 18½ lbs)	1.8		3.2	
Tight-fill	Lug†	Carton‡	Lug	Carton
Underweight (17½ lbs)	1.7	1.4	3.1	2.6
Standard weight (18½ lbs).	1.5	1.2	3.2	2.6
Overweight (19½ lbs)	1.6	1.4	3.2	2.6

* Scored on 0–5 scale, 0 = no damage; 5 = unmarketable. Each score represents average of 100 fruit samples per replication, average of 4 replications.

† Calex lug prepared with ¼-inch unitized lid and bottom, tight-fill packed with redwood bark top pad (200 lbs/1000 sq ft).

‡ Telescope carton—5 × 10⅛ × 16¾ inches inside dimensions, body and lid of 275# AFM construction, curtain coated both sides, 5% side venting provided by four ½ × 2 inch vents each side, tight-fill packed with redwood bark top pad (200 lbs/1000 sq ft).

Vibration injury

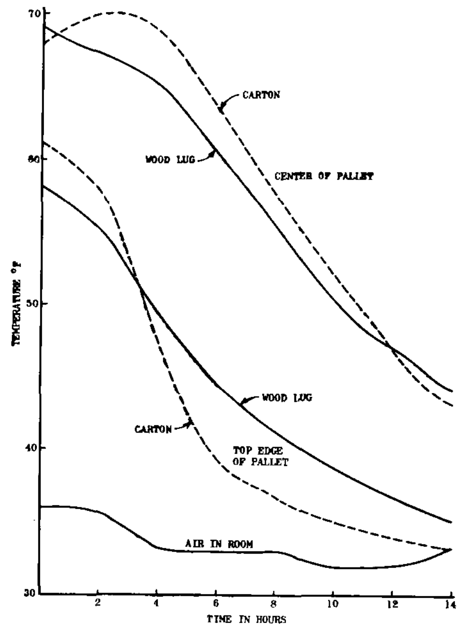
The results of these laboratory tests indicated that vibration injury can be a serious problem in loose-packed cherries, and that application of tight-fill packing principles could reduce this problem. In these tests the potential benefits of tight-fill packing appeared greater for reducing fruit deterioration than for reducing stem deterioration.

As a consequence of these results, loose- and tight-fill packed cherries were compared in trial shipments from California to Detroit and Philadelphia. The waxed, corrugated container which had been used in the laboratory tests was redesigned according to specifications developed for tight-fill packing of other fruits, and tight-fill-packed calex lugs were constructed with ¼-inch unitized lids and bottoms to afford greater container rigidity and increased resistance to bulge. Minor changes were also made in the fill weight and padding used in the containers. Various fill weights were compared in both corrugated and wooden containers.

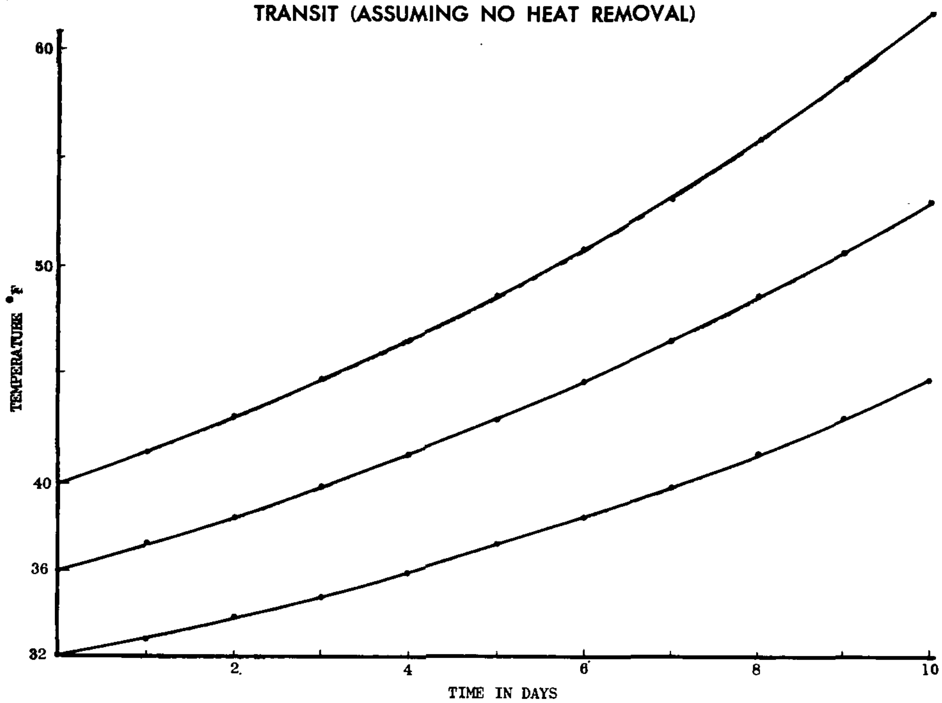
In these shipments, tight-fill packing protected fruit against transit injury better than loose packing (see table). As in the laboratory tests, the packing system used had little effect on stem condition, with all stems showing moderate browning. Under-filling of containers produced greater transit injury to the fruit, while over-filling increased compression bruising.

The redesigned, corrugated container used in these tests performed well, and

GRAPH 1. COOLING COMPARISON OF CHERRIES PACKED IN CARTONS AND CALEX LUGS, PALLET-STACKED AND ROOM-COOLED



GRAPH 2. EFFECT OF HEAT OF RESPIRATION IN WARMING BING CHERRIES DURING TRANSIT (ASSUMING NO HEAT REMOVAL)



showed somewhat less fruit injury than did the calex lug. Less stem deterioration occurred in the carton. Much of this benefit was apparently due to the effect of the waxed container in inhibiting moisture loss, rather than to protection from transit bruising.

These results suggest that tight-fill packing of cherries should be explored on a limited commercial basis. A moderate improvement in arrival condition of the fruit can be expected if the packing requirements are carefully followed.

Container design

Whenever changes in a packing method are contemplated, it is important to determine whether alterations in container design also would be desirable. A primary consideration in container design is the relationship between depth of fill and fruit injury. The calex lug, presently in popular use for cherries, is $3\frac{3}{4}$ inches deep. As a follow-up to the trial shipments, laboratory tests were conducted comparing packing depths ranging from 4 to 10 inches. Except for container dimensions, all specifications and procedures were identical with those used in other trials. In these tests the incidence of injury remained constant at depths of 4 to 6 inches, but increased at depths greater than 6 inches. Serious injury occurred in the 10-inch-fill depth.

These results indicate that considerable latitude exists in the design of a suitable cherry container. A container holding the same amount of fruit as the present lug could be designed with a greater depth and smaller horizontal dimensions. Because of the smaller top surface, such a container would provide greater resistance to top bulge.

The potential usefulness of corrugated containers in tight-fill packing of cherries necessarily is linked to problems of cooling and temperature management. Since cherries are normally room-cooled after packing, the comparative cooling rates of calex lugs and corrugated containers are important. Cooling studies were conducted, using a container venting pattern which had been established in tests with other fruits. Cartons used in these tests had four vents in each side, designed to give approximately 5% side venting. The calex lugs were not modified, with ventilation provided by the container and lid construction. Under comparable stacking and air-management conditions, the corrugated containers cooled at approximately the same rate as the calex lugs (graph 1). Thus the cooling rate would not appear to limit the usefulness of corrugated containers.

Transit temperature

The adaptability of a new container to transit temperature-management procedures is as important as its cooling characteristics. Past studies have indicated that a solid loading pattern provides the greatest protection for corrugated containers during rail transit by protecting against side bulging and shifting of containers during transit. Such a load also eliminates the need for the application of dunnage. Although this loading procedure prevents the circulation of cool air around the fruit, very little warming will occur in fruits which have a relatively low respiration rate and which have been thoroughly cooled before transit. Unfortunately, cherries have a relatively high respiration rate and thus will produce considerable heat during transit. Based on cherry respiration studies, if no heat removal occurred during transit, fruit loaded at 32° F could exceed 41° F after an eight-day transit period (graph 2). If the cooling were not quite so thorough, and the fruit were loaded at 36° F, it could reach 48° F by arrival time.

Venting containers

Top-and-bottom venting of containers has been used with some commodities to allow air circulation around the fruit, thus preventing warming during transit. However, the small size of the cherry fruit makes the use of such vents impractical. Thus, while tight-fill packing looks promising, the successful use of corrugated containers for rail transit of cherries is dependent on modifications in car-loading procedures or container design which will facilitate heat removal during transit.

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