

Establishment of Orderly Citrus Marketing in Latin America

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In any honest appraisal, it is apparent that commercial citrus trees are planted for one principal reason and that is to make money. A great deal of money, time and effort is expended to produce citrus crops. Much of this precious investment of land, time, effort and money can be wasted, or fail to return an adequate profit, if there is no orderly marketing pattern to use the crops produced. This is particularly true when a local market has to be developed to nurture an infant citrus industry as is often the case in new citrus districts in Latin America.

During eight years at the Florida Citrus Experiment Station, the writer has played host to visitors from all over the world interested in studying both our research and also our commercial methods of handling fresh citrus fruit. In the course of this constant exchange of ideas and experience certain worthwhile concepts have emerged. These are discussed here without going into technical details, all of which are available in the literature as indicated.

Probably no citrus industry has ever developed in a strictly logical manner — certainly not our own. However it is possible to give a general impression of what constitutes an orderly development of a marketing procedure for districts where commercial citrus is being newly established. In this the underlying philosophy can sometimes be more important than the technical details.

Of first importance is recognition of the fact that what is best here in Florida, or the U. S. generally, is not necessarily best in some other radically different economy. For example, in the United States labor is comparatively costly and machinery relatively cheap and hence considerable mechanization is often not only advisable, but essential. In many other citrus districts, this may not be true at all and, moreover, sociological and political considerations may be as important as economics. This was driven home to me when I helped design a large South American packinghouse. The director of the

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company stipulated that it was his moral obligation to give employment to a given number of workers. It was my task to design a set-up in which they could turn out the required volume of fruit in eight hours per day instead of 12 to 16 hours daily, meanwhile producing a better pack. The resultant packinghouse differed markedly from anything in the U.S.A., but was very well suited to their particular situation.

The sociological aspects of mechanization are not limited to a simple choice of using men or machines to perform a given task. In countries where machinery is very scarce or expensive every effort must be made to get the maximum use out of each machine. Trucks are expensive anywhere, but in much of Central and South America their initial cost is sometimes several times as high as in the U.S.A. If inefficient unloading facilities cause them to spend as much time waiting at the packinghouse as they do traveling on the road, then this great cost is again doubled. In one case where such unloading was a major impediment, the writer found that the trucks were very largely owned by the drivers who lost money heavily when delayed. A new system of unloading that called on the labor and initiative of the drivers more than doubled the speed of unloading. Thus more efficient mechanization was achieved through utilization of a sociological situation typical of that district.

Similarly, not only labor, but machinery, processes, packages, etc., should be used only as suited to the particular country and market. For instance, a great many of our overseas agriculturists are absorbed by our various "cosmetic" processes and often ask only that we tell them how to "color-add" (10) or "degreen" (3, 9) —nothing else. They are usually astonished if I warn them that they *may* be "taking a tiger by the tail".

SIZING

Personally, I would say that the first essential in establishing an orderly market is accurate sizing as an elementary step towards establishing customer confidence. The rich man wants to buy large fruits of regular size and shape to serve his guests, and he will pay handsomely if he is sure of getting them. The poor man wants small fruit, as many as possible in the package or per kilo, so each member of the family can have one. A few large fruit in the bottom of the basket can precipitate a crisis in a poor family with many small children!

Sizing equipment need not be expensive and can be designed so that ultimately other equipment can be added on before and/or after to form a complete packing line, arrived at in easy stages. For small scale operation, some version of the "belt and roll" or "belt and rope" sizer is probably as satisfactory as any (9, 10).

DECAY CONTROL

The next priority I would give to decay control for which three methods are available. In their order of practicality, they are: careful handling; the use of fungicides; and refrigeration.

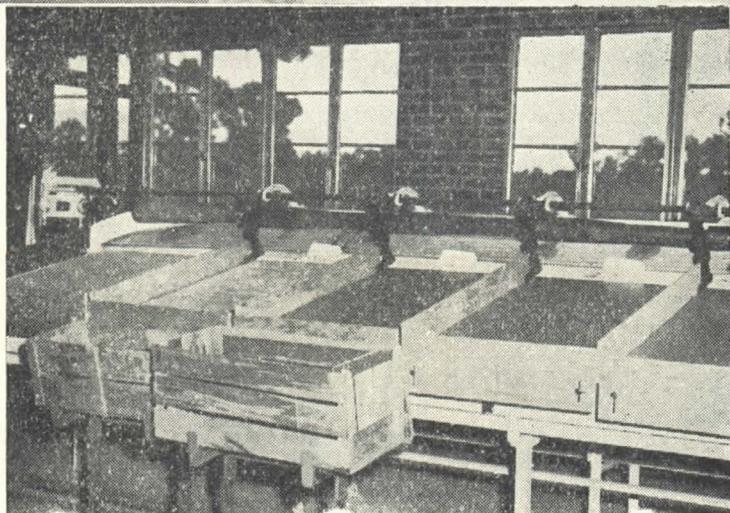


Fig. 1 (Above) Packing bins along a «belt and roll» sizer. (In motion).
Fig. 2 (Below) A «belt and roll» sizer; packing bins have been modified to form shallow «roll boards». (U. S. D. A. photograph)

"Careful handling" sounds simple, but often we find individuals unnecessarily damaging fruit due to practices that they believe to be beneficial. For example, we have repeatedly checked various versions of the practice of "curing", "sweating", or "quailing" in which the citrus fruits are deliberately shriveled slightly to make them more resistant to handling damage. Repeated checks at Lake Alfred (6) have failed to show any advantage and usually increased decay resulted. The only consistently observed decay reduction was by holding at 85° F. in cool weather when *Penicillium* mold was the principal pathogen (5). Shriveling of the fruit was not necessarily involved. Fruit varieties and pathogens vary between districts and these observations may not necessarily be true elsewhere, but they agree very closely with those of deFossard in Jamaica (1). An experiment with careful controls should be tried several times before deciding whether any such treatment is suitable in any given district. Only too often "what everybody knows" turns out to be quite incorrect.

Another example of misguided zeal is often involved in the clipping (rather than pulling or plucking) of the fruit from the tree. Mandarin type fruits usually have to be clipped to prevent tearing, but in districts having endemic stem-end rot, decay is almost always less in pulled oranges and grapefruit since the decay organisms are harbored in the "buttons" (persistent calyces). We have checked this in Florida, year after year, and with any types of fruit that will not "plug" (that is to say, will not suffer tears in the skin), the pulled fruit have less decay than the clipped (4). Nevertheless, we still have operators who, when seeking to be especially conscientious, pay a premium for their pickers to have oranges clipped, thereby raising the amount of stem-end rot considerably and sometimes also getting considerably more blue mold due to the clipper cuts and stem punctures that result when the clipped oranges are handled.

Citrus fruits of all kinds should not be picked while wet, because at that time the oil cells are unduly prominent, easily broken and the resultant damage (*oleocellosis*) causes disfiguration of the peel and increased susceptibility to decay. Perhaps it is this that started the fashion for curing, but the answer is to avoid picking the fruits while they are wet, rather than to harvest them, cause the damage, and then try to dry them out.

Exaggerated precautions are often taken against dropping citrus fruit during handling. Citrus fruit are rather resistant to damage due to dropping onto a fairly smooth surface, but their structure makes them very susceptible to decay due to pin-point injuries or abrasions, either of which allow pathogens direct entry into the spongy white albedo tissue which forms a perfect incubation medium for fungi.

"Careful handling", therefore, involves the following points:

- (1) Pick when dry.
- (2) Avoid all unnecessary delays between picking and marketing.
- (3) If delays are inevitable, hold the fruit in a moist (but not wet) atmosphere. Use refrigeration if available.
- (4) Do not clip citrus fruits in stem-end rot districts if this can be avoided.

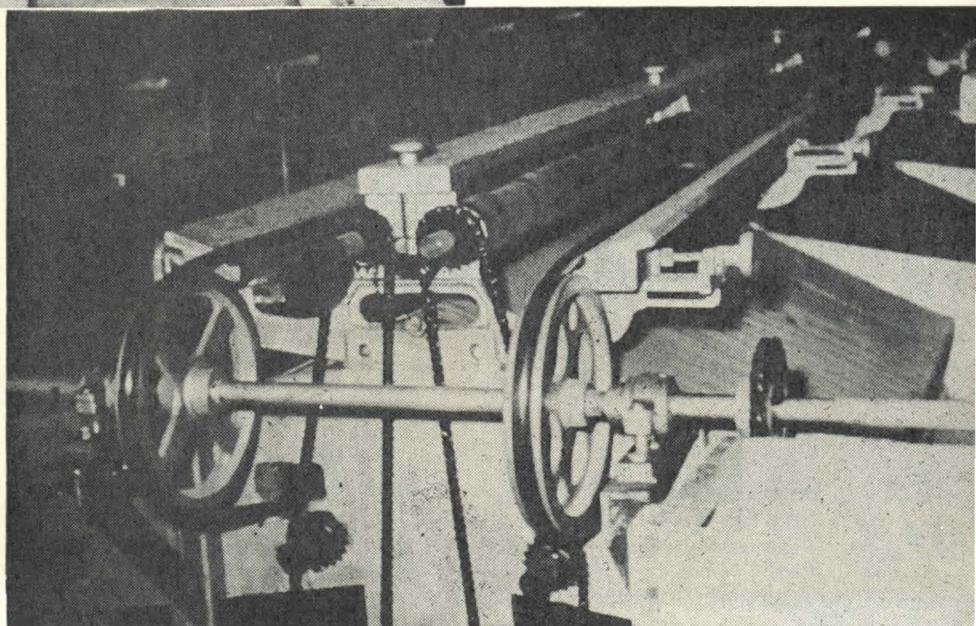
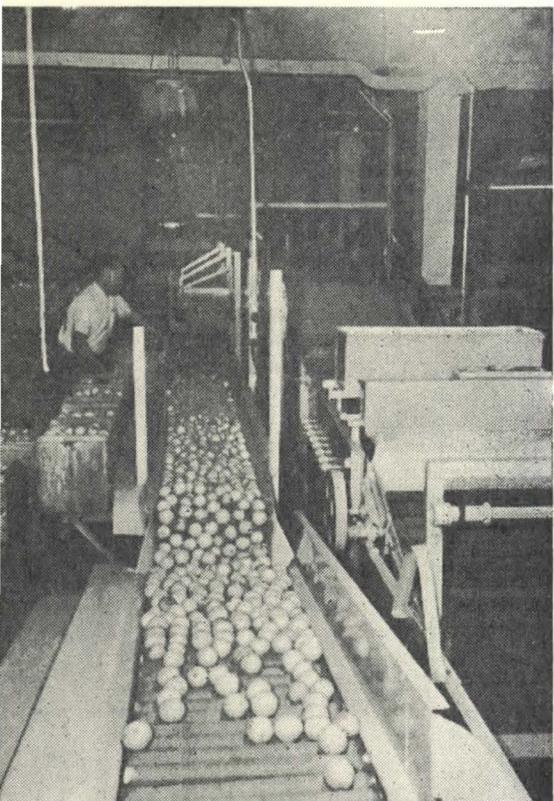


Fig. 3 (Above) Dumping oranges in the Experiment Station packing-house at Lake Alfred, Florida.

Fig. 4 (Below) «A rope and roll» sizer equipped with heavy plastic hose instead of rope. (Citrobrasil S. A. photograph).

- (5) Avoid anything, such as sand in the picking boxes, clipper cuts, rough boxes, scraping along machinery (instead of rolling), that can tend to break the almost "germ-proof" cuticle and admit the ubiquitous decay spores.

Fungicides, used correctly, are more effective than either careful handling or refrigeration. Readers are warned against haphazard use of fungicides, few of which are genuinely effective for post-harvest use on citrus, some are harmful to the fruit, and others are harmful to the customer. We recommend only two fungicides for general post-harvest use. These are sodium o-phenylphenate (Dowicide A) and diphenyl (biphenyl). The former can be applied as a dip, wash, flood (7, 9, 10) or in a wax emulsion (8). The simplest and safest type of solution to use is the Dowicide A-hexamine combination developed by Hopkins and Loucks of the Florida Citrus Commission staff at Lake Alfred (6). Any form of Dowicide application involves enough equipment to at least dip and probably wash and rinse the fruit mechanically.

Diphenyl is a volatile chemical usually applied on impregnated wrappers or by inserting impregnated pads in closed containers such as cartons (7). When wicker baskets, wooden crates, etc., are used, superb decay control can be obtained by hand wrapping each fruit in diphenyl paper. In countries in which labor is cheap enough for this, the cost of importing the necessary diphenyl wraps is apt to be a problem, except for end-of-season storage or special fancy fruit. Another disadvantage of diphenyl is that it has a distinctive "floral" aroma that clings to the fruit for several days after the wraps are removed. Some customers object to this and occasionally the obvious presence of some chemical starts rumors that the fruit has been treated with something harmful. Actually, diphenyl has extraordinarily low toxicity towards human beings.

Refrigeration is usually available only in very well established citrus districts and is no cure-all for citrus fruit. When refrigeration below 50° F. (10° C.) can be provided *continuously* (that is to say through shipping, marketing and in the customer's home) decay control is, of course, almost perfect over any reasonable marketing period, particularly if combined with an effective fungicide treatment. However, we achieve this for only a minor portion of our Florida citrus shipped as fresh fruit.

Hydro-cooling (cooling suddenly with ice water) is definitely not advised. Citrus fruit so cooled must be kept under refrigeration continuously thereafter as excessive decay results on removal from refrigeration (2).

WAXING

Once a uniform fruit of a reputable keeping quality is achieved, attention can be paid to improving the appearance of the fruit. In humid climates the fruit is apt to be dirty and the simple operations of washing improves its appearance immensely. However, washed citrus fruit shrivel very rapidly and, unless the marketing period is very short, washing should be followed by waxing (8, 9, 10).

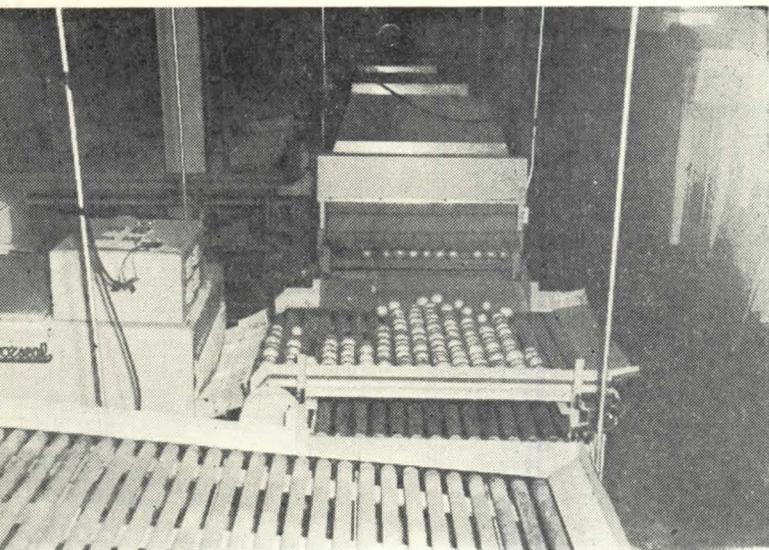


Fig. 5 (Above) Oranges entering a patented wax applicator.

Fig. 6 (Below) Oranges leaving a transverse brush washer; A= Compressed air soaper that foams soap or detergent solution onto the fruit below; B= Oranges on the washer brushes; C= Sprays of clear water to remove soap and dirt.

Waxing methods that involve excessive brushing of the fruit should be avoided. Often such methods do as much harm to the cuticle of the fruit as they do good in depositing a wax coat. The simplest waxing process involves simply dipping the fruit in an aqueous wax emulsion. In recent years such emulsions have been developed containing the o-phenylphenate fungicide (8). Thus a rather simple apparatus can be used to wash, apply a fungicidal wax, dry the fruit and size it into several size categories.

DEGREENING AND COLOR-ADDING

So far no mention has been made of the "cosmetic" treatments, unless waxing is so considered. (Let us resist the tendency to consider a high shine, or "gloss", more important than decay control and reduction of water loss). If the local market is taking "off-color" fruit, then resist the temptation to "degreen" and "color-add", neither of which improve eating quality. Such processes are usually started in order to obtain a premium price. This price advantage, however, tends to disappear as soon as the process becomes general and to be followed by a penalty for fruit not so treated or which do not respond to these treatments. ("Off-bloom" fruit, produced out of its normal season, often will not degreen; "regreened" Valencias often will not degreen; and color-add can not cover up dark green color). Only introduce these processes to regain a local market from prettier or imported fruit or to export to a market that demands higher fruit color. Customers buy by habit and what they are used to buying is acceptable until something else is offered. In the U.S.A. lemons can only be sold bright yellow and limes dark green. Green lemons or yellow limes are unsaleable. But in Brazil I observed both sold, almost regardless of color, as "limãos"—a far more sensible practice to which we in the U. S. can never return, as our customers "know" that lemons are yellow and limes are green.

The chief disadvantage of degreening and color-adding for a small local market is that very soon off-color fruit cannot be sold at a profit until cannery facilities are developed.

When it is necessary to degreen or color-add for a market already used to brilliant fruit, a quite considerable expenditure becomes necessary and the equipment should be designed and set up by professionals, as quite minor errors can be very costly.

TRADE ASSOCIATIONS

Two other quite different approaches to orderly marketing remain to be discussed. One is formation of a trade association consisting of a voluntary alliance of growers, shippers and packers of fresh citrus. The primary role of such an association is two-fold. It forms a channel for dissemination of information to its members and also affords them a means of communicating with various experts and government agencies. The writer has worked in many fruit districts with a variety of fruit crops. Where there has been an effective trade asso-

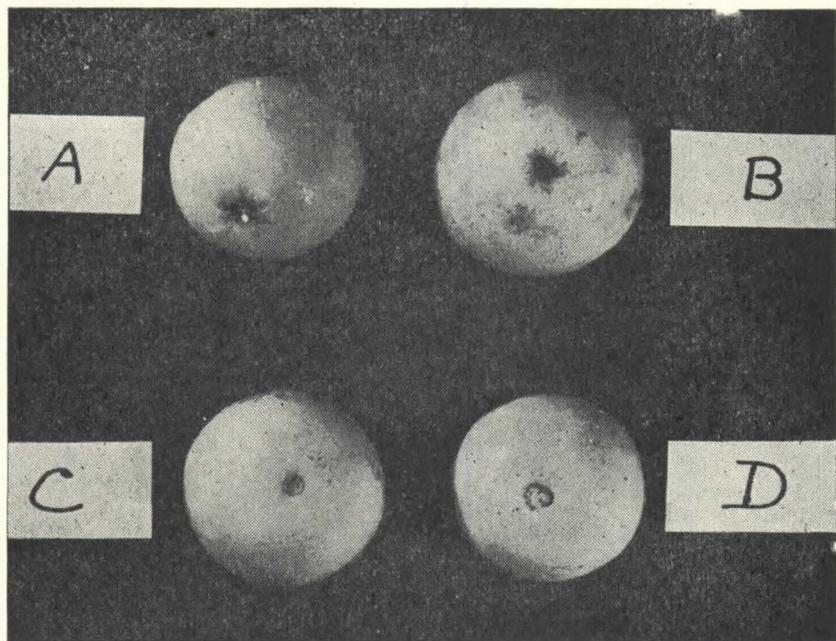


Fig. 7. A. Fruits clipped with sharp stems damage other fruit with which they come in contact.

B. Pulled fruit do not damage other fruit, but in stem-end rot districts are still liable to infection from spores if the button (calyx) remains.

C. Fruit that pulls cleanly, so little if any calyx tissue remains, are comparatively resistant to stem-end rot.

D. Fruit must be clipped if pulling results in a high proportion of «plugged» fruit like this.

ciation important information could be communicated to a single person who would promptly pass it to all members of his association. Research and market information was thus promptly used. Where there was no such trade organization, research and market information went to waste as though whispered down a well.

MATURITY STANDARDS

The indubitable prime requisite for orderly marketing of citrus I have left to the last. The fruit must be edible and palatable and that implies maturity tests for internal quality. Standards cannot be set up and enforced without a thriving industry, preferably with an organized grower group to work with government officials for that industry's own benefit. An industry is past its infancy when it assists actively in its own regulation (11).

These, then are the primary requirements in establishing orderly citrus marketing:

- (1) Fruit of adequate maturity and attractive taste.
- (2) Scrupulous sizing with no "facing" of packages.
- (3) Minimum decay and minimum shriveling.
- (4) An alert trade organization.
- (5) Artificial aids to fruit color and shine to be stressed only when the other requirements have been met and when adequate cannery (or other outlets) are available for the fruit that does not meet such external standards despite these cosmetic treatments.

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