



- Methods and Costs of
- Handling Texas Citrus
- 1946-51

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DIGEST

The citrus industry in Texas underwent considerable change during the 1946-51 period. Volume of production dropped from a high of 29,800,000 boxes for the 1946-47 season to 300,000 for the 1950-51 season as a result of tree-killing freeze periods in the 1948-49 and 1950-51 seasons.

Methods of harvesting, packing, processing and selling did not undergo significant changes during this period although trends in the use of containers for fresh citrus showed the rise in popularity of consumer-size mesh bags. The increase in proportion of these bags was from 2 percent of the total to 13 percent for grapefruit and from 10 percent to 32 percent for oranges. Introduction of special bag-handling equipment in some packing houses accompanied the increase in use of these bags.

Truck movement of fresh citrus from the Lower Rio Grande Valley increased from 20 percent of the large movement during the 1946-47 season to 72 percent of the small volume during the 1950-51 season. This increase was influenced by the drop in volume resulting from the freezes. The truck portion of the last pre-freeze season, 1947-48, was 33 percent.

The areas lying north of Texas and Northeast to Pennsylvania have been Texas' principal markets for citrus. Prospects appear favorable for an extension of this area to the Rocky Mountains and beyond on the west. The trend in population expansion in the western half of the United States indicates opportunities for new markets for Texas citrus in that area.

Costs of packing oranges and grapefruit in 1-3/5 wirebound boxes increased about 36 percent during the postwar period. Volume was the principal factor affecting costs for the cooperating firms.

The definite relationship between volume and cost indicates that packing houses and canning firms in the Lower Rio Grande Valley must increase their volume to effectively lower costs. The number of firms packing and processing citrus must be limited to gain this increase in volume. This is particularly important for the next few seasons of low Texas citrus production.

The many estimates of future plantings in the Lower Rio Grande Valley indicate 75 percent will be red grapefruit, 10 percent other grapefruit, 10 percent Valencia oranges, 4 percent early oranges and 1 percent in miscellaneous plantings. The production area is being shifted from the eastern to the western part of the Valley. This shift will eliminate some packing houses and reduce citrus processing by some canning firms in the coastal part of the Valley.

A careful study of production and existing facilities of the industry might prevent a recurrence of the excessive number of plants that operated prior to the disastrous freezes.

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Methods and Cost of Handling Texas Citrus, 1946-51

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INTRODUCTION

THE METHODS UTILIZED AND COST INVOLVED in the packing and processing of Texas citrus fruits have become particularly important during the post World War II years. The demand for fresh fruit in consumer containers, the introduction of frozen concentrates and increasing labor shortages have focused attention on technical changes in fruit handling methods. Increasing national volume accompanied by decreasing citrus prices during a period when general price and wage levels are increasing has necessitated careful attention to efficient plant operation and marketing.

This report has been prepared to provide general information on the harvesting, packing, processing and marketing of citrus fruits in Texas during the postwar period with special reference to costs of operation.

The Texas Citrus Industry

The citrus industry in Texas underwent major changes during the 1946-51 period. Volume of production reached the highest point for its 50-year history during the 1947-48 season. Then a disastrous freeze in January 1949 and two more in the 1950-51 season dropped Texas citrus production to the position it held 20 years earlier.

The Lower Rio Grande Valley citrus industry came into recognition about 1920 when 123,951 trees were reported for the area.¹ The rate of tree plantings was accelerated and by 1929 there were about 5 million trees. It was estimated that in 1933 grapefruit led the citrus industry with plantings totaling 6 million trees as compared with 1.5 million orange trees. By 1946, total plantings were well over 9.5 million trees and the production of 29.8 million boxes of fruit represented 61 percent of the potential total from these trees.

The first commercial fresh citrus shipments of any importance from the Valley were made during the 1921-22 season when 54 carloads were shipped. The following year, 142 carloads were shipped.² The number of boxes shipped increased rapidly to 1,420,388 in the 1933-34 season and a peak of 17,465,868 boxes during the 1946-47 season.³

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The bulk of Texas oranges and approximately half of Texas grapefruit have been marketed fresh with wide variations in the marketing practices, facilities and methods employed. In the 1946-47 season, 60 or more commercial shippers were in operation, shipping by rail and truck. A number of firms handled only the gift fruit shipping business.

In 1925, it was reported that grapefruit comprised 68 percent of the total citrus production, with oranges totaling 38 percent and miscellaneous types of fruits 4 percent.² Fresh fruit shipments shown in Table 1 indicate that by the

Table 1. Number of 1-3/5 bushel boxes equivalent of Texas citrus shipped, 18 seasons

Season	Grapefruit	Oranges	Tangerines	Total
				Thousands
1933-34	1,061	349	11	1,421
1934-35	2,232	471	18	2,721
1935-36	2,131	632	20	2,783
1936-37	7,067	1,876	36	8,979
1937-38	6,735	1,279	32	8,046
1938-39	8,318	2,643	42	11,003
1939-40	7,377	2,152	45	9,575
1940-41	7,181	2,420	45	9,646
1941-42	7,854	2,332	43	10,229
1942-43	9,436	2,242	57	11,735
1943-44	9,128 ¹	3,172	55	12,355 ¹
1944-45	12,292	4,068	66	16,426
1945-46	13,079	3,989	95	17,163
1946-47	13,235	4,166	65	17,466
1947-48	11,487	4,328	58	15,873
1948-49	5,512	2,593	34	8,139
1949-50 ²	3,565	1,622	41	5,228
1950-51	2,471	1,441	18	3,930

¹ 7,306 boxes grapefruit from Winter Garden and Laredo districts not included.

² Mexican citrus included.

1946-47 season, the proportion of grapefruit had risen to about 75 percent. The best estimates of plantings following the 1951 freeze indicate 75 percent in red grapefruit, 10 percent in other grapefruit, 10 percent in Valencia oranges, 4 percent in early oranges and 1 percent in miscellaneous plantings.

There have been significant changes in the movement of the packed citrus from the Valley.

Table 2. Total shipments of fresh citrus from Texas by rail and truck, 18 seasons

Season	Rail		Truck		Total
	Number	Percent	Number	Percent	
1933-34	1,807	46	2,096	54	3,903
1934-35	4,600	62	2,832	38	7,432
1935-36	4,650	64	2,659	36	7,309
1936-37	17,508	77	5,277	23	22,785
1937-38	14,019	71	5,600	29	19,619
1938-39	17,392	60	11,514	40	28,906
1939-40	12,676	50	12,645	50	25,321
1940-41	9,691	40	14,311	60	24,002
1941-42	16,056	64	8,846	36	24,902
1942-43	20,212	82	4,319	18	24,531
1943-44	20,382	81	4,823	19	25,205
1944-45	27,890	86	4,519	14	32,409
1945-46	28,484	85	5,026	15	33,510
1946-47	27,154	80	6,703	20	33,857
1947-48	20,807	67	10,342	33	31,149
1948-49	7,089	45	8,722	55	15,811
1949-50	3,728	36	6,636	64	10,364
1950-51	2,192	28	5,733	72	7,925

In the 1922-23 season, it was reported that 60 percent of the fruit was shipped by freight and 40 percent by express.² Since that time, truck shipments have assumed importance and for some seasons 50 percent or more of the total citrus volume moved out of the Valley by truck, as shown in Table 2.

Processing of grapefruit juice started in the late 1920's. About 18,000 cases of 24/2 equivalents were produced during the 1929-30 season. The processing of grapefruit segments began about the same time but the 1933-34 season, with 7,000 cases, marked the first appearance of a significant volume. The citrus processing industry made rapid progress, as indicated in Table 3, and in the 1945-46 season 40 or more canning firms processed 10,572,000 cases. Segments during that season accounted for 288,800 cases of the total production.

Table 3. Lower Rio Grande Valley production of all processed citrus fruits for the past 18 seasons

Season	Cases ¹	Season	Cases ¹
	Thousands		Thousands
1933-34	50	1942-43	7,402
1934-35	365	1943-44	7,981
1935-36	565	1944-45	9,452
1936-37	2,840	1945-46	10,572
1937-38	5,000	1946-47	9,173
1938-39	4,740	1947-48	9,687
1939-40	6,050	1948-49	5,659
1940-41	5,820	1949-50	2,869
1941-42	5,614	1950-51	5,790

¹ Production is reported on basis of 24 No. 2 cans per case.

The citrus industry was crippled by a freeze in January 1949, and 2 years later, when recovery appeared near, disaster struck again with the most severe freeze in 40 years according to weather records. This freeze killed an estimated 75 to 80 percent of the citrus trees and caused complete removal of many orchards. Economic disaster was averted for many growers by rapid conversion from citrus to cotton production. Many of the citrus orchards are being replaced as nursery stock becomes available, but they require a number of years to reach the production of the 1946-47 season.

The Lower Rio Grande Valley has recorded freezing weather on numerous occasions dating back to the first records of 1876.⁷ Although there was no regularity in the occurrence of the freezes, 20 times in the past 75 years the temperature has been below 26°F., the temperature at which damage can be expected. Temperatures of 20°F. or lower were recorded only in 3 years at Brownsville, 1880, 1881 and 1899.

Character of Study

This report is the result of a 5-year study of the cost of packing and processing of Texas citrus. It covers the methods and costs of harvesting, packing, processing, selling and distributing fresh citrus and citrus products. The study included a total of 38 packing houses and 29 processors as cooperators, representing independent and cooperative firms.

Secondary data were obtained from reports of the Texas-Federal Inspection Service, the Texas Canners Association and publications of the Texas and Florida Agricultural Experiment Station.

For the fresh fruit study, companies which handled more than 50 percent of the total volume of packed fruit supplied cost data and related information each season, as shown in Table 4.

Table 4. Percentage of total Texas fresh fruit packed by firms included in the study, 5 seasons

Season	Texas total volume packed fruit ¹	Sample firms packed fruit ¹	Percent in sample
	Thousands	Thousands	
1946-47	17,466	10,549	60
1947-48	15,874	8,841	56
1948-49	8,139	5,451	67
1949-50	5,229	3,480	67
1950-51	3,930	2,123	54
Total	50,638	30,444	60

¹ 1-3/5 bushel equivalent.

At the same time, the processing companies included in this study accounted for an average of 67 percent or more of the total volume processed by the Lower Rio Grande Valley citrus processing industry, as shown in Table 5.

Table 5. Texas citrus products processed by the firms included in the study, 5 seasons

Season	Total volume processed ¹	Sample firms volume processed ¹	Percent in sample
	Thousands	Thousands	
1946-47	9,173	8,168	89
1947-48	9,687	6,093	63
1948-49	5,658	3,699	65
1949-50	2,869	1,268	44
1950-51	5,790	3,044	53
Total	33,177	22,272	67

¹ 24/2's case equivalent.

METHODS OF HANDLING TEXAS CITRUS

The marketing of citrus fruits begins on the tree when maturity is reached. From this point the packing or processing firm handles all shipping point functions. The grower may market his fruit through a grower cooperative, sell to an independent packer shipper or sell to an independent processor. Information obtained from 10 packing firms in 1951 indicates that an average of 195 growers and 6,880 acres of orchard were served by each association. Radii of the areas served by these firms ranged from 10 to 50 miles and averaged 27 miles.

The citrus harvested by the firms represented in this study follows one of three channels: from orchard to cannery; from orchard to packing house and packed for fresh shipment; or from orchard to packing house to canner as cull or offsize fruit. The distribution by percentage for these channels is shown in Table 6.

Table 6. Use and accumulation of citrus fruit harvested by companies worked with, 5 seasons

Type of use	1946-47	1947-48	1948-49	1949-50	1950-51	Average ¹
	Percent					
House to cannery	19	19	12	17	19	17
Grove to cannery	11	15	27	11	23	17
Total packed ¹	70	66	61	72	58	66
Total all fruit	100	100	100	100	100	100

¹ Fresh.

Harvesting Operations

The harvesting of citrus is done by contract picking crews assembled by the owners of trucks. These crews are supervised by the buyers or fieldmen of the packing or processing firm but are controlled otherwise and paid by the contractor. The number and size of crews vary considerably but 14 crews of 10 pickers each is a typical packing house requirement.

The harvesting contractor is paid by the firms on the basis of so much for picking and so much for hauling to the packing house. The picking rate varies with the type of fruit and method of picking. Early in the harvesting season, "ring picking" or the use of sizing rings is a common practice in order that small fruit may be left on the trees to grow larger. This extra care by the picker results in a higher picking cost. Distance is sometime considered in determining hauling rates but more often all contractors for a given firm operate on a fixed rate for the entire season.

The contractor normally provides a truck and the necessary picking bags, rings and ladders for the harvesting crew. The packing house or processing plant provides the field boxes used for harvesting and hauling.

Packing House Operations

The functions performed at the packing house by fresh fruit shippers include degreening, dumping, washing, coloring, drying, waxing, grading, sizing, packing and loading. The degreening process is done by placing the fruit in color rooms upon arrival at the packing house and filling these rooms with ethylene gas for several days until the green pigment has been removed. The fruit is then moved from the color room to the washing, waxing and coloring machinery. From this point, the fruit moves over grading belts where fruit having disqualifying characteristics of size, shape or blemishes are removed and the market grades are separated before going into the sizing machinery. After the fruit is dropped into the packing bins from the sizing rollers, it is hand packed into

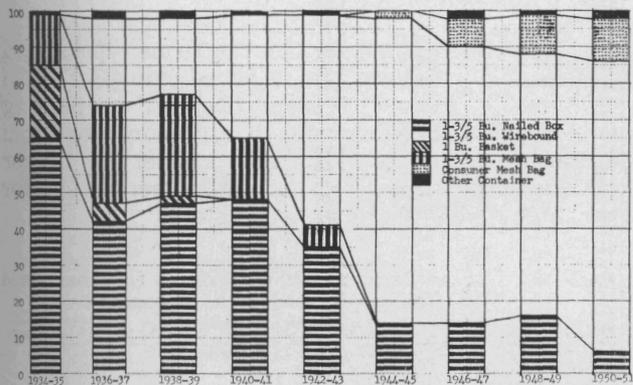


Figure 1. Proportion of fresh grapefruit packed in each of the principal container types, 1934-51.

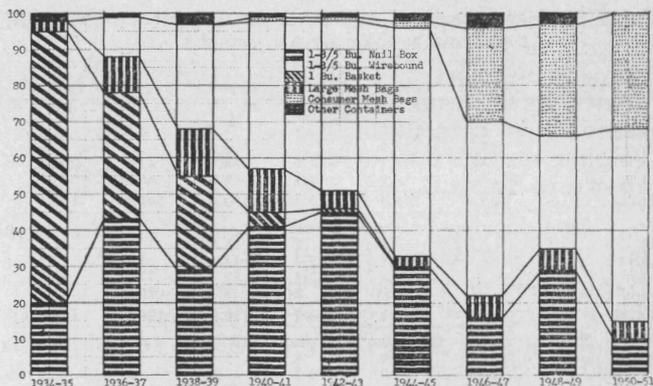


Figure 2. Proportion of fresh oranges packed in each of the principal container types, 1934-51.

the boxes or bags selected for the shipment being packed.

Boxes normally move out of the packing area on a belt or roller conveyor to a point where the lid is fastened. From there the box moves by hand truck to the truck or rail car in which it is shipped.

Consumer-size bags are transported within the plant by several methods. Two-wheel hand trucks and four-wheel dollies are used by most of the firms, although this equipment entails more labor and maneuvering space than do the other methods. The overhead chain conveyor has been installed in some plants. It offers savings in space and cost of handling to the point of loading but the initial cost of the equipment and double handling before shipping has eliminated economies for several plants. Belt conveyors are used by several plants with resultant savings in space and labor costs, although they also have the double-handling requirement.

The containers used for fresh citrus fruits in Texas and their relative importance are shown in Figures 1 and 2. The bushel basket and the 1-3/5 standard nailed box were the principal containers for oranges and grapefruit, respectively, during the 1930's. The 1-3/5 wirebound Bruce box was introduced during the 1938-39 season and rapidly became the principal container for both oranges and grapefruit.

Consumer-size bags were introduced during the 1934-35 season but were not widely used until the 1938-39 season when the equivalent of 25,000 boxes were shipped. Consumer-size bags accounted for 17 percent of the fresh shipments, or 2,717,000 box equivalents, during the 1947-48 season, as shown in Table 7.

Table 7. Percent of total fresh fruit shipments in consumer-size bags by type of fruit, 8 seasons

Season	Oranges		Grapefruit		All citrus	
	Percent					
1943-44	1		1		1	
1944-45	2		2		2	
1945-46	10		4		5	
1946-47	26		8		12	
1947-48	36		10		17	
1948-49	31		11		17	
1949-50	26		9		14	
1950-51	32		13		20	

¹ Less than .5 percent.

Table 8. Percentage of consumer packaged oranges and grapefruit by bag size, 6 seasons

Bag size, lbs.	1945-46	1946-47	1947-48	1948-49	1949-50	1950-51
Oranges						
20	3.8	1.3	.8	1.8	1.5	1.5
10	96.2	27.0	.7	.6	.8	.6
8	—	71.4	93.7	56.9	31.9	24.2
5	—	.3	4.8	40.7	65.8	73.7
Total	100.0	100.0	100.0	100.0	100.0	100.0
Grapefruit						
20	1.0	.6	.7	1.0	.9	1.2
10	99.0	92.1	45.7	13.0	1.1	.7
8	—	7.3	53.4	82.3	77.8	55.3
5	—	—	.2	3.7	20.2	42.8
Total	100.0	100.0	100.0	100.0	100.0	100.0
Oranges and grapefruit						
20	2.2	1.0	.8	1.4	1.2	1.4
10	97.8	59.9	19.7	5.8	.9	.6
8	—	39.0	76.7	67.6	54.3	37.0
5	—	.1	2.8	25.2	43.6	61.0
Total	100.0	100.0	100.0	100.0	100.0	100.0

The relative importance of the various consumer bags has changed during the past 6 seasons, as indicated in Table 8. The 10, 8 and 5-pound bags followed in succession as the most important consumer container. Each container was used for oranges first and then for grapefruit.

The machinery and plant arrangement for citrus packing houses are standardized and the only appreciable difference between plants is in the number of units or machinery groups they contain. Most of the Texas packing houses are one-unit plants although there are several two-unit plants and one four-unit plant. One-unit plants must stop operation and make machinery adjustments when switching from one fruit to another. Multiple-unit plants can pack both types of fruit at the same time. Floor space, and receiving and shipping arrangements are factors contributing to plant efficiency.

The number of employees required for the plants included in this study ranged from 15 to 70, excluding packers and cratemakers who are customarily piece-rate employees. The average number of employees utilized in various departments is shown in Table 9 for four one-unit plants and six two-unit plants from which this information was obtained.

Table 9. Average number of employees in the departments of a citrus packing shed

Department	Average no. employees	
	One-unit	Two-unit
Receiving (receive, truck & dump)	5	14
Graders	5	9
General (foremen, mechanics, janitor & watchmen)	7	12
Shipping (truck, check & load)	12	21
All departments	29	56

Processing Operations

Citrus processing firms in Texas were of two general types during the 1946-51 period, those that specialize in citrus products only and those that also process vegetables.

Citrus-juice processing is highly mechanized and the equipment and procedure also are standardized. It is processed, filled, labeled and cased mechanically. Many plants also are equipped with

Table 10. Volume of principal containers used in processing grapefruit, orange and blend juices and grapefruit segments, 5 seasons

Type container	1946-47	1947-48	1948-49	1949-50	1950-51
Thousands					
Grapefruit juice					
24/2	2,060	461	829	297	524
12/404	4,085	3,878	1,763	764	1,430
6/10	71	151	25	1	6
72/5-3/4	—	132	61	—	38
48/5-3/4	—	24	3	17	21
Orange juice					
24/2	49	37	66	1	112
12/404	42	66	131	—	263
72/5-3/4	—	13	25	—	14
Blend juice					
24/2	101	60	59	1	44
12/404	181	128	111	—	99
6/10	1	—	—	—	—
72/5-3/4	—	6	11	—	4
Grapefruit segments					
24/2	423	49	71	—	3
12/404	17	5	3	—	15
48/8	—	—	3	—	—

¹ Less than 500 cases.

mechanical conveyors to move the cases into the warehouses or freight cars.

The processing of grapefruit and orange segments is largely a hand-labor operation. The fruit must be moved through warm water to loosen the peel so that it can be removed by hand. The fruit is then conveyed through a warm lye solution to remove the albedo. After this operation, the fruit is conveyed by belt to workers who, with the aid of a special knife, separate the juice sacs from the fibrous material.

The principal containers used for citrus juice and segments in Texas have been the 24/2 case and the 12/404 case, as shown in Table 10. The number 2 can, which contains about 18 ounces of fluid, and the number 404 can, which contains 46 ounces, are most popular with housewives, and the large 6/10 can, which contains 6 pounds 9 ounces, is popular with institutions.

Table 11. Season average return per box to growers for oranges and grapefruit, 1919-51

Year	Orange ^{1,2}		Grapefruit ²	
	Dollars		Dollars	
1919	2.25		1.65	
1920	1.55		1.70	
1921	2.18		1.59	
1922	1.70		1.40	
1923	1.35		.95	
1924	2.20		1.20	
1925	1.95		1.81	
1926	1.56		1.64	
1927	2.40		1.97	
1928	1.75		1.51	
1929	2.67		2.15	
1930	1.62		1.26	
1931	1.34		.81	
1932	1.11		1.00	
1933	.78		.82	
1934	.96		.67	
1935	1.00		.81	
1936	1.50		.43	
1937	.95		.47	
1938	.66		.28	
1939	.96		.31	
1940	1.00		.37	
1941	1.18		.62	
1942	2.10		1.11	
1943	2.42		1.47	
1944	2.49		1.42	
1945	2.38		1.26	
1946	1.85		.90	
1947	1.50		.49	
1948	1.36		.61	
1949	2.29		1.95	
1950	1.21		.99	
1951	4.60		4.95	

¹ Includes tangerines.

² Equivalent packing house-door returns for all methods of sale.

Table 12. Mid-month average on-tree Texas citrus prices received by growers, 8 seasons¹

Season	Nov.	Dec.	Jan.	Feb.	March	April	May	Dollars							
Grapefruit															
1950-51	2.01	1.22	.93	.61	—	—	—								
1949-50	1.87	1.87	1.85	1.70	2.01	—	—								
1948-49	.69	.71	.81	.41	.35	—	—								
1947-48	.99	.55	.45	.52	.40	.29	.35								
1946-47	1.29	.89	.54	.65	.74	.68	.63								
1945-46	1.30	1.20	.94	.93	1.14	1.31	1.12								
1944-45	1.37	1.23	1.04	1.28	1.30	1.33	1.43								
1943-44	1.48	1.27	1.16	1.14	1.43	1.48	1.54								
Oranges															
1950-51	1.82	1.31	.93	.84	—	—	—								
1949-50	1.65	1.53	2.12	2.83	2.98	—	—								
1948-49	.89	1.21	2.16	1.01	.57	—	—								
1947-48	1.55	1.03	.95	1.76	1.96	1.88	1.78								
1946-47	1.88	1.25	.82	1.61	2.37	2.52	2.60								
1945-46	2.19	2.02	1.91	2.12	2.50	2.59	2.64								
1944-45	2.19	2.19	2.13	2.12	2.17	2.46	2.62								
1943-44	2.12	2.23	2.10	1.86	2.47	2.62	2.62								

¹ The on-tree returns to Texas growers were reported by the U. S. Department of Agriculture and represent all methods of sale and prices for packed boxes and in-field sales converted to on-tree equivalents for all sales.

Grower Prices

The citrus farmer in the Lower Rio Grande Valley sells his fruit on the tree. The average return per box to growers for oranges and grapefruit from 1919 to 1951 is shown in Table 11.

The seasonal variations in prices are shown in Table 12, which gives the mid-month average on-tree price for both grapefruit and oranges. For three seasons previous to the 1949 freeze, the average month-to-month price variation was 14 percent for grapefruit and 19 percent for oranges. The price trends usually were down from November to January and up from January until the end of the season in May.

DISTRIBUTION OF TEXAS CITRUS

Methods of Sales

Sales of fresh-packed citrus are handled by a central sales agency for some cooperatives while cooperative packers and other packer shippers maintain their own sales staff. Sales other than shipments to terminal market auctions normally are on a f.o.b. basis. Varying amounts of the

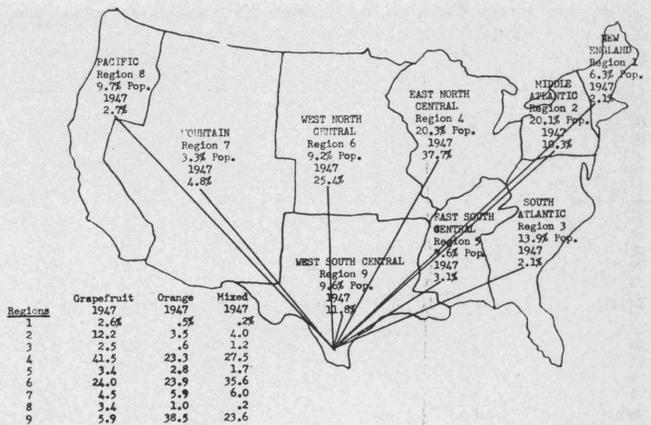


Figure 3. The percent population for the eight U. S. regions and the percent distributions of Texas citrus shipments of all citrus fruit, 1947.

f.o.b. sales are through brokers. An average of about 36 percent of all sales is f.o.b. shipping point, and most of them are for truck movement.

Texas Citrus Outlets

The distribution of Texas citrus is shown in Figure 3, in which the population percentages for specified regions are compared with the percentages of Texas citrus fruits shipped to those regions during 1947.

The outlets for Texas citrus are mainly in East North Central, Region 4; West North Central, Region 6; and West South Central, Region 9. These areas have approximately 39 percent of the U. S. population and take 70 percent of the grapefruit and 89 percent of the oranges and mixed citrus shipments. The region directly north of Texas, Region 6, seems to be our best market. There, 9 percent of the population receives 24 percent of the grapefruit and oranges.

Regions 7 and 8, Mountain and Pacific areas, may be a source of new markets for Texas citrus as they have 13 percent of the U. S. population and are growing rapidly. They now take 7 percent

Table 13. Texas grapefruit weighted average auction prices in 10 cities, 17 seasons¹

Seasons	Baltimore	Boston	Chicago	Cincinnati	Cleveland	Detroit	New York	Philadelphia	Pittsburgh	St. Louis
	Av. price	Av. price	Av. price	Av. price	Av. price	Av. price	Av. price	Av. price	Av. price	Av. price
Dollars										
1950-51	3.98	—	4.07	3.47	4.14	3.87	3.88	4.28	3.71	3.16
1949-50	5.35	—	4.28	4.28	4.59	4.22	—	4.54	4.50	3.92
1948-49	3.42	—	2.91	2.88	3.13	3.02	3.44	3.44	2.97	2.48
1947-48	2.97	2.23	2.68	2.60	2.74	2.66	3.19	3.16	2.78	2.18
1946-47	3.20	2.75	2.76	2.78	2.77	2.73	2.67	2.95	2.77	2.33
1945-46	3.88	3.63	3.00	2.95	3.14	3.26	3.43	3.17	3.11	2.79
1944-45	3.79	3.18	3.18	3.05	3.25	3.33	3.30	3.35	3.47	2.83
1943-44	3.15	3.10	2.96	2.95	—	—	3.57	3.25	3.13	2.81
1942-43	3.10	2.79	2.72	2.83	2.89	2.92	3.24	3.11	2.96	2.33
1941-42	2.18	2.31	2.10	2.25	2.24	2.26	2.49	2.47	2.34	1.83
1940-41	2.15	2.00	1.85	2.02	2.09	2.11	2.32	2.28	2.17	1.55
1939-40	2.38	2.14	2.02	2.09	2.23	2.19	2.21	2.29	2.30	1.69
1938-39	—	2.04	1.85	1.98	2.04	2.07	2.06	2.10	2.09	1.68
1937-38	—	—	2.08	2.14	2.18	2.25	—	—	2.20	1.95
1936-37	—	—	2.02	2.22	2.21	2.23	—	—	2.23	1.92
1935-36	—	—	2.55	2.56	2.71	2.72	—	—	2.78	2.43
1934-35	—	—	2.29	2.36	2.60	2.53	—	—	2.66	2.18

¹ Source—Market News Service on Fruits and Vegetables. Marketing Texas Citrus Lower Rio Grande Valley of Texas. Summaries of 1946-47 to 1950-51 seasons.

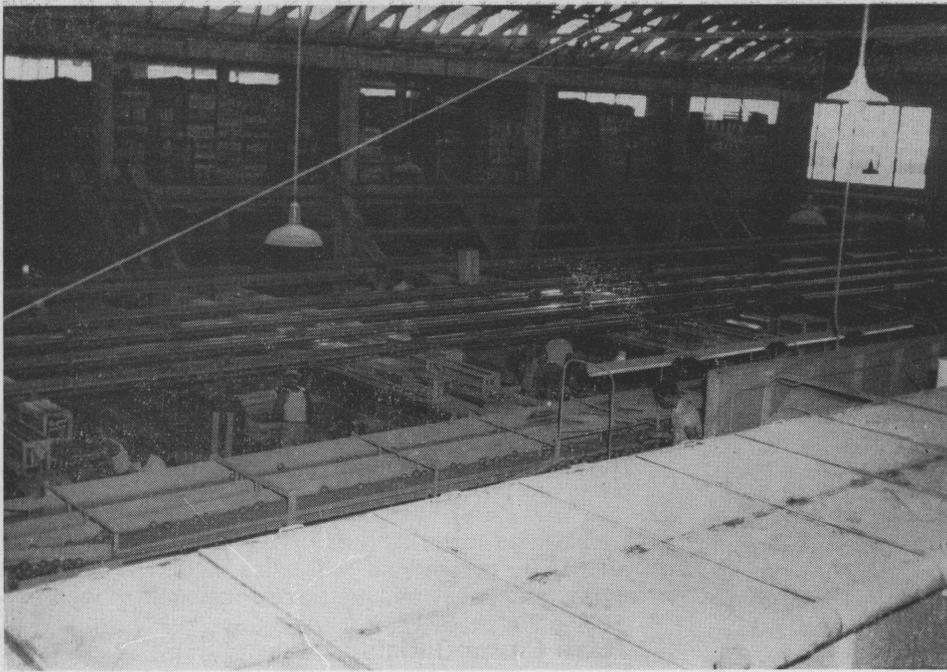


Figure 5. General view of a citrus packing shed. Conveyor lines are shown running lengthwise of the picture.



Figure 6. Receiving bags of citrus at the end of conveyor line and loading it onto a hand cart.

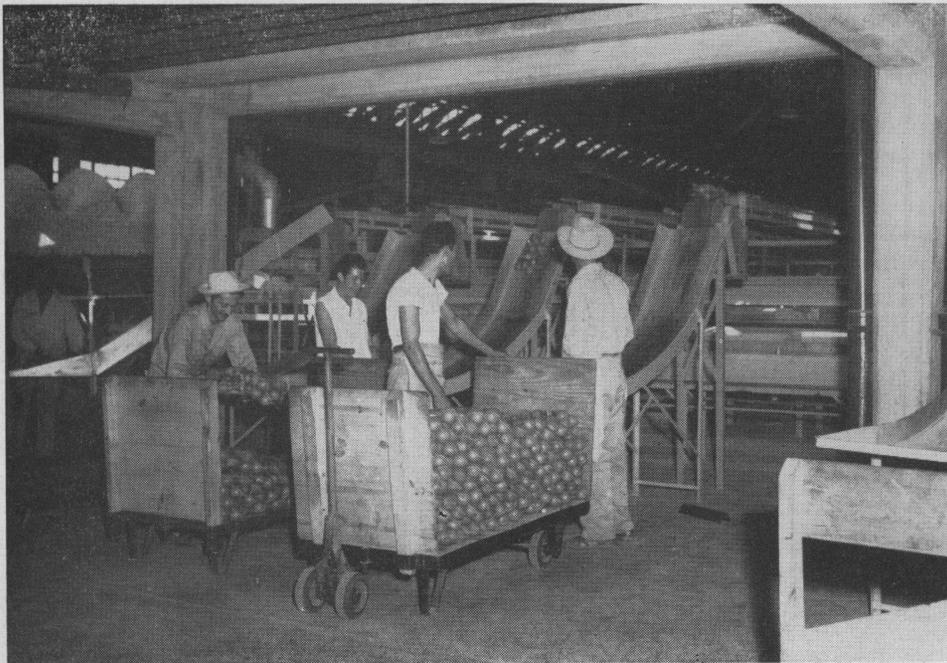


Figure 4. Hand-harvesting citrus from a fruit tree.



Figure 7. Moving boxed citrus on a conveyor line to the loading dock for shipment.



Figure 8. A housewife selects citrus in the vegetable and fruit section of a supermarket.



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of a Valley grape-

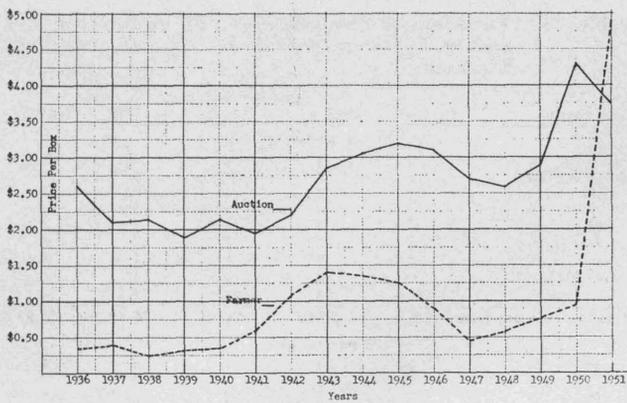


Figure 9. Auction and grower prices per box for grapefruit, 1935-51.

of Texas grapefruit, 7 percent of Texas oranges and 6 percent of the mixed-car shipments.

Auction Sales

Auction prices of Texas grapefruit for 10 major cities are shown in Table 13. Chicago, St. Louis, Detroit, Cleveland and Cincinnati received most of the Texas grapefruit. During the 5 seasons, 1946 to 1951, auction prices in Cleveland were generally higher and those in St. Louis were generally lower than in the other leading auction cities. Chicago consistently received the largest volume and seems to be near the price average for the 10 cities each year.

The auction and the grower price per box are compared in Figure 9. The two prices were closer together during the period 1941 to 1943 than for other periods. In 1951, the grower price was higher than the auction price. This could be due to the fact that most of the fruit in 1951 moved by truck and since direct sale prices were higher, the auction price does not represent a true picture.

COSTS OF HANDLING TEXAS CITRUS

Costs and efficiency of handling citrus and citrus products have become of increasing importance to the grower, shipper and processor during the postwar period. High production on a national scale had lowered prices, and increased cost for labor, materials and transportation have narrowed margins. Table 14 gives a composite picture of the relation among the various shipping point cost items for citrus.

Harvesting Costs

Harvesting costs include the picking and hauling charges and half of the field-box expense.

Table 14. Percentage of cost for harvesting, packing, processing and selling citrus

Fresh pack	Percent	Processed	Percent
Harvesting	15	Harvesting	11
Direct packing	68	Direct processing	66
Indirect packing	5	Indirect processing	14
Adm. and selling	12	Adm. and selling	9
Total	100	Total	100

Table 15. Field-box expenses charged to harvesting and to packing operation, 5 seasons

Item	1946-47	1947-48	1948-49	1949-50	1950-51
Charged to harvesting	\$29,241.77	\$16,148.39	\$22,712.64	\$17,057.92	\$20,998.15
Charged to packing	29,241.77	16,148.39	22,712.64	17,057.92	20,998.15
Total	\$58,483.54	\$32,296.78	\$45,425.28	\$34,115.84	\$41,996.30
Total volume fruit, boxes	6,985,782	4,683,705	4,324,310	3,646,389	3,354,703
Cost per box	\$.0084	\$.0069	\$.0105	\$.0094	\$.0125

The remaining half of the field-box expense is charged to the packing-house operation. Table 15 shows the total field-box expense for all firms from which these data were available during the period of the study. The buyer or fieldman salary is considered part of the administrative expense because his principal duty is procurement of fruit.

Table 16 presents costs of harvesting oranges and grapefruit for 5 postwar seasons. The cost of harvesting oranges did not increase as much as

Table 16. Harvesting costs for oranges and grapefruit for 1-3/5 Bruce-box equivalents, 5 seasons

Item	1946-47	1947-48	1948-49	1949-50	1950-51
Oranges					
No. of firms	12	9	6	8	8
1-3/5 equiv. oranges	1,264,869	1,458,536	572,730	416,796	797,471
Harvesting cost	\$190,332.69	\$219,975.14	\$68,877.01	\$59,863.18	\$130,026.70
Cost per 1-3/5 equiv.	.1505	.1508	.1203	.1436	.1630
Grapefruit					
No. of firms	13	10	7	8	8
1-3/5 equiv. grapefruit	7,759,627	6,348,112	2,358,419	1,830,236	1,957,806
Harvesting cost	\$717,222.17	\$536,043.51	\$217,801.03	\$207,649.58	\$247,950.19
Cost per 1-3/5 equiv.	.0924	.0844	.0924	.1135	.1266

that of grapefruit during this period. Before the 1949 freeze, orange cost averaged 61 percent higher than grapefruit but only 28 percent higher afterward.

Grapefruit harvesting costs were decreasing during the 1946-47 and 1947-48 seasons when there was an increase in volume of fruit picked. There was an increase in harvesting costs in the 1949-50 and 1950-51 seasons; this can be attributed to the low volume of fruit picked each year following the loss of a large number of trees in the freeze of January 1951. The condition of the orchards did not allow rapid harvesting work because the trees had been severely pruned and had very little fruit. The pickers had to move more often from tree to tree and this reduced their efficiency.

Packing Costs

The industry average costs for packing oranges and grapefruit in various containers is shown in Table 17. The cost of packing an equivalent volume of fruit in different containers varies due to differences in the cost of materials, packing labor rates, cost of handling packed fruit and slowdown of output.

Table 17. Cost of packing and selling Texas citrus by type of container, 5 seasons

Season	1-3/5 Bruce	20-lb. bag	10-lb. bag	8-lb. bag	5-lb. bag	Dollars					
						Grapefruit					
1946-47	.65	—	.73	.82	—	Oranges					
1947-48	.62	—	.85	.94	—	Oranges					
1948-49	.75	1.01	.88	.93	1.12	Oranges					
1949-50	.81	.91	.95	.99	1.21	Oranges					
1950-51	.89	.92	—	1.16	1.38	Oranges					
1946-47	.75	—	.87	.92	—	Oranges					
1947-48	.77	—	.97	1.10	—	Oranges					
1948-49	.86	—	.90	1.03	1.33	Oranges					
1949-50	.91	.96	1.49	1.13	1.37	Oranges					
1950-51	1.02	1.03	—	1.28	1.55	Oranges					

Grapefruit cost in 1-3/5 Bruce box for the last uninterrupted production season, 1947-48, was 62 cents. The 8-pound bag cost for the same season was 94 cents, or 50 percent more than 1-3/5 Bruce on an equivalent basis.

Table 18. Percent of total fruit that was sent to the cannery from the packing house, 5 seasons

Season	Grapefruit	Oranges
1946-47	23	8
1947-48	25	11
1948-49	18	5
1949-50	21	10
1950-51	31	28

Processing Costs

The percentages of grapefruit and oranges received at the packing houses that were graded out for sale to processors during each of the 5 seasons are shown in Table 18. Only two of the sample plants used pre-sizers to remove a part of this fruit before it began movement through the packing-house units. The offgrade fruit received the same handling up to the point of grading, consequently the cost was the same as for the packed fruit. The average cost of handling cannery fruit through the packing house is shown in Table 19.

Table 19. Average cost per 1-3/5 bushel equivalent of handling the house to cannery fruit for the sample packing houses, 5 seasons

Season	Grapefruit		Oranges	
	Cents	Cents	Cents	Cents
1946-47	13	16	16	12
1947-48	9	12	12	16
1948-49	11	16	18	18
1949-50	16	18	18	18
1950-51	14	18	18	18

VARIATIONS OF PACKING COSTS

Costs for packing houses varied greatly for each type of container, as shown in Table 20. The cost of packing and selling grapefruit in 1-3/5 Bruce boxes varied over a range of 35 cents in the 1946-47 and the 1947-48 seasons, 65 cents in the 1948-49 season and 40 cents in the 1950-51 season.

Variations for 5 and 8-pound bags were greater than for the 1-3/5 Bruce. Packing costs for 8-pound bags varied approximately 50 cents during the 1946-47, 1947-48 and 1950-51 seasons, 70 cents in the 1948-49 season and 40 cents in the 1949-50 season. These higher variations in cost

Table 20. Variation in the cost per box of packing and selling Texas grapefruit by type of container, 5 seasons¹

Cost group	Number of firms				
	1946-47	1947-48	1948-49	1949-50	1950-51
1-3/5 Bruce					
Under \$.60	6	8	0	0	0
\$.60 - .69	11	13	4	3	0
.70 - .79	8	2	12	2	1
.80 - .89	1	0	3	9	4
.90 - .99	1	1	1	3	4
1.00 - 1.09	0	0	1	1	3
1.10 - 1.19	0	0	1	0	0
1.20 and over	0	0	1	0	0
Total	27	24	23	18	12
Average cost per firm	\$0.65	\$0.65	\$0.81	\$0.83	\$0.93
8-pound bag					
Under \$.70	2	0	0	0	0
\$.70 - .79	2	0	2	0	0
.80 - .89	8	5	2	2	0
.90 - .99	6	11	7	6	0
1.00 - 1.09	1	2	7	6	2
1.10 - 1.19	0	2	1	5	5
1.20 - 1.29	0	2	0	0	3
1.30 - 1.39	0	0	2	0	1
1.40 and over	0	0	0	0	1
Total	19	22	21	19	12
Average cost per firm	\$0.87	\$0.95	\$1.01	\$1.01	\$1.21

¹ Includes administrative and selling expenses.

for bags were caused primarily by the differences in volume of fruit packed in bags and the method of handling.

Relation of Costs to Volume

Costs were influenced by volume during all 5 seasons, although other factors influenced the cost on certain containers for several seasons, as shown in Table 21. The average increase in costs was 4 percent for medium over high-volume firms and 12 percent for low over high-volume firms. The cost spread between the large and small-volume groups was greater for the consumer bags than for the 1-3/5 Bruce box.

Costs from season to season could not be compared since the great change in volumes for all plants from season to season made it impossible to use the same volume designations for the whole period.

The five-seasons' costs for 10 firms were held in the grouping they occupied by volume for the

Table 21. Average cost of packing oranges and grapefruit in selected containers by volume of fruit packed, 5 seasons

Volume groups in 1,000	Cents					
	1-3/5 Bruce		8-pound bag		5-pound bag	
	Oranges	Grapefruit	Oranges	Grapefruit	Oranges	Grapefruit
1946-47						
Under 300	.83	.69	1.04	.90	—	—
300-500	.76	.67	.98	.92	—	—
Over 500	.70	.62	.82	.72	—	—
1947-48						
Under 250	.82	.67	1.16	1.01	1.39	—
250-500	.78	.63	1.05	.92	1.43	—
Over 500	.74	.59	1.13	.94	—	—
1948-49						
Under 150	.91	.83	1.20	1.17	1.45	1.40
150-300	.84	.77	1.09	.95	1.37	1.13
Over 300	.85	.71	.95	.88	1.23	1.10
1949-50						
Under 125	.97	.85	1.19	1.07	1.43	1.30
125-250	.88	.78	1.16	.98	1.38	1.16
250 and over	.91	.79	1.09	.96	1.34	1.19
1950-51						
Under 100	1.15	.99	1.53	1.22	1.77	1.56
100-200	1.09	.88	1.32	1.21	1.68	1.45
Over 200	.95	.87	1.24	1.11	1.46	1.33

Table 22. Cost of packing and selling 1-3/5 Bruce grapefruit for 10 packing houses by volume groups, 5 seasons

	1946-47	1947-48	1948-49	1949-50	1950-51
	Cents				
2 small-volume firms	75	71	78	84	107
5 medium-volume firms	63	60	70	77	87
3 large-volume firms	61	62	76	83	87

1946-47 season and are shown in Table 22. The level of capacity at which these firms operated during these seasons influenced the cost relationship between the groups. Data were not adequate to measure accurately the level of capacity at which the sample firms operated.

Distribution of Packing-house Expenses

The packing house operation expenses for the 5 seasons were divided into several categories and are shown in Table 23.

Table 23. Packing-house expenses, 5 seasons

Item	Percent
Material	48
Labor	22
Other direct expenses	5
Indirect expenses	6
Total packing expenses	81
Adm. and selling expenses	14
Other operating	5
Total	100

Material expense was the greatest item of cost for the packing houses and the only appreciable influence on this category was made by the choice of container type. The material costs for 5-pound bags were about 50 percent higher than for the 1-3/5 Bruce boxes.

Labor expense ranged from 20 to 24 percent of total packing house cost during the 5 seasons and varied by type of container used and by type of fruit. Tables 24 and 25 show labor costs for the principal containers used for oranges and grapefruit.

Oranges require more labor cost than grapefruit because of the smaller size of fruit and the additional time required to handle a given volume through the packing house. Generally, oranges require about 1.5 times as long to move through the packing house as is required for an equal volume of grapefruit. Piece rates are also higher for oranges as fewer box equivalents can be packed per unit of time.

The choice of container has more influence on labor cost than does any other factor. About 60 percent of the total labor cost is in the packing and handling of fruit after it is graded and sized.

Table 24. Labor costs for the principal containers used for oranges, 5 seasons

Season	1-3/5 Bruce	1-3/5 std.	4/5 box bag	8-lb. bag	5-lb. bag
	Cents				
1946-47	18	—	—	—	—
1947-48	20	31	—	30	—
1948-49	13	32	20	23	30
1949-50	20	26	20	25	31
1950-51	23	—	26	28	34

Table 25. Labor costs for the principal containers used for grapefruit, 5 seasons

Season	1-3/5 Bruce	1-3/5 std.	4/5 box bag	8-lb. bag	5-lb. bag
	Cents				
1946-47	14	—	—	—	—
1947-48	13	24	—	23	—
1948-49	14	21	12	20	26
1949-50	15	23	17	22	26
1950-51	17	28	20	25	28

Therefore, the higher packing rates and additional labor required to handle packed fruit in the consumer-size bags make costs for these containers much higher than for the 1-3/5 Bruce box. Overhead chain and belt conveyors have been installed in some plants to handle the consumer-size bags but the volume has not been sufficient to allow a narrowing of the labor cost gap between the consumer-size bags and the 1-3/5 Bruce box.

Administrative and selling expenses accounted for about 14 percent of the total packing-house cost but varied greatly within the industry. The variations depended on the selling method used, the diversification of operation and the volume of fruit handled. Kind of fruit and type of container had only minor influence on these costs.

Indirect plant expenses—depreciation, taxes, insurance and facility interest—were influenced primarily by volume, as previously stated, but also were higher for oranges than for grapefruit to a degree about in proportion to the plant slowdown.

Direct operating expenses—utilities, maintenance, sundry plant supplies and half the field-box expense—varied greatly among plants and between seasons for individual plants. These costs were influenced only slightly by the kind of fruit, type of container and volume. The variations were due principally to management decisions concerning these items during each season.

Other operating expenses—inspection, coloring, waxing, precooling, maturity stamps and Texas Citrus Commission tax—were higher for oranges largely because of the use of the color-add process on them. Grapefruit required a degreening treatment early in the season but this cost was nominal.

Cost of Processing and Selling Juices and Segments

The costs of canning citrus juices and segments for the five postwar seasons are shown in Table 26. On an actual case basis, the costs

Table 26. Per-case cost of processing, warehousing and selling Texas citrus, 5 seasons

Season	Grapefruit juice		Orange juice		Blended juice		Grapefruit segments	
	24/2	12/404	24/2	12/404	24/2	12/404	Without sugar	With sugar
	Dollars							
1946-47	1.00	1.07	.96	1.00	.93	.96	1.94	2.12
1947-48	1.02	1.04	.97	1.00	.95	.99	1.96	2.19
1948-49	1.21	1.35	1.17	1.26	1.13	1.19	2.08	2.23
1949-50	1.25	1.33	—	—	—	—	—	—
1950-51	1.27	1.33	—	1.37	—	1.35	—	—

Table 27. Cost of processing, warehousing and selling Texas citrus on an equivalent-volume basis¹, 5 seasons

Season	Grapefruit juice		Orange juice		Blended juice	
	24/2	12/404	24/2	12/404	24/2	12/404
	Dollars					
1946-47	1.00	.85	.96	.80	.93	.76
1947-48	1.02	.83	.97	.80	.95	.79
1948-49	1.21	1.07	1.17	1.00	1.13	.95
1949-50	1.25	1.06	—	—	—	—
1950-51	1.27	1.06	—	1.09	—	1.07

¹ 24/2.

for processing 12/404 cases were higher for all products largely because of higher direct labor, indirect operating, and administrative and selling expenses which are usually calculated on a juice-content basis. However, when costs are converted to an equal-volume basis, as shown in Table 27, the cost of processing in 12/404 cases was lower than in 24/2 cases. The cost of processing grapefruit juice in 24/2 cases was about 18 percent greater than for an equivalent volume of juice in 12/404 cases.

The industry average cost of processing orange and blended juices is shown to be lower than for grapefruit juice, although this is not true for some plants. The few plants processing orange and blended juices had costs below average grapefruit juice cost for the industry, thus resulting in lower industry averages for these two types of juices.

Eighteen of the sample firms processed grapefruit segments during the 1946-47 season. This number dropped to six during 1948-49, the season of the first freeze, and to one during 1950-51. The cost of processing segments in 1946-47 was 14 cents greater per case than in 1948-49. The total cost of processing a case of segments increased approximately 19 cents when segments were sweetened.

Variations in Costs

Variations in costs for processing and selling citrus products are shown in Table 28. These variations were much greater for processed citrus than for packing fresh citrus. The variations also were greater for the 1946-47 season when the sample represented 90 percent of the total processed citrus than in the 1949-50 and 1950-51 seasons when 44 and 53 percent, respectively, of the total were included in the sample. The principal reason for these variations was volume.

Table 28. Variation in the cost per case of processing and selling Texas grapefruit juice by 12/404 cans, 5 seasons

Cost group	1946-47	1947-48	1948-49	1949-50	1950-51
	Number of firms				
Under-\$0.90	1	0	0	0	0
\$0.90 - .99	2	1	0	0	0
1.00 - 1.09	7	4	0	0	0
1.10 - 1.11			3	0	1
1.20 - 1.29	3	0	2	2	2
1.30 - 1.39	2	1	3	3	2
1.40 - 1.49	4	0	1	0	1
1.50 - 1.59	0	1	3	0	2
1.60 and over	1	2	1	1	0
Total	24	13	13	6	8
Av. cost	\$1.19	\$1.23	\$1.37	\$1.39	\$1.38

Table 29. Relation of volume to cost of processing, warehousing and selling grapefruit, orange and blended juices, 5 seasons

Volume groups 1,000 cases	Grapefruit juice		Orange juice		Blended juice	
	24/2	12/404	24/2	12/404	24/2	12/404
	Dollars					
	1946-47					
Under 100	1.10	1.20	1.11	1.22	1.11	1.16
100-299	1.09	1.16	.98	1.04	1.01	.98
300 and over	.94	1.02	.94	.98	.91	.95
	1947-48					
Under 100	1.41	1.39	1.13	1.25	1.43	1.40
100-299	1.05	1.17	1.09	1.11	1.05	1.06
300 and over	.99	1.00	.94	.97	.94	.97
	1948-49					
Under 150	1.45	1.55	1.41	1.55	1.53	1.38
150-249	1.24	1.40	1.12	1.22	1.12	1.22
250 and over	1.16	1.29	1.16	1.23	1.13	1.19
	1949-50					
Under 100	1.41	1.52	—	—	—	—
100-199	1.25	1.33	—	—	—	—
200 and over	1.23	1.30	—	—	—	—
	1950-51					
Under 200	1.42	1.50	—	1.62	—	1.58
200-499	1.26	1.31	—	1.31	—	1.31
500 and over	1.26	1.30	—	1.30	—	1.29

Table 29 shows the effect of volume on processing 12/404 grapefruit juice, which leads in volume for all seasons. The average increases in costs were 8 percent for medium-volume over large-volume processing plants, and 22 percent for low-volume over large-volume plants. The relationship of variation in costs to the variation in volume between firms is more positive for processed juice than for fresh citrus.

Overhead costs (other manufacturing expense and administrative and selling expenses), which were directly influenced by volume, accounted for 26 percent of the total processing, warehousing and selling costs, as shown in Table 30.

Lowering of these overhead costs is the most effective way to lower total costs. This may be done for some firms by lengthening the operating season and increasing the total volume through diversification to include the processing of vegetables. For these firms, lower overhead cost could result from increased volume or greater efficiencies in the administrative and selling functions.

Material, labor and other operating costs represented 74 percent of the total processing plant cost. Plant managers have little opportunity for reducing these costs for processing juice because of the fixed nature of these expenses. Labor cost shows some influence of volume.

Reduction in the cost of processing segments could be made if the sectionizing process could be mechanized. Labor accounts for about 50 percent of the cost of processing segments, and about 90 percent of this labor cost was for sectionizing.

Table 30. Costs for processing citrus, 5 seasons

Item	Percent
Material	63
Labor (processing and warehousing)	10
Other manufacturing expenses	16
Total processing and warehousing	89
Administrative and selling expenses	10
Other operating cost	1
Total	100

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This report covers the cost of marketing Texas citrus for the 5-year period, 1946-47 to

1950-51 seasons, as a Texas phase of the Southern Regional Research Project S.M.-4, "Marketing Citrus Fruits." Costs of packing and processing citrus in Texas and Florida for the 1946-47, 1947-48, 1948-49, 1949-50 and 1950-51 seasons have been published previously, as shown in the References.

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DEFINITION OF TERMS

Volume Group

Determined for each packing house by the total boxes 1-3/5 bushels equivalent handled as packed or bulk fruit through the packing house, and for each cannery by the total cases of citrus products processed.

Packing Operations

Boxes per packing house: average volume packed, 1-3/5 bushel equivalent.

Containers:

1-3/5 Bruce, 1-3/5 standard wrapped, 1-3/5 venco: 1-3/5 bushel by volume. Venco box is the same as a flat pack.

4/5 Bruce, 1/2 box bags, 8-pound bags, 5-pound bags: all expressed in the equivalent of 1-3/5 bushel by volume.

Items of cost:

Materials: crate material; bags; fruit wraps; nails, strips and straps; labels and paste; and end guards.

Labor: receive, truck and dump; crate making and labeling; foremen, graders and others; wrap and pack; truck, check and load; and payroll taxes. Payroll taxes include both social security and compensation insurance.

Other direct cost: the cost of power, lights and water; repair of building and equipment; and miscellaneous supplies.

Indirect operating: insurance, taxes, licenses and depreciation.

Total packing cost: the total of materials, labor and other direct cost and indirect operating.

Administrative and selling: management and office salaries; office supplies and expense; auto and travel; telephone and telegraph; miscellaneous office expense; sales department cost, or charge for selling. Selling cost does not include brokerage or any terminal market charges.

Other cost: gas coloring; color add and wax; pre-cooling and inspection.

Processing Operations

Blended juice: a blend of orange and grapefruit juice. The proportion of each varies from 60-40 to 40-60 percent.

Cases per firm: average volume of actual cases produced.

Containers:

24/2: a case of 24 eighteen-ounce cans.

12/404: a case of 12 forty-six-ounce cans.

Items of cost:

Materials: cans, cartons, labels and freight on materials.

Labor:

Direct: receiving, processing, filling and closing.

Indirect: Supervision, watchman, mechanic, janitor and payroll taxes.

Warehouse and shipping: labeling, handling, shipping.

Other manufacturing cost: expense for depreciation, repairs and maintenance; power, lights and water; fuel; royalties; insurance; taxes; miscellaneous supplies; miscellaneous operating cost and warehouse cost other than labor.

Administrative cost: includes management and office salaries, office supplies and expense, auto and travel, operating interest, telephone and telegraph, legal and audit, dues and subscriptions and other general administrative cost.

Selling cost: salaries of salesmen and others, advertising and miscellaneous plant-selling cost. Does not include commercial brokerage, discounts and allowances.

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SUPPLEMENTARY TABLES AVAILABLE

Data supporting the material reported in this publication are available in a separate mimeographed report entitled "Supplementary Tables for Method and Cost of Handling Texas Citrus, 1946-51." Copies of these tables may be obtained from the Agricultural Information Office, Texas A&M College System, College Station, Texas.