



# Florida Cooperative Extension Service

## PACKINGHOUSE NEWSLETTER



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Key Word Index Chilling injury, Decay Control, Export, Fumigation, Fungicides, Grapefruit, Humidity, Japan, Picking, Waxing.

### HANDLING GRAPEFRUIT, PARTICULARLY FOR THE EXPORT MARKET

Research can produce only so many absolutely definite answers, particularly when working with biological material such as fruit. There is always an area of indecision in which factual advice is just not available. Those calling upon us for advice sooner or later ask: "Well, if it was your fruit what would you do." Thus many of the comments below are strictly on the basis of "given my druthers, this is how I would ship them." We do not have complete agreement on some points such as late season shipping temperatures. In general, these comments are made up from observations over 25 years that might not necessarily hold up under statistical analysis.

We will start with grapefruit on the tree and work through to the ship's hold.

#### Picking

The weak link today is in picking; there is little that we can do for the quality and decay of grapefruit if it has been shaken off the tree, pulled off with hooks, etc. Good, heavy, flat, seedless Indian River grapefruit are more tender than tangerines. (Tangerines do not get "blossom-end clearing" when dropped). Grapefruit must be picked into picking bags with care and pallet boxes must not be overfilled. At least a two-inch head space should be allowed at the top of each pallet box to avoid injury from the runners of the pallet box above. Grapefruit are very susceptible to sunburn after picking, and should be shaded if they are not brought to the packinghouse as soon as possible. (In Israel, the Export Marketing Board will condemn any pallet box seen in the grove that is not covered with a sheet of brown paper.)

#### Prepacking Delays

We see no advantage to trying to rush grapefruit into cold storage, particularly when they are very tender early in the fall. Fruit held for several days after picking usually show less susceptibility to chilling injury than those that have been promptly packed and

refrigerated. Less chilling injury develops in degreened fruit than in comparable fruit placed immediately in storage. However, if there are any delays, grapefruit should be held in humid conditions (such as a properly run degreening room, without ethylene during the nondegreening season). There is no advantage in letting the fruit dry out since this can accentuate peel injuries.

#### Freeze Damage Considerations (See available publications)

Freeze damaged citrus must pass the Inspection Service standards for evidence of freeze injury. Careful grading for cuts and plugs is especially important for a freeze damaged crop. The graders should be aware that they cannot detect freeze damage by external appearance. In fact, the damaged fruit often has the best color and cannot shrivel. Export shipments should be avoided after a freeze until the internal fruit drying can be evaluated. Once the drying of injured areas is complete and the grade standards are met for each size, (there may be important differences between sizes) the grapefruit should have normal keeping quality. Late shipments after the normal bloom period should be viewed as risky.

#### Fungicides

The fullest possible advantage should be taken of fungicides to the extent that the regulations of the importing country allow. The same warm, moist climate that produces sweet, juicy citrus fruit also favors endemic decay organisms. See Extension Circular 359A for fungicide application methods and Packinghouse Newsletter No. 70 for regulations in the importing overseas markets.

A particular problem occurs with the Japanese market in that, at the time of writing, the only fungicide allowed is diphenyl (biphenyl) and it has recently been found to accentuate chilling injury of grapefruit stored at 40°F but not at 60°F. Somewhere between these temperatures, chilling injury is initiated. This probably varies with variety, season, and possibly cultural practices.

#### Waxing

As with fungicides, the wax used must meet the regulations of the importing countries. European countries accept the same fruit waxes as used for U.S. and Canadian markets. Japanese regulations limit fruit waxes to those of "natural origin." Waxed grapefruit are less liable to chilling injury than unwaxed. A good wax job is definitely helpful in reducing shrinkage and hence fruit deformation during the voyage.

#### Packing

The increasing limitations on height of pack are excellent. Overfilling cartons is harmful to fruit appearance, increases decay through mechanical injury and gives away fruit.

#### Fumigation

Where injury has occurred in fumigation of packed grapefruit in trucks, it has invariably been traced to poor ventilation of the load in the period immediately after fumigation. Only trucks with front and back vent doors should be used for fumigation. The trucks must never be parked immediately after fumigation. When they have a long road run following fumigation, the vent doors should be left open for the first 24 hours. If they have a short haul, as to a Florida dock for break-bulk loading, they should be unloaded immediately on arrival. If this cannot be scheduled, fumigation should be postponed until such a schedule is possible.

### Precooling

We know of no advantage in rapid vs. slow precooling for grapefruit. When the time lapse is to be no more than 48 or 60 hrs between packing and loading in the ship's hold, we see no value in dockside refrigeration and it can cause weakening of the cartons due to condensation between the cooler and the ship's hold.

### Shipping Temperatures

Everyone agrees that optimum shipping temperatures vary during the shipping season. There is not complete agreement on how they should vary. The traditional view has been that as maturity increases, susceptibility to chilling injury decreases. Grapefruit shipping temperatures always involve walking a chalk-line between chilling injury and excessive decay. It is generally agreed that we should start with no lower than 60°F (15.5°C) for the very early shipments in September or October. By mid-November, it is usually safe to go down to about 55°F (12.5°C). After Christmas and until the trees start to bloom or develop their first spring growth flush, 50°F (10°C) is generally agreed upon. It has been customary to use this temperature until the end of the season. We have evidence that as the trees' growth become more active, the fruit becomes more susceptible to chilling injury and the shipping temperature should be raised. Because postbloom grapefruit are very susceptible to decay, using 55°F for the rest of the season seems a reasonable compromise when the best fungicides are not approved as in Japan. For nearer markets and proper fungicides, 60°F is a favored temperature.

### Humidity In The Ship's Hold

Humidity as high as we can get without precipitation is preferred for fruit condition, but limits are set by carton strength. Most of the time, we have just had to accept humidity as it settles out in the ships' holds. The operators of some new ships claim to be able to control the humidity with surprising accuracy. Where this is the case, we advise a humidity of approximately 85-90% RH.

### Ventilation of Holds

The benefit of ventilation was thought in the past to be due to removal of CO<sub>2</sub>. Reducing of ethylene is probably far more important. Only a few parts per million of ethylene can hasten the senescence of grapefruit, whereas it takes several percent of carbon dioxide to have any physiological effect. Excessive air changes make it very hard to maintain humidity and temperature levels, but we do not have any good research data on how much ventilation is necessary to keep the ethylene concentration down to negligible levels. A complete air change every two or three hours would probably be adequate, particularly once the fruit reaches transit temperature.

### Arrival Inspection

Routine inspections and reports by qualified inspectors can do much to stave off the possibility of trouble. When complaints occur, analysis of what went wrong is only possible when accurate, detailed reports are received. These should include the history of the shipment (including picking, packing, loading and unloading dates if possible). Descriptions of fruit and container condition should be supplemented by color photographs. These should either be slides or glossy photographs. "Mat-finish" prints make it impossible to check details under magnification.

### Length of the Shipping Season

Grapefruit has an extraordinarily long shipping season, but, as with other types of citrus, keeping quality tends to diminish toward the end of the shipping season for a given

variety. Keeping quality is maximal from the end of the degreening season through February. From bloom time on, keeping quality tends to decrease rather rapidly. Particular care should be taken to handle the fruit carefully, avoid unnecessary delays and make intelligent use of fungicides allowed. Very late in the season, e.g. in April or May, shipment of Florida grapefruit overseas even with use of standard fungicides (TBZ or Benlate) can be risky.

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AVAILABLE PUBLICATIONS

Available from Dr. W. Wardowski, AREC, P. O. Box 1088, Lake Alfred, FL 33850

"Citrus postharvest fungicide tolerances" by W. Wardowski and B. Hillebrand. Packinghouse Newsletter No. 70, February 26, 1975.

"Separation and grading of freeze damaged citrus fruits" by W. Wardowski and W. Grierson. Fla. Ext. Serv. Circ. 372. April, 1972.

"Postharvest decay control recommendations for Florida citrus fruit" by A. A. McCornack, W. Wardowski and G. E. Brown. Fla. Ext. Serv. Circ. 359-A. February, 1976.

"Proceedings of the 1972 Conference on Handling Perishables" 345 pages. This publication was previously for sale and is now available at no charge.

"Palletising Chart" for rectangular 40" X 48" pallet without overhand and corrugated fibre containers from 8" X 6" to 24" X 18", by Australian Paper Manufacturers, Ltd.

"Florida citrus spray and dust schedule 1977" compiled by Univ. of Fla., IFAS, and U.S. Dept. of Agr., Agr. Res. Serv., Circ. 393-C, January, 1977.

"Ethylene degreening of 'Bearss' lemons" by C. R. Barmore, T. A. Wheaton, and A. A. McCornack. HortScience 11(6):588-590. Dec. 1976.

Available from Division of Fruit & Vegetable Inspection, P. O. Box 1072, Winter Haven, FL 33880

"1975-76 Season Annual Report."

Available from Mr. R. H. Grant, Citrus Machinery Division, FMC Corp., Fairway Ave., Box 1708, Lakeland, FL 33802

"English/Metric Converter", a slide rule with conversion factors.

Available from Florida Department of Citrus, P. O. Box 148, Lakeland, FL 33802

"Fresh orange usage" by Douglas R. Hoffer. Market Research Report, Feb. 15, 1977.

This newsletter is published at a cost of \$81.85, or 8.2 cents per copy, to give the latest news to the packinghouse industry.

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