HARVESTING AND HANDLING PRACTICES GROVE TO PACKINGHOUSE

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The fresh citrus industry is a very important part of the total Florida citrus industry which was valued on-tree at 703 million dollars in 1985-86 (7). But even though Florida has three times the acreage of California, Florida's fresh citrus shipments are only 72% of California's (Table 1). Further, California earned $745 million for fresh fruit (5) compared to only $380 million for Florida fresh fruit in 1985-86 (7).

Table 1. Florida and California fresh citrus shipments for the 1985-86 season with corresponding acreage (5).

Fruit Type	Cartons Shipped (1000) or Acreage (1000)					
	Florida			California		
	Domestic	Export	Acreage	Domestic	Export	Acreage
Oranges	16,833	202	466	72,792	16,543	180
Grapefruit	28,307	11,078	118	776	87	22
Tangerines	2,318	4	40	--	--	4
Tangelos	2,563	--		--	--	5
Temples	1,722	--		--	--	--
Lemons & Limes	1,045	--	8	10,000	10,000	50
Totals	53,001	11,284	625	83,568	26,630	262

Florida is not catching up but is falling behind California in fresh citrus volume. Prior to the freezes of the early 80's, fresh shipments of round oranges, temples, and tangerines fell to half of the amount of the mid-60's (6) (Table 2). Grapefruit sales remained steady over this period and tangelo shipments increased only slightly. What are the constraints on the Florida fresh citrus industry, and why are we losing ground relative to our previous shipping?

Table 2. Florida fresh fruit utilization between major freezes (6).

Year	Boxes	
	Oranges	Tangerines
	(1,000)	(1,000)
1966-67	17,876	3,032
1970-71	13,962	2,661
1975-76	11,730	2,362
1980-81	8,276	1,905

Price for fresh fruit has been favorable. Over a recent 6-season period, the on-tree price for fresh fruit has consistently exceeded processed, but only 7% of the orange crop and 42% of the Florida grapefruit crop were marketed fresh in 1985-86. Therefore, supply has probably met present demand for the fresh fruit we now deliver. Since grapefruit and orange production are expected to increase as much as 50% over the next 10 years (9), demand for fresh and processed product must be increased. Increased advertising might increase fresh sales but this would have to be coupled with delivery of better quality fruit to the consumer. We did not lose half of our fresh orange and tangerine sales because of reduced advertising or supply.

A major problem is the relatively poor quality of fruit delivered to the packinghouse. Blemishes and decay problems are much greater in Florida than in a mediterranean climate like California's (4). As many as 70 causal agents of fruit blemishes are recognized in Florida (1). Major

external problems include windscar, rust mite, scales, greasy spot, melanose, poor color, and spray burns. Internal quality problems include early season immaturity and late season section drying (3). Further, shippers who extend holding and shipping times for export and summer storage are plagued by excessive decay problems (2, 3) that are largely related to poor handling methods in the field and packinghouse.

Historically, some injury due to rough handling was reduced by the conversion to bulk bins (10). Compared to 90 lb boxes (oranges), bulk bins reduced the number of edges fruit were exposed to when being dumped from picking bags. This reduced the chances for contact with sand and for container surface abrasions. On the negative side, crews often pick citrus for fresh use in the same way as for processing. This results in too much rough handling of fruit and fruit hitting the ground leaving abrasions and adhering sand. Sand is routinely picked up from dragging the extended picking bags used in the Florida industry. Oleocellosis (peel oil burn) results after oil gland rupture and is the most common harvesting related peel blemish (4, 17). Stem plugging tears, limb stub cuts, sand abrasions, bin edge cuts, etc. greatly contribute to the invasion of decay organisms. The contention in recent years that increased numbers of fruit are making ground contact during harvesting is supported by the greater problems with sour rot (4). Earlier work clearly demonstrated that more careful handling is required to prevent high decay rates (Table 3).

Table 3. Orange shipping experiments, Florida (16).

Treatment	% Blue Mold			
	On arrival	+1 week	+2 weeks	+3 weeks
1910 1911, 79 tests				
Careful pick & pack	0.6	1.1	1.6	1.9
Commercial	7.0	10.8	13.2	14.2
1911-1912, 65 tests				
Careful pick & pack	0.6	0.9	1.4	2.2
Commercial	4.0	6.8	10.4	14.2

Besides the oleocellosis and decay problems that are directly related to picking practices (16), the third major quality problem associated with harvesting is excessive peel desiccation because of delays in getting fruit to and through the packinghouse. This is usually the major contributor in cases of stem end rind breakdown (4, 15). Exposure to dry air in full sunlight or even in shade desiccates field run citrus fruit to a critical level very rapidly.

Some special situations should be mentioned. Mature, tender Indian River grapefruit and Tahiti limes are very susceptible to bruising. Any drop can rupture juice vesicles in the blossom end leading to blossom-end clearing of grapefruit (12) or stylar-end breakdown of limes (4). Of more concern is the special problems and requirements for tangerines. These

require better growing care as well as handling to assure good packout and minimum decay and peel injuries (11). Tangerines are often too small and poorly colored. These problems require cultural practice modifications such as yearly moderate hedging, careful fertilizer balance, and good irrigation practices. Tangerines also have a very short harvest season from when they are immature until when they develop juice vesicle granulation. Coupled with these problems is the thin cuticle and wax covering which makes tangerines extremely susceptible to abrasions leading to higher decay and to desiccation which brings on peel necrosis problems such as stem-end rind breakdown. Use of smaller, hard-sided picking buckets has been recommended in the past for tangerines (11), but generally, the Florida industry has not adapted these smaller bags.

Considering the on-tree value of citrus most years (6, 7) and the investment in picking, hauling, packing, and selling costs (8, 13, 14) (Table 4), it does not make sense to lose fruit to poor harvesting and delivery practices. In the past, it has been suggested to the industry that some picking crews should be designated for fresh fruit only and receive special training and pay in order to improve the condition of delivered fruit. Most packinghouse operators say it will not work and they would lose these crews, or they have too much turn-over to invest extra money in picking crews. On the other hand, some gift fruit shippers have successfully tried this approach, but few of the large commercial shippers have. Research in the early 1900's showed that careful harvesting by Florida commercial crews did significantly reduce injuries and decay (16), and this has also been demonstrated during the 1987-88 season (personal communication, W. Wardowski). Another practice that can help reduce decay is to disk under or windrow out drop fruit just before harvest. This helps avoid decay contamination and bad fruit from being picked up during harvest.

Table 4. Approximate on-tree and F.O.B. values of fresh Florida citrus in 1985-86 and estimated picking, hauling, packing, and selling costs (6, 7, 8, 13, 14).

Fruit type	Dollar value/box				
	On-tree	Pick Haul	Pack Sell	F.O.B. packed	Margin
Oranges-E-M[z]	4.62	1.86	4.46	10.94	0.00
L[z]	3.90	1.86	4.46	10.34	0.12
Grapefruit-W[z]	4.20	1.40	4.15	9.75	0.00
P[z]	5.70	1.40	4.15	11.35	0.10
Tangerines	19.40	2.70	4.91	29.42	2.41
Tangelos	6.40	2.38	4.16	12.94	0.00

[z] E-M = early and mid-season
L = late season
W = white seedless
P = pink seedless

In California, where all citrus is intended for fresh marketing, many incentive innovations have been instituted to improve picker morale, productivity, and carefulness while picking fruit (12). Generally, in most areas of the world producing fresh citrus in significant amounts, all procedures to minimize fruit damage during the harvesting process are carefully monitored.

Although many of our Florida citrus quality problems, such as blemishes and poor color, exist at the time of picking, a much better and more reliable fresh product could be delivered through use of better handling practices (17). Considerable effort needs to be made to turn around the downward trends in fresh fruit sales. We need to sell more fresh fruit to help move the projected increased production of citrus in Florida.

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