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MEASURING EFFICIENCY IN FLORIDA FRESH CITRUS PACKINGHOUSES, 1994-95 SEASON

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Abstract. In recent years, many changes have occurred at all levels of the Florida citrus industry. These include increases in the supply of fresh citrus from Florida and in the intensity of competition from other sources and products, changes in technology used in packinghouses, and changes in merchandising and pricing practices for fresh citrus. The effects of these changes on the efficiency of packing and distributing fresh citrus are not well documented. In October 1995, a Florida citrus packinghouse cost efficiency study, funded by the Florida Department of Citrus, was initiated. The research project was a multi-disciplinary project including expertise in economics, engineering and horticulture. The intent of the research project was to:

1) Measure the level of efficiency in the fresh citrus packinghouses located in Florida;

2) Identify changes in operating practices that could improve efficiency of handling fresh citrus;

3) Provide confidential firm level information to individual packinghouses that participate in the research study. This firm level data will show the cost of packing fruit and the efficiency of each firm in packing the volume of fruit handled; and

4) Characterize factors that contribute to packinghouses operating at 100% efficiency.

This research study will contribute to improving efficiency of the fresh citrus industry at the packer level and will also enhance the level of cooperation in providing information that will benefit all areas of the industry. It will also result in the development of a program that will provide benefit to the industry for many years into the future.

Florida's fresh citrus industry has experienced lower returns in recent years. Many grapefruit growers have experienced fruit prices at or below costs. Estimated 1994-95 f.o.b. costs for fresh packed Indian River white grapefruit ranged from $8.09 per carton at 50% packout to $6.09 per carton at 100% packout (Muraro and Hebb, 1995). Estimatedf.o.b. costs for southwest Florida red grapefruit ranged from $7.93 per carton at 50% packout to $5.39 per carton at 100% packout (Muraro et al., 1995). Average f.o.b. prices were $5.36 and $5.31 per carton for Florida red and white grapefruit, respectfully, in the 1994-95 season (CAC, 1995).

Changes within the citrus industry have occurred in recent years that have impacted the competitiveness of producers within Florida. These changes include increases in the

supply of fresh citrus from Florida and increases in the intensity of competition from other sources and products, changes in the technology used in packinghouses, and changes in the merchandising and pricing practices for fresh citrus. These changes have led to changes in the competitive position of growers and packers.

Competition inspires development of new technologies to allow growers and packers to become more efficient and competitive in the global market for fresh citrus. Florida grapefruit growers were more efficient than California grapefruit growers according to results of an efficiency study completed by Andre in 1996 (Andre, 1996). His results indicate that the average efficiency for Florida grapefruit growers was 20%, compared to only 6% for California growers. Florida growers were operating at 27% technical efficiency and 76% scale efficiency. The 20% technical efficiency indicates that the combination of resources used to grow fresh grapefruit in Florida contributed most to the inefficiency of grapefruit growers while the scale efficiency of 76% indicates that growers were operating at 76% of their optimal efficiency on a scale basis.

These results point to the need for analyzing the efficiency of operations at the packinghouse level. This research involved collecting data from packinghouses operating in Florida and analyzing the efficiency of their operations. All fresh fruit packinghouses were contacted to collect data needed for calculating efficiency measures for packinghouses. Of the 54 packinghouses contacted and visited, only 10 packinghouses returned data which could be used in the analysis. A summary of that information follows with a simpler analysis of the efficiency of these firms. The intent of the study was to perform an efficiency analysis similar to that performed by Andre in the analysis of fresh grapefruit growers. A lack of response to the survey limited the analysis of efficiency to a discussion of costs related to packing fresh citrus.

Results

A total of 10 surveys were completed by fresh citrus packinghouses in Florida. Seven of the packinghouses were located in the Interior area with the other three coming from packinghouses located in the Indian River area. A total of 11.179 million field boxes were packed by the packinghouses included in the survey (Table 1). The average volume of the Interior packinghouses was 1.210 million field boxes received with 0.703 million field box equivalents packed as fresh citrus (Table 2). The average volume of Indian River packinghouses was 0.902 million field boxes received with 0.530 field box equivalents packed as fresh fruit. The average percent pack-

Table 2. Average volume of fruit handled by packinghouses, 1994-95 season.

Production region	Average total fruit received	Average fruit packed	Average cannery eliminations	Average percent packout
	------------- 1,000 Field box equivalents -------------			
Interior				
Oranges	672.0	384.2	287.8	57.2%
Grapefruit	289.3	158.8	130.5	54.9%
Temples	49.1	29.7	19.4	60.4%
Tangelos	63.4	36.4	27.0	57.4%
Tangerines	136.5	94.3	42.2	69.1%
Total	1,210.3	703.3	507.0	58.1%
Indian River				
Oranges	65.7	53.8	11.8	82.0%
Grapefruit	800.8	448.7	352.1	56.0%
Temples	3.6	1.9	1.7	52.0%
Tangelos	30.9	25.1	5.8	81.2%
Tangerines	1.2	0.5	0.8	37.1%
Total	902.2	529.9	372.3	58.7%

Represents data from 10 fresh citrus packinghouses located in the Indian River and Interior citrus producing regions.

out for all packinghouses was 58.3%, indicating that 41.7% were eliminations, not packed as fresh fruit. The average packout did not differ significantly between the Interior and Indian River packers, with both packing out about 58% of the fruit handled.

A summary of packed fruit by type of container for all the packers participating in the cost efficiency study is shown in Table 3. A total of 12.735 million 4/5 bushel equivalent cartons were packed which represents 18.6% of the total Florida fresh citrus packed during the 1994-95 season. A total of 8.474 million standard cartons, which includes both domestic (6.858 million) and export (1.616 million) cartons, accounted for over 66.5% of the total cartons packed. The Indian River area packed over 86.6% of the total export cartons consisting almost entirely of grapefruit. Bag master containers represented 21.9% of the 2.783 million total cartons packed. The remaining 1.478 million packed cartons consisted of 2/5 bushel gift fruit cartons (6.3%) and bulk fruit shipped in pallet boxes and bins (5.3%).

The cost of operating the packinghouses varied between producing areas and within the producing areas. The per unit average total of all costs for packing fresh citrus varied slightly between the Interior and Indian River producing areas, averaging $3.23 per 4/5 bushel carton in the Interior and $3.45

Table 1. Summary of fruit volume handled through packinghouses, 1994-95 season - all packers.

Variety	Total fruit received	Fruit packed	Cannery eliminations	Percent packout
	------------- 1,000 Field box equivalents -------------			
Oranges	4,901.0	2,850.8	2,050.1	58.2%
Grapefruit	4,427.5	2,457.7	1,969.8	55.5%
Temples	354.5	213.2	141.3	60.1%
Tangelos	536.7	330.2	206.5	61.5%
Tangerines	959.3	661.2	298.1	68.9%
Total	11,178.9	6,513.1	4,665.8	58.3%

Represents data from 10 fresh citrus packinghouses located in the Indian River and Interior citrus producing regions.

Table 3. Summary of packed fruit by type of container, 1994-95 season - all packers.

Variety	2/5 bu cartons	4/5 bu cartons std	Bag master containers	Bulk in pallet boxes and bins	Total cartons packed
	--------- 1,000 4/5 bushel equivalents ---------				
Oranges	507.3	2,818.9	1,942.0	327.8	5,595.9
Grapefruit	157.7	3,868.5	564.0	233.9	4,824.1
Temples	137.3	376.5	121.3	77.7	712.7
Tangelos	1.5	393.3	26.6	10.2	431.6
Tangerines	3.2	1,017.0	129.2	21.2	1,170.6
Total	806.9	8,474.1	2,783.1	670.8	12,735.0

Represents data from 10 fresh citrus packinghouses located in the Indian River and Interior citrus producing regions.

Table 4. Estimated per carton packing costs for packinghouses, 1994-95 season.

Item	Interior	Indian River	All packers
	----- $ per 4/5 carton -----		
Production cost:			
Materials	$0.90	$1.15	$0.97
Labor	0.96	0.96	0.96
Other direct packing costs	0.47	0.50	0.48
Indirect packing costs	0.24	0.18	0.22
Total production costs	$2.57	$2.79	$2.63
Selling Expense	0.21	0.19	0.20
General and administrative costs	0.24	0.31	0.26
Total packing costs	$3.02	$3.29	$3.09
Special assessments	0.23	0.17	0.21
Total all costs	$3.25	$3.46	$3.30
Range	$2.66 - $3.58	$3.13 - $3.72	$2.66 - $3.72

Represents data from 10 fresh citrus packinghouses located in the Indian River and Interior citrus producing regions.

per 4/5 bushel carton in the Indian River area (Table 4). The total cost of operating the packinghouses ranged from $2.66 to $3.58 per 4/5 bushel carton in the Interior and from $3.13 to $3.72 in the Indian River area. The total of all costs for all packers averaged $3.30 per carton with a range of $2.66 to $3.72 per carton.

Efficiency, as a concept, is built on the premise of determining the best combination of resources operating at the optimum scale which produces a bundle of goods with the least expense possible. The procedures followed by Andre involve estimating a production function and determining the efficiency assuming that one firm is operating at 100% efficiency. A similar logic can be followed using costs to determine the cost of efficiency of packing fresh citrus for the fresh market. Efficiency is estimated here as the proximity of the packinghouse (firm) to the least cost packinghouse (firm) in operating costs on a per unit basis. The firm operating at the lowest per unit cost was defined as 100% efficient and the deviation from that lowest firm's per unit cost for other firms was defined as inefficiency. A production function could not be estimated because of the lack of sufficient data to estimate the regression equation necessary to define efficiency. Estimating efficiency of packing using per unit costs provides a second approach that does approach a true measure of efficiency.

Following these procedures, efficiency was measured for the 10 participating firms in this study. The results presented in Table 5, indicate that the average efficiency of the firms in the study is 76.2% when compared to a 100% efficient cost of $2.66 per 4/5 bushel carton. Further comparison shows the Interior packinghouses operated more efficiently than firms in the Indian River area, 78.6% and 70.5% respectively.

Table 5. Average of mean efficiency and range of efficiency for packinghouse in cost study, 1994-95 season.

Production region	Average	Low range	High range
	----- % Efficiency of packinghouses -----		
Interior packers	78.6%	65.5%	100.0%
Indian River packers	70.5%	60.2%	82.4%
All packers	76.2%	60.2%	100.0%

Represents data from 10 fresh citrus packinghouses located in the Indian River and Interior citrus producing regions.

Lack of data made an analysis of factors contributing to efficiency difficult to measure two simple correlations were estimated for efficiency, one using the percent contribution of labor to total cost and the second utilizing the packout percentage. The correlation of labor costs to efficiency was estimated to be -0.139, indicating that firms with a higher percent of their total costs in labor were less efficient. The correlation of packout with efficiency was estimated to be 0.085, indicating that firms with a higher packout tended to operate more efficiently.

These results highlight two important conclusions to draw from this research. First, there are significant differences in the operations of packinghouses in Florida. Firms should benefit from a more intense analysis of their operations. As was expected, the results indicate that those packinghouses that operate with the highest packout percentage do operate more efficiently as do those with labor as the smallest contribution to total cost.

The second conclusion drawn from this study is the need for greater industry support and participation in this research effort. As new technologies are developed to improve efficiencies in growing and packing fresh citrus, it becomes vitally important to measure their contributions to efficiency. It is important to expand the base on which this study was completed. More firms need to be encouraged to participate so that a production function can be estimated for measuring efficiency. Using per unit costs as a proxy for measuring efficiency serves a useful purpose, but developing a production function would be more theoretically correct.

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