

grapefruit was one and the same. But, when red grapefruit was sold at retail, the obvious red blush indicated that this was in reality a different kind of fruit, at least in appearance. This obvious difference was enough to arouse consumer interest.

This kind of success does not just happen, because a lot of factors went into this becoming a reality. There was considerable help from the Citrus Commission (Florida Department of Citrus), who spent money on trade incentive programs, as well as in-store demonstrations, and also the co-operation between the commission and the foreign agriculture service of the department of agriculture (FAS) made funds available through the Three Party Program. The fact that Texas had a freeze in 1978 certainly benefited our cause and the weakness of the U.S. dollar at that time in Europe made Florida grapefruit a bargain. We also found the distribution system which was a combined Texas/Florida loading on ships that were fast and delivered the cargo to Rotterdam and Le Havre in good condition in about 10 days.

At this stage of our new season, there are some very real problems that Florida is facing as an exporter to Europe. The currency situation is one of the most dramatic because of the monetary impact it has on this trade. Today in France, an importer must pay close to 6 French francs to buy a U.S. dollar in order to pay us for the fruit we ship. A year ago, the same importer paid about 4 French francs for a U.S. dollar. In relating this to prices, the carton of fruit that was \$5.00 last season now will cost the importer almost \$7.50. The same is true about ocean freight. The carton that cost \$4.50 to ship now costs over \$6.00 in French currency, so that has a bearing. This past summer was a disaster in the European fruit trade. Citrus from South Africa and from South America was poor quality and the consumer acceptance was terrible. European apples were poor quality, along with pears and other deciduous fruit, which resulted in heavy financial losses to the fruit trade, so we are coming into a rather negative situation. Florida suffered a freeze last January, so overall, supplies are expected to be limited, which automatically means higher prices. Our European friends and buyers ask us "How high is high and "How much do you think we can pay"? There is a limit and this limit is probably going to reduce our shipments by 25% to 30%. Overall, this may not hurt us too much because domestic demand for Florida and Indian River red grapefruit will be strong, but what effect does it have on the future.

Let's look at the future—can we sell more? The answer is definitely yes!

We have 3 major markets that represent real potential for us—West Germany, the U.K. and Italy. In my opinion, these countries have the potential of importing up to 3 million cartons of red grapefruit. This increase is contingent on establishing the distribution system that we have been alluding to and particularly in U.K. and to some extent in West Germany, we have to change their philosophy of obtaining fruit. For many years, these countries have been supplied with citrus on a consignment basis and the very concept of buying for cash is quite repugnant to them. This barrier is slowly being eroded and when the importers in these countries can recognize the profit potential, they will go along with our system of selling on an F.O.B. basis. Fortunately, the future does not indicate any tremendously competitive situation so far as Florida and Indian River grapefruit is concerned. Cuba might offer same quantities in the years to come, but they are pretty well committed to supplying the East European countries. Long range production forecasts for Florida shows a steady growth in production, but I question these forecasts because it is our understanding that on the Indian River in Martin, St. Lucie and Indian River counties, there are 88,000 acres being planted now or being readied for planting. That will mean a *lot* more grapefruit.

Can this European market handle this increase in the next decade? The probability is good if:

If there is some long range economic and financial stability between the U.S. and the Common Market;

If the Common Market can re-define their common agricultural policy and do away with the inequities that currently exist with reference to tariffs;

If there can be some development in the use of gamma radiation instead of refrigeration and reduce freight costs; and

If we don't have world war III.

In our business, we must have a little faith which reminds me of a story.

We as an industry will survive and continue to grow. We must look for some changes that will reduce our costs and increase our efficiencies and be aggressive in a competitive world of citrus. If Florida had only a third of the packing houses it has now and these were all new and efficient, the industry would be a lot more profitable and total volume could be handled with much lower costs. Let us be positive and in 10 years from now, we'll be able to determine how accurate our predictions were and for all our sake, I hope I'm on target.

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## HARVESTING FLORIDA CITRUS FOR OVERSEAS EXPORT<sup>1</sup>

W. GRIERSON

*University of Florida, IFAS,*

*Agricultural Research and Education Center,  
700 Experiment Station Road, Lake Alfred, FL 33850*

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**Abstract.** For overseas export, Florida citrus fruits have to survive in good condition for far longer periods than when

marketed in the U. S. and Canada. Careless harvesting is most commonly the cause when heavy decay losses occur in export shipments. Monetary losses due to fruit decay and deformation can be markedly reduced by improving harvesting practices. Minor differences in handling practices are recommended for oranges, grapefruit, lemons and limes, respectively.

Transpacific or transatlantic shipment involves, distances, transit conditions, and marketing periods, far more exacting than in domestic marketing. Although packers, exporters, and importers may pay considerable attention to

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transit and holding conditions, prior conditions may be of even greater importance (5), principal among these significant preshipment conditions is harvesting (1).

### Maturity standards

The 10% tolerance on maturity standards for fruit for export (3) is often criticized by those who consider this concession cynical. However, internal standards are so trivial in the markets to which we ship that our internal quality will still be most acceptable (10). There is, however, a particular risk when exporting red-fleshed grapefruit using this 10% tolerance. At one time, severe losses due to sloughing occurred with very early shipments of red- and pink-fleshed grapefruit (8). Sloughing is a dramatic peel injury in which the peel develops large, moist, chocolate-brown areas that slough off under slight finger pressure. It develops several days after packing and only occurs with very early pickings (7, 8). It has hardly been seen in Florida since maturity standards were raised enough to delay the first pickings by about 10 days. If sloughing should occur in an export shipment it could be a very costly disaster.

Something else to look for *before* picking are gum pockets in the albedo caused by arsenic toxicity, boron deficiency or both. In October, 1981 an apparently excellent crop of grapefruit was rejected at Tampa dock when this condition was detected by Japanese buyers' inspectors.

Lemons are usually shipped on a very generally accepted standard of 30% juice by volume. California allows 25% for export on the presumption that extractable juice will increase during transit. Sometimes this does not happen with Florida lemons (4), which should not be picked until they yield 30% juice by volume.

### Preharvest treatments

Fruit which are to be ethylene degreened prior to export are very susceptible to diplodia stem-end rot (6) and for this reason should receive a Benlate (benomyl) spray prior to harvest (14).

### Picking

Fruit for export *must* be picked with reasonable care, even if a premium has to be paid to ensure this. The losses on the export market due to bad picking have never been documented, but they are high. When losses occur and fruit are sent to us at AREC, Lake Alfred for diagnosis, only too often the original cause is obviously picking damage. Curiously, these fruit came to us for diagnosis because the cause for such losses was considered unknown. Does not one *want* to look close enough to see the punctures, bruises, scrapes, sand damage, etc.?

All fruit for export should be picked carefully. Oleocellosis (oil spotting) is a particularly common hazard and leads to an ugly peel blemish that can soon result in decay. Oleocellosis can be minimized by not picking until early morning turgor pressure has decreased significantly. It is the water *inside* the fruit that causes the oil cells to protrude and be so vulnerable, not water on the outside (18). Pulling can be preferable to clipping if it is done carefully and if the fruit does not plug (1). No fruit should ever touch the ground. Pallet boxes should be filled no higher than 2 inches (2.5 cm) from the top. Lemons should be picked only in the rigid-framed, smaller bags such as are used for deciduous fruit. Once picked, fruit should always be shaded from the sun if it is not to be hauled in promptly (16).

Some types of fruit have their own particular vulnerabilities. Limes are particularly susceptible to harvesting losses

since breaking a single cell or juice vesicle can cause the onset of the once-mysterious styler end breakdown (2, 11). Also, rough handling can greatly accelerate the green to yellow color change thereby throwing them out of grade. Another one-time mystery used to be blossom-end clearing of seedless grapefruit in which the blossom end turns translucent and decay soon follows. It is no mystery. It is caused by dropping heavy, thin-skinned seedless grapefruit, particularly late in the season (15).

### Hauling

Once picked, there are differences in preferred handling methods for the various types of citrus. Oranges and specialty fruits should be hauled in as quickly as possible, never allowed to dry out, and any delay between picking and washing and waxing should be under humid conditions to minimize the risk of stem-end rind breakdown (SERB) (16). Lemons should be left undisturbed in the grove until hauled in the day after picking. Just keep them shaded as much as possible. If possible, hold them in the original pallet boxes for several days prior to dumping to minimize damage from oleocellosis (4, 18). Grapefruit are a special case because of their susceptibility to chilling injury, against which they can be conditioned to a certain extent by "curing" prior to refrigeration (12). We have studied this extensively and find that various combinations of time, temperature and humidity can give effective curing (9). This is not an invitation to abuse grapefruit. Any form of rough handling at all during harvest greatly increases their susceptibility to later deformation and internal cavities when subjected to stress, as when stacked after packing (17).

The tree-to-customer investment in exports is very high indeed; the ultimate price on arrival can be many times the original on-tree price of the fruit. Financial losses due to decay on foreign markets can be so high as to discourage further buying (13). The small sums expended on such precautions as a preharvest Benlate spray, bonuses for careful picking, etc., should be regarded not as extra expenses, but as investments on which the net return exceeds anything on the money market, while providing inexpensive insurance.

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## PACKINGHOUSE OPERATIONS AND SHIPPING CONDITIONS OF CITRUS FOR EXPORT<sup>1</sup>

W. F. WARDOWSKI  
University of Florida, IFAS,  
Agricultural Research and Education Center,  
700 Experiment Station Road,  
Lake Alfred, FL 33850

**Abstract.** The greatest positive influence packinghouse management can have on citrus fruit quality is to secure careful harvesting, and with the exception of lemons, assure prompt movement to the packinghouse. Degreening with no more than 5 ppm ethylene, high relative humidity, fresh air ventilation and adequate air movement assures an optimum degreening rate with minimal risk to quality. In the packinghouse, prompt handling of fruit at high relative humidity especially until it is waxed, will retard moisture loss. Application of an approved benzimidazole fungicide, alone or with other approved fungicides, is essential to control decay. Application of fungicides and waxes must be consistent and thorough to assure good decay control and minimal loss of moisture. Shipping temperatures should be varied with the type of citrus fruit, and, for grapefruit, with the time of year and growing conditions. Citrus should not be cooled to a potential sweating temperature prior to fumigation. Overpacking citrus cartons should be avoided as this common practice, sometimes requested by fruit buyers, is especially harmful to citrus destined for the longer term export market. High humidity through the long export transit is important to maintaining citrus fruit quality. Generally, common sense and attention to details in the packinghouse and during transit will keep citrus fruits fresh and viable for the overseas consumer.

A citrus fruit never has better quality than the instant it is removed from the tree. Citrus fruits can be made to appear better, but never taste better after harvest. The greatest influence management can have on quality of citrus fruit is to provide very careful harvesting as described in the previous paper (12). If a fruit has the skin broken, the injury is frequently fatal, due to fungal decay, as it may not be controlled by the fungicide treatment. It would be better to prevent injury rather than use "band-aid treatments" to attempt to repair damage.

The quality of citrus fruit exported from Florida is greatly influenced by the maturity and grade standards which are rigidly enforced through the Florida Department of Citrus rules and the State of Florida Statutes (6, 7). The internal quality of Florida citrus fruit is higher than for most other growing areas in the world (15) while the external appearance is lower due to such factors as green or pale color, wind scar, rust mite damage, etc. (27). To take best advantage of these characteristics, Florida shippers should take great care to select only the crop grown for

optimum external quality, which usually assures good internal quality.

The influence of packinghouse management on quality of export citrus can be discussed in relation to major changes in Florida citrus packinghouse operations. Such changes were limited to either end but not the middle of the packingline from the late 1950's through the 1970's. We are beginning to see energy cost inspired changes in the center of the line in the 1980's. These changes can affect the quality of citrus for the export market, and will be discussed in this paper. Much of this information can be found in an excellent review by Brown (2).

With the exception of lemons, where handling should be delayed 24 hours after harvest to reduce oleocellosis (25), citrus should be moved promptly to the packinghouse. Pallet bin (also called pallet box) handling is recognized as being much more efficient and less damaging to citrus fruit than the old nearly outdated standard 90 lb. (for oranges) Florida field box (3, 16, 26).

Modern degreening rooms generally adopted in the 1970's are superior to older designs (9, 11, 19, 24). These degreening rooms feature positive flow air circulation, very high humidity, low (1-5ppm) ethylene concentration, and controlled fresh air ventilation. Such rooms increase the speed of degreening and result in better fruit quality, particularly lower decay and less dehydration.

Trash elimination is a continuing and increasing problem for Florida citrus packers (5, 10). The elegant solution to trash would be to simply eliminate the vast majority of it at the time of harvesting. However, this is not always possible, or expected to happen, so packers are beginning to install systems to remove sand, leaves, limbs, bottles, cans and other trash. Once trash is delivered to the packinghouse, the ideal situation is to get it off the line immediately after dumping so that fruit and machinery are not damaged further by the trash. The best trash elimination systems deliver the refuse to pallet boxes or trucks for efficient removal.

Fruit quality can be lowered in the packinghouse by brushes. Generally speaking, dry fruit should not be allowed on dry brushes as this can cause peel injuries. Brushes are used in the washer and in a water wax application. Brushes should rotate at a relatively slow speed of not over 100 rpm, and in the wax applicator they should be horse hair or horse hair grade. It is advisable to avoid installing new stiff brushes in a washer at the beginning of the season while the fruit peel is still very tender. New brushes can be more safely installed during the Christmas break. Brushes are sometimes found in dryers to "polish" the fruit for a better shine and to remove sooty mold. This practice is not recommended due to the risk of putting dry fruit on dry brushes and causing injury. (14). However, it is done commercially with slowly rotating very soft brushes.

The packinghouse manager can improve packed quality

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