



UNIVERSITY OF
FLORIDA

CIR443

EXTENSION

Institute of Food and Agricultural Sciences

Pallet Boxes for Florida Citrus¹

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Pallet boxes are large, mechanically handled, containers used in harvesting and handling Florida fresh citrus fruit. These are sometimes called "bulk bins" or "bin boxes." The term "pallet box" is preferable, being an accurate designation for a box incorporating a forklift pallet (Figure 1). Such pallet boxes, usually holding 900 pounds (408.6 kilograms) of oranges. Most pallet boxes are intended to have a 10 Florida field box equivalent capacity and become a legal measure when used as a bases for paying pickers or the sale of citrus by volume. In recent years, 9 and 11 Florida field box equivalent capacity have become popular. When Florida citrus is sold by weight, single box equivalents are: oranges=90 pounds (40.8 kilograms), grapefruit=85 pounds (38.6 kilograms), and tangerines=95 pounds (43.1 kilograms) are almost universally used in Florida for handling citrus fruit between the grove and the packinghouse, and within the packinghouse. Pallet boxes represent a considerable investment and the least expensive pallet box to buy can be the most expensive in the long run.

SIZE

The Florida citrus pallet box is standardized by mutual agreement, rather than by rules and



Pallet boxes.

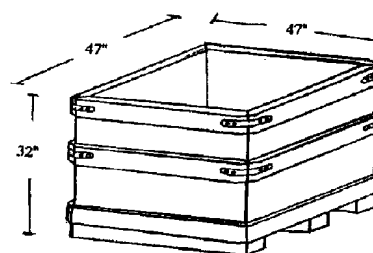


Figure 1. Typical wooden citrus pallet box.

regulations as are other citrus containers in Florida. A joint IFAS-USDA committee, established at the request of the Florida Department of Citrus, recommended in 1966 that pallet boxes should be standardized as follows: "A container of capacity equivalent to 10 standard field boxes shall have external dimensions not to exceed 32 inches in overall height nor 47 inches in overall width and an

1. This document is Circular 443, a series of the Department of Horticultural Sciences, Florida Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida. Publication date: January 1989. Revised: June 1994; March 2002.

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internal volume to be filled with fruit of 43,500 cubic inches. Such containers for fresh fruit use should provide a headspace above the fruit of at least 2 inches to minimize fruit damage and to facilitate stacking and degreening. When a headspace is used, the level equivalent to 43,500 cubic inches shall be clearly marked inside the container on all four sides or all four corners. Any containers that differ from 43,500 inches net internal volume, shall be referred to the Commissioner of Agriculture for a ruling as to net contents in terms of field boxes. Such net contents shall be clearly marked on the outside of the container in letters and digits at least 2 inches high." The proposed regulation was not adopted. However, the pallet box manufacturers and the citrus industry voluntarily, and almost unanimously, adopted pallet boxes meeting the above specifications.

The internal volume is less than ten times a field box volume of 4,800 cubic inches (78,672 cubic centimeters) since a single container of 48,000 cubic inches holds more than eleven field boxes equivalent. Experiments with a variability within plus or minus 2% were used to determine the recommended volume of 43,500 cubic inches. The limit of an overall height of 32 inches (81 centimeters) is, from experience, the maximum height pickers can lift full picking bags with minimum fruit damage. The provision for headspace is principally to prevent fruit damage when pallet boxes are stacked. The width limitation of 47 inches (119 centimeters) is to allow convenient stacking on an eight-foot (2.4 meter) wide truck bed without breaking Florida highway laws.

Alternate sizes of five or seven field box capacities (by altering the height of the box) have been used from time to time. These smaller sizes have been generally abandoned after a few years' use as *having no advantages in reducing mechanical damage to fruit*. The disadvantages of smaller pallet boxes include not being compatible with standard dumping equipment, transporting considerably more weight per volume of fruit being transported, less fruit per degreening room because of the added number of pallets, and higher costs for more pallet boxes.



Five field box capacity.

CONSTRUCTION

Pallet boxes can be made of various materials including wood, plywood, metal, and plastic. In Florida, because of problems in using forklift tractors on sandy soil, long runs from tree to roadside, and the need to transport tractors from grove to grove, the handling system in the field usually involves truck-mounted hydraulic loaders that grip the pallet box by the top. Once they are delivered to the packinghouse site, they are handled in a more conventional manner by forklift trucks lifting one to four pallet boxes at a time from the bottom pallet. A rigid base is thus needed and the containers must have both tensile and compressive strength. Florida citrus pallet boxes get hard usage. They make about 40 round trips to the field each season, in contrast to pallet boxes commonly used for apples, which, with several months storage, may be used only one to three times per year. Ample storage area is usually available in the off season so that knock-down pallets are not required, although pallet boxes left to the mercy of the elements are subject to decay and mildew. Off-season storage in the packinghouse may

affect insurance rates, so you should consult with your insurance agent before storing pallet boxes inside.



Metal.



Plastic.



Wood with truck-mounted hydraulic loader.



Fork lift trucks.

The cleats or top rails by which wooden boxes are lifted should be of straight grained, seasoned hardwood. If light angle iron is used to protect the wood where the loader clasps it, the metal should be pierced with a cutting torch before attaching it to the box to reduce the hazard of metal sliding on metal. That way, the "fingers" of the loader do not slip.

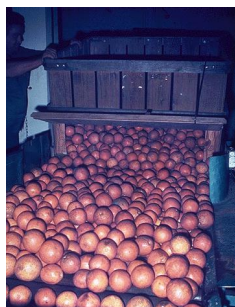
Modern degreening and cold storage rooms require some ventilation of fruit in pallet boxes which are most commonly stacked 6 high. Ventilation through the sides of the pallet boxes is of no value unless the material costs can thereby be reduced. Holes should not be cut into the sides of the pallet boxes. The bottoms, however, should have approximately 10% of the surface area open, usually as slots. The edges of the slots should be beveled ("bullnosed") to prevent fruit damage by sharp edges.

Although truck entry from all four sides may be useful in some specific cases, it is not necessary for most citrus packinghouse operations and is not compatible with the air pattern in modern horizontal airflow degreening rooms. Cross runners or "flotation strips" found on some deciduous fruit pallet boxes are *not* desirable in that they pick up sand, which is very damaging to citrus fruit.

The estimated life of a wooden pallet box is six years, a theoretical figure that ignores constant repair and occasional retreatment with wood preservative. We have not seen comparable figures for metal or plastic pallet boxes. The cost of labor for repairs is a major consideration, accelerating sharply after the first year. Pneumatic stapling and nailing tools have helped to reduce repair costs. Plywood, metal, and plastic pallet boxes have been made with the feature of easily replacing a side or bottom with a premade section.

The pallet box must be smooth inside and free of nails, bolts, rough edges and any similar protrusions to prevent fruit damage. Bolt heads, corner braces, etc., on the outside *must not protrude* lest one pallet box catch onto another with disastrous consequences.

Pallet boxes with a side door dumping for small packing operations or special conditions such as within a packinghouse are sometimes advantageous. This feature increases the initial cost of the pallet box, but allows a simple and relatively inexpensive alternative to the traditional mechanical dumpers used in high volume packinghouses. It is essential that latches for securing such gates be of simple, rugged construction. *The gate must be at right angles to the pallet runners*, and strengthened with angle iron below the door (Figure 2).



Side door dumping.

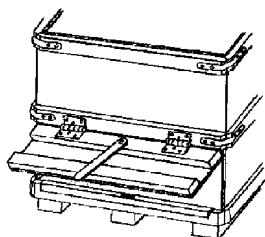


Figure 2. Pallet box with side dumping door.

WOOD AND METAL PRESERVATIVES

It is very poor economy to buy untreated wooden pallet boxes. The *only* wood preservative on which we have seen full FDA approval plus adequate testing data from the USDA Forest Products Laboratory is copper-8-quinolinolate. It is better to dip the assembled box, rather than the wood before making up the box. (If you have untreated boxes and want to dip them yourselves, it is easier to do so handling them with a lift truck because the hydraulic arm holds them under so they do not have to be weighted).

Copper-8-quinolinolate is available in two formulations, one using an organic solvent and one that can be mixed with water. The latter, more recent, formulation, eliminates any fire hazard. Most of the wood rot problems are in the bottom half of pallet boxes, so that retreatment methods for only the bottom half of the pallet boxes have been proven satisfactory.

Metal pallet boxes in California are usually painted white to reduce the heating of metal by the sun. This could also reduce corrosion, particularly if a catalyst-type epoxy paint is used.

Any preservatives used on citrus containers must be approved for contact with citrus by the appropriate federal and state agencies. Even a minute amount of contamination on the citrus peel must be approved as a food additive or the fruit can be considered to be illegal and could result in fruit seizure and destruction.

FRUIT QUALITY

Fruit quality is an important consideration in the construction and use of fresh fruit containers. Generally there is less damage to citrus fruit handled in pallet boxes than in the Florida field box mentioned above. Most damage comes from contact with the container rather than with other fruit. In pallet boxes less than half as many fruit contact the container as in the two compartment Florida field boxes. Also, lifting 105 pounds (47.6 kilograms) or more made up of 90 pounds of oranges plus 15 pounds of box results in rough handling by tired men, while hydraulic equipment seldom drops boxes. Nevertheless, some fruit quality comments are worth emphasizing.

Do not overfill containers. The recommended marked two-inch headspace should not be filled lest fruit be damaged when stacking pallet boxes (Figure 3). Fruit loss from overfilled pallet boxes far exceeds any economies that might be realized by overfilling.

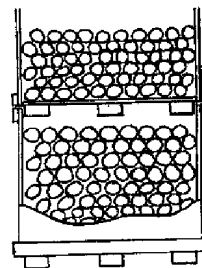


Figure 3. Pallet boxes stacked with 2-inch headspace in the top of the pallet to avoid fruit damage.

The two most important points with regard to strength are that the bottom should be rigid and the top cleats (when picked up by a hydraulic loader) must be strong. If the bottom of the box can noticeably flex when the full box is lifted, the consequent distortion will damage fruit in the bottom.

When such damage is noted, it is almost invariably, but erroneously, attributed to excess depth of fruit in the box.

Food additive laws have already been mentioned for wood treatment chemicals or paint used on metal containers. In addition, hydraulic equipment needs to be kept in good repair, because an oil leak onto the fruit will not only damage the fruit, but also would constitute an illegal food additive.

THE METRIC SYSTEM

In the foreseeable future, measurements will be in metric rather than traditional units. Although metric units will make very little difference to the construction and use of Florida citrus pallet boxes, we should begin to "think metric." Some conversion measurements are given in metric in this circular. For example, 47 inch x 47 inch pallets will, no doubt, in time be superseded by 120 centimeter x 120 centimeter metric pallets.

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