

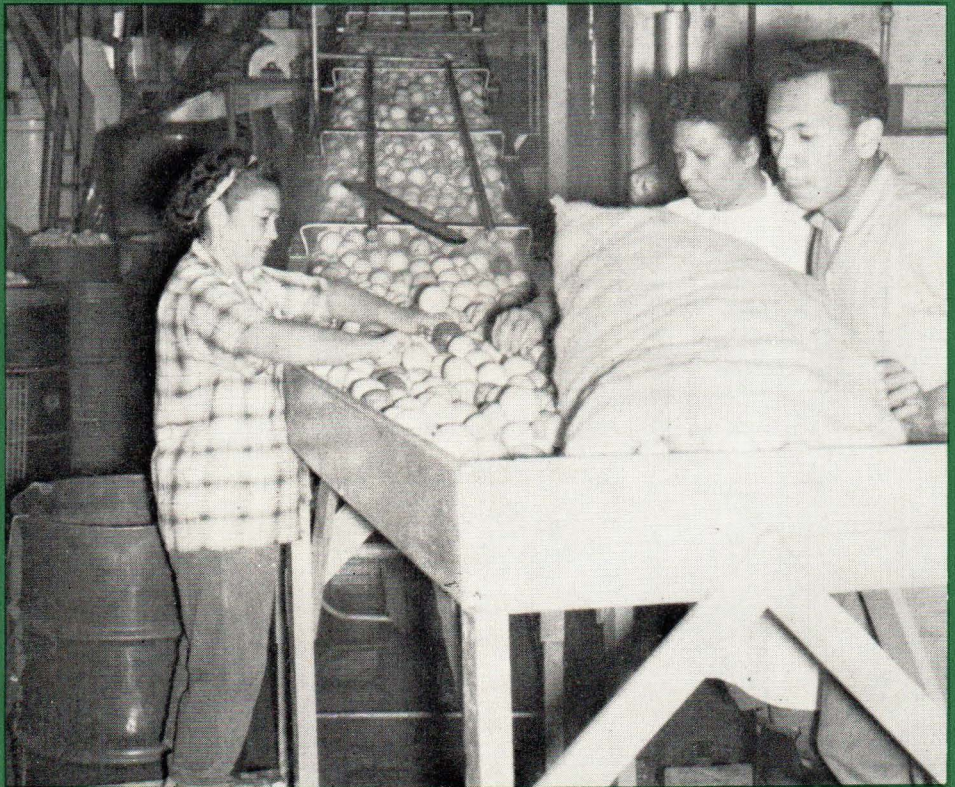
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AN ECONOMIC ANALYSIS OF

# PASSION FRUIT JUICE PROCESSING

MODELS OF COSTS AND RETURNS

Frank S. Scott, Jr.



Agricultural Economics Bulletin 18  
Hawaii Agricultural Experiment Station, University of Hawaii  
in cooperation with the  
Agricultural Experiment Stations of the Western States  
April 1959

## **ACKNOWLEDGMENTS**

Special credit is due Hawaiian Fruit Growers Exchange, Hawaiian Juice Industries, and Puna Juice Cannery, without whose very generous cooperation this study would not have been possible; and to Mrs. Grace Unemori of the HAES Department of Agricultural Economics for her valuable assistance in synthesizing costs and returns for the plant models.

This publication is one of a series based on Hawaii's phase of Western Regional Marketing Research Project WM-17 entitled "Competitive Position of the Western Region in Marketing Frozen Fruits and Vegetables." WM-17 research has included participation by the University of California, Washington State College, Oregon State College, and the USDA Agricultural Marketing Service as well as the University of Hawaii.

The study was financed by Federal RRF funds allocated to Contributing Project 360 of the Hawaii Agricultural Experiment Station.

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# AN ECONOMIC ANALYSIS OF PASSION FRUIT JUICE PROCESSING

## Models of Costs and Returns

*Frank S. Scott, Jr.*<sup>1</sup>

### INTRODUCTION

Passion fruit processing, although technologically a production operation, is in effect one of the major steps in the marketing of passion fruit. To the broker or distributor, the processing plant is the source of the finished product. But from the standpoint of the producer it is the immediate market outlet for a raw product which must be converted into juice. In this sense a detailed study of costs and returns of processing is essential to an adequate analysis of the market structure and, finally, to measurement of the market potential.

Because of the recent origin and limited size of the passion fruit industry, commercial processing has not yet developed to the point where expansion to optimum-sized plants has been feasible nor has it been sufficiently coordinated with seasonality of production. Thus in order to make a study of costs and returns which would be applicable to an expanded industry, it was considered essential to draw conclusions from economic models synthesized from data on actual factor requirements<sup>2</sup> of plants now in operation.<sup>3</sup>

This analysis is primarily concerned with the processing of passion fruit juice into 6-ounce cans for freezing. However, the same methodology would be generally applicable to plants where the juice is heat processed.

The study was designed to evaluate the more important variable factors in terms of costs and returns, rather than to study the engineering efficiency at each step in processing. Since the new industry has not yet developed standardized methods of processing, an economic analysis of existing techniques seems appropriate as an initial step. An engineering-economic cost study might well be the next step toward improved processing efficiency.

<sup>1</sup> Associate Agricultural Economist, Hawaii Agricultural Experiment Station, and Associate Professor of Agriculture, University of Hawaii.

<sup>2</sup> Land, buildings, equipment, machinery, labor, management, and materials.

<sup>3</sup> Cost and production data were obtained from all plants processing frozen passion fruit juice in 6-ounce cans.

## PROCEDURE

Major components of the study such as effect of scale or plant capacity, length of season, cost of raw fruit, and other variables are based on costs and returns of three model plants with daily capacities of 20,000 pounds, 40,000 pounds, and 80,000 pounds of raw fruit. These were considered the most logical divisions of scale in light of actual machinery capacity, labor and equipment requirements, and the present size of the industry. Similar relationships would be expected to apply, but to a lesser degree, for expansion to plants with capacities in excess of 80,000 pounds.

Factor requirements of plants now in operation were used as a guide in developing the base model of 20,000 pounds daily capacity. This plant was expected to provide the minimum size for an operation which would return 6 percent on the invested capital, provide sufficient funds for market development, and enable the product to be sold at approximately 13 cents per 6-ounce can f.o.b. Honolulu and retailed at 21 cents on the West Coast. This does not imply that a plant of a somewhat smaller capacity would be unprofitable. It does, however, indicate that a plant of about 20,000 pounds capacity would be required for an efficient combination of land, buildings, equipment, labor, and management when taking into consideration existing equipment and labor requirements.

Per unit reduction in certain overhead costs was taken into consideration in synthesizing the models for the larger plants with daily capacities of 40,000 pounds and 80,000 pounds.

This study is concerned only with the possibilities of increasing returns and/or decreasing prices through changes in those aspects of processing which appear to offer the greatest opportunities for economy at this time. Inasmuch as almost 90 percent of passion fruit processing costs are variable, these costs are logically the first to be considered in attempting to improve the economic efficiency of the new passion fruit industry where machinery design has not yet been standardized.

## ECONOMY OF SCALE

Effects of scale of operation on costs and returns for model plants A, B, and C are shown as annual plant totals in table 1 and per case and per 6-ounce can in table 2. For this purpose all variable costs were evaluated at 1958 prices, and length of processing season was

TABLE 1. Basic costs and returns, plants A, B, and C, 118-day operating season

Factor requirements	Plant A, daily capacity, 20,000 pounds of raw fruit			Plant B, daily capacity, 40,000 pounds of raw fruit			Plant C, daily capacity, 80,000 pounds of raw fruit		
	Computation	Annual cost	Percent of f.o.b. Honolulu cost	Computation	Annual cost	Percent of f.o.b. Honolulu cost	Computation	Annual cost	Percent of f.o.b. Honolulu cost
		Dollars			Dollars			Dollars	
Land.....	10,000 sq. ft. @ \$3= \$30,000			15,000 sq. ft. @ \$3= \$45,000			15,000 sq. ft. @ \$3= \$45,000		
Buildings.....	6,000 sq. ft. @ \$6= \$36,000			8,000 sq. ft. @ \$6= \$48,000			8,000 sq. ft. @ \$6= \$48,000		
Annual depreciation @ 20-yr. life.....		1,800	.6		2,400	.4		2,400	.2
Equipment									
Machinery.....	\$35,000; depreciation @ 15-yr. life=\$2,333			\$39,000; depreciation @ 15-yr. life=\$2,600			\$39,000; depreciation @ 15-yr. life = \$2,600		
Truck, flat bed, used.....	\$2,000; depreciation @ 4 yrs. remaining life=\$500			\$2,000; depreciation @ 4 yrs. remaining life=\$500			\$2,000; depreciation @ 4 yrs. remaining life=\$500		
Office equipment.....	\$4,000; depreciation @ 10 yrs. life=\$400			\$4,000; depreciation @ 10 yrs. life=\$400			\$4,000; depreciation @ 10 yrs. life = \$400		
Annual depreciation on machinery and equipment.....		3,233	1.1		3,500	.6		3,500	.3
Salaries, office staff									
Supervisor.....	@ \$ 800 mo.			@ \$ 800 mo.			@ \$ 800 mo.		
Accountant.....	@ 400 mo.			@ 400 mo.			@ 400 mo.		
Secretary.....	@ 300 mo.			@ 300 mo.			@ 450 mo. <sup>a</sup>		
Total.....	\$1,500 mo.			\$1,500 mo.			\$1,650 mo.		
Annual cost.....		18,000	6.3		18,000	3.3		19,800	1.9

<sup>a</sup> One secretary full time, one secretary half time.

(Continued)

TABLE I. *Continued*

Factor requirements	Plant A, daily capacity, 20,000 pounds of raw fruit			Plant B, daily capacity, 40,000 pounds of raw fruit			Plant C, daily capacity, 80,000 pounds of raw fruit		
	Computation	Annual cost	Percent of f.o.b. Honolulu cost	Computation	Annual cost	Percent of f.o.b. Honolulu cost	Computation	Annual cost	Percent of f.o.b. Honolulu cost
		<i>Dollars</i>			<i>Dollars</i>			<i>Dollars</i>	
<i>Wages</i> .....	1 man, 12 mos. 6 men, 8 mos. 12 mos. @ \$300 48 mos. @ \$250			2 men, 12 mos. 7 men, 8 mos. 24 mos. @ \$300 56 mos. @ \$250			2 men, 12 mos. 15 men, 8 mos. 24 mos. @ \$300 120 mos. @ \$250		
Total wages.....		15,600	5.4		21,200	3.9		37,200	3.5
<i>Workmen's compensation</i> 1.8% of gross wages		281	.1		382	.1		670	.1
<i>Repairs and maintenance</i> .....		2,000	.7		3,000	.6		4,000	.4
<i>Cans</i> .....	2,359,992 cans <sup>b</sup> @ 2.249¢	53,076	18.4	4,719,984 cans <sup>b</sup> @ 2.249¢	106,151	19.6	9,439,968 cans <sup>b</sup> @ 2.249¢	212,304	20.2
<i>Cartons</i> .....	98,333 cartons @ 7.12¢	7,000	2.4	196,666 cartons @ 7.12¢	14,000	2.6	393,332 cartons @ 7.12¢	28,000	2.7
<i>Chemicals and detergents</i> (\$30 per 100,000 pounds of fruit).....		708	.3		1,416	.3		2,832	.3
<i>Freezing and storage:</i> <i>Hawaii</i> <sup>c</sup> (first month, ¾¢ per pound; second month, ½¢ per pound)	98,333 cases @ 14 pounds per case = \$17,209			196,666 cases @ 14 pounds per case = \$34,418			393,332 cases @ 14 pounds per case = \$68,836		

<sup>b</sup> At a 30 percent net juice yield, one pound of raw fruit provides enough juice in combination with sugar for one 6-ounce can of passion fruit juice base.

<sup>c</sup> Including cost of quick freezing.



TABLE I. *Continued*

Factor requirements	Plant A, daily capacity, 20,000 pounds of raw fruit			Plant B, daily capacity, 40,000 pounds of raw fruit			Plant C, daily capacity, 80,000 pounds of raw fruit		
	Computation	Annual cost	Percent of f.o.b. Honolulu cost	Computation	Annual cost	Percent of f.o.b. Honolulu cost	Computation	Annual cost	Percent of f.o.b. Honolulu cost
<i>Allowance for additional storage to be paid by processor<sup>d</sup> (first month, 0.4¢ per pound; second and third months, 0.3¢ per pound each)</i>	98,333 cases @ 14 pounds per case = \$13,767	<i>Dollars</i>		196,666 cases @ 14 pounds per case = \$27,534	<i>Dollars</i>		393,332 cases @ 14 pounds per case = \$55,068	<i>Dollars</i>	
<i>Total storage.....</i>		30,976	10.8		61,952	11.5		123,904	11.8
<i>Insurance</i>									
On buildings and equipment.....	\$450			\$700			\$700		
On stock (15¢ per \$100).....	\$425			\$850			\$1,700		
<i>Total insurance.....</i>		875	.3		1,550	.3		2,400	.2
<i>Taxes on gross sales</i>									
\$2.80 per case × 1%.....		2,832	1.0		5,664	1.1		11,328	1.1
<i>Taxes on improvements.....</i>		800	.3		1,200	.2		1,200	.1
<i>Utilities</i>									
Telephone.....	\$480			\$720			\$ 720		
Lights.....	\$360			\$360			\$ 720		
Power for machinery.....	\$800			\$960			\$1,920		
Water.....	\$108			\$188			\$ 348		
<i>Total.....</i>		1,748	.6		2,228	.4		3,708	.4

<sup>d</sup> The product is considered to be sold f.o.b. cold storage warehouse and a necessary reserve for storage is charged as a cost to the processor (Continued) whether the storage is incurred in Honolulu or on the West Coast. Storage for the third through fifth months is based on West Coast costs.

TABLE 1. Continued

Factor requirements	Plant A, daily capacity, 20,000 pounds of raw fruit			Plant B, daily capacity, 40,000 pounds of raw fruit			Plant C, daily capacity, 80,000 pounds of raw fruit		
	Computation	Annual cost	Percent of f.o.b. Honolulu cost	Computation	Annual cost	Percent of f.o.b. Honolulu cost	Computation	Annual cost	Percent of f.o.b. Honolulu cost
<i>Advertising and promotion</i> .....	2,360,000 pounds fruit @ 3.5¢/lb. = \$82,600 × 3% <sup>e</sup>	4,956	1.7	4,720,000 pounds fruit @ 3.5¢/lb. = \$165,200 × 3% <sup>e</sup>	9,912	1.8	9,440,000 pounds fruit @ 3.5¢/lb. = \$330,400 × 3% <sup>e</sup>	19,824	1.9
<i>Sugar</i> .....	471,998 pounds @ 9¼¢/lb.	43,660	15.2	943,996 pounds @ 9¼¢/lb.	87,320	16.2	1,887,992 pounds @ 9¼¢/lb.	174,640	16.7
<i>Fruit at 4¼¢ to processor</i> .....	2,360,000 pounds @ 4¼¢	100,300	34.8	4,720,000 pounds @ 4¼¢	200,600	37.1	9,440,000 pounds @ 4¼¢	401,200	38.2
TOTAL COSTS to Processor, f.o.b. Warehouse, Honolulu.....		287,845	100.0		540,475	100.0		1,048,910	100.0
GROSS REVENUE to Processor, f.o.b. Warehouse, Honolulu	98,333 cases @ \$3.09/case	303,877		196,666 cases @ \$3.09/case	607,754		393,332 cases @ \$3.09/case	1,215,508	
NET RETURNS to Processor.....		16,032			67,279			166,598	
RATE OF RETURN		6.0%			14.8%			21.8%	

CAPITAL INVESTMENT (See supplement to table 1)

<sup>e</sup> In addition to 3 percent deduction from farmers gross revenue.

TABLE 1. (Supplement)

Capital investment	Plant A, daily capacity, 20,000	Plant B, daily capacity, 40,000	Plant C, daily capacity, 80,000
	pounds of raw fruit	pounds of raw fruit	pounds of raw fruit
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Land.....	30,000	45,000	45,000
Buildings.....	36,000	48,000	48,000
Machinery and equipment.....	41,000	45,000	45,000
Inventories:			
Sugar.....	7,277	14,554	29,108
Juice.....	118,000	236,000	472,000
Cans.....	17,692	35,384	70,768
Cartons.....	7,000	14,000	28,000
Chemicals.....	236	472	944
Operating fund.....	10,000	15,000	25,000
Total investment.....	267,205	453,410	763,820
Six percent return to capital....	16,032	27,205	45,829

TABLE 2. Passion fruit processing costs per case and per 6-ounce can of frozen juice, plants A, B, and C

Factor requirements	Plant A, daily capacity, 20,000		Plant B, daily capacity, 40,000		Plant C, daily capacity, 80,000	
	pounds of raw fruit		pounds of raw fruit		pounds of raw fruit	
	Per case	Per 6-oz. can	Per case	Per 6-oz. can	Per case	Per 6-oz. can
	<i>Dollars</i>	<i>Cents</i>	<i>Dollars</i>	<i>Cents</i>	<i>Dollars</i>	<i>Cents</i>
Land.....						
Buildings.....	0.018	0.08	0.012	0.05	0.006	0.03
Equipment.....	.033	.14	.018	.08	.009	.04
Salaries.....	.183	.76	.092	.38	.050	.21
Wages.....	.159	.66	.108	.45	.095	.39
Workmen's compensation.....	.003	.01	.002	.01	.002	.01
Repairs and maintenance.....	.020	.09	.015	.06	.010	.04
Cans.....	.540	2.25	.540	2.25	.540	2.25
Cartons.....	.071	.30	.071	.30	.071	.30
Chemicals and detergents.....	.007	.03	.007	.03	.007	.03
Freezing and storage <sup>a</sup> .....	.315	1.31	.315	1.31	.315	1.31
Insurance.....	.009	.04	.008	.03	.006	.02
Taxes on gross sales.....	.029	.12	.029	.12	.029	.12
Taxes on improvements.....	.008	.03	.006	.03	.003	.01
Utilities.....	.018	.07	.011	.05	.009	.04
Advertising and promotion.....	.050	.21	.050	.21	.050	.21
Sugar.....	.444	1.85	.444	1.85	.444	1.85
Fruit at 4¼¢ to processor	1.020	4.25	1.020	4.25	1.020	4.25
6 percent return to capital	.163	.68	.138	.58	.117	.49
Total.....	3.090	12.88	2.886	12.04	2.783	11.60

<sup>a</sup> Including allowance for mainland storage costs to be incurred by processor.

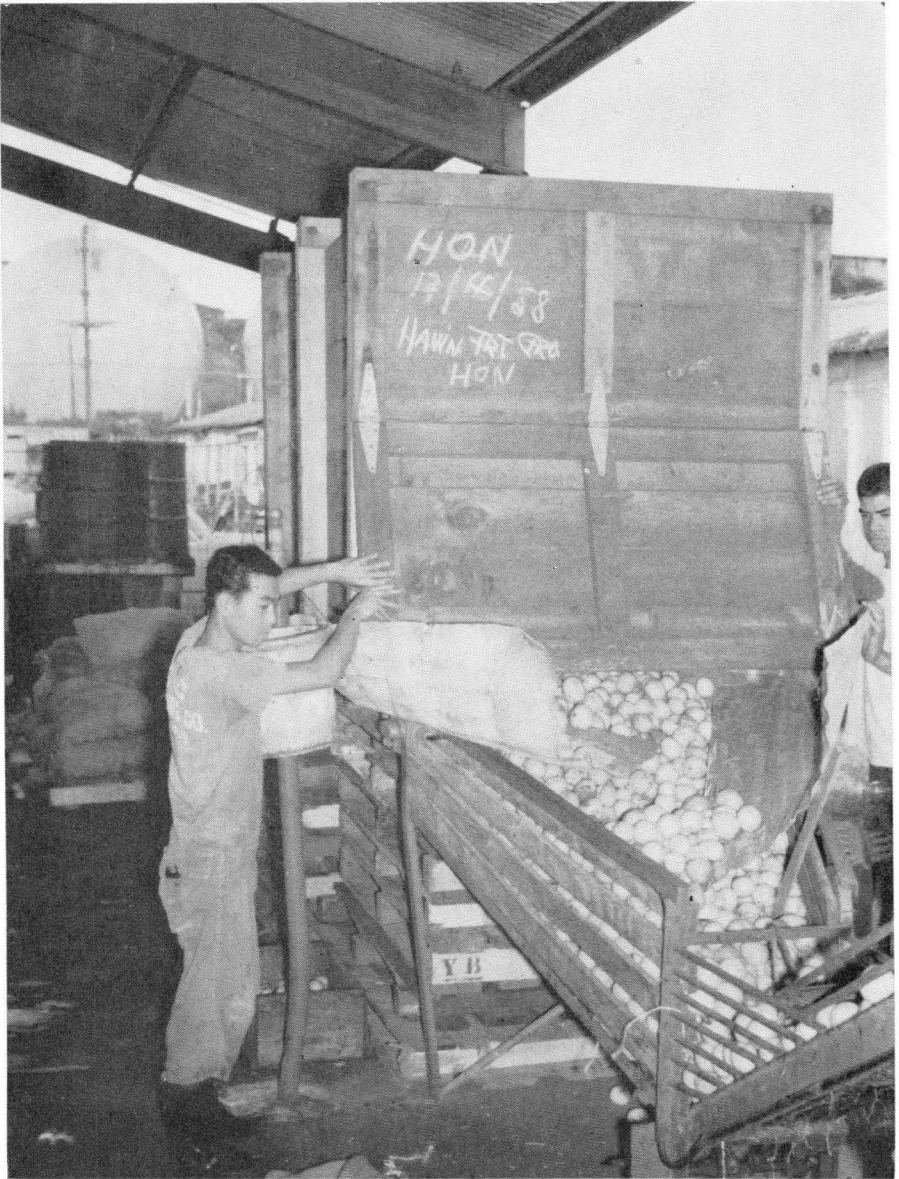
computed at 118 days. In determining the effect of economy of scale on rate of return, price was held constant at \$3.09 per 6-ounce can f.o.b. Honolulu which would permit a competitive West Coast retail price of 21 cents per 6-ounce can. In determining the effect of scale on price, rate of return was held constant at the going alternative cost of 6 percent. Standard requirements for labor, equipment, land, buildings, and materials were obtained from commercial plants. The length of season for this purpose is the number of days during which passion fruit is available for processing rather than the total number of 8-hour days of processing. The number of hours of operation has been set according to the design of operation for each plant model.

Plant A is considered the minimum size which would permit reasonably economical machinery and labor utilization and allow a 6 percent rate of return on investment, which is essentially a break-even figure considering alternative rates of return to investment capital. Plant B, with twice the capacity of plant A but with a more efficient combination of production factors, affords greater economy in the use of land, buildings, equipment, office personnel, and labor per unit of output. Costs of materials are proportional to those for plant A. Plant C is an expansion of plant B into two 8-hour shifts with a capacity twice that of plant B and four times that of plant A. Insofar as operating season is concerned, plant B when expanded into two shifts would be no different than a one-shift plant twice the size of plant B although the first case is an expansion in output per hour and the second an expansion in the number of hours operated. Other possible combinations or expansions might be designed such as a double shift for plant A. However, the logical move in this case would be an expansion to plant B rather than a double shift for plant A since essentially the same machinery is used for B as for A but the larger unit provides a much more efficient use of labor. On the other hand, an expansion from plant B to plant C on a capacity per hour basis rather than a two-shift basis would require duplication of certain machines used to maximum hourly capacity in plant B.

### **Rate of Return**

Whereas under the conditions listed in table 1 the net rate of return to capital is only 6.0 percent for plant A, it is 14.8 percent for plant B, and 21.8 percent for plant C with the price per 6-ounce





Unloading 1-ton crate of passion fruit into conveyer. Crate shipped to Honolulu from island of Hawaii.



Bags of passion fruit from island of Hawaii ready for processing in Honolulu.

can held constant<sup>4</sup> (table 1 and figure 1). Thus the rate of return increases considerably with expansion in scale, but at a decreasing rate. Plant B with double the capacity of A shows a rate of return 3.6 times as great as A. Plant C with double the capacity of B has a rate of return of only 1.5 times as great as B. This is largely due to the fact that plant B provides a more efficient combination of labor and machinery than does plant A. But some steps in plant B require no additional labor above the requirements of plant A. Plant C, on the other hand, except for management, requires a doubling of the labor used in plant B. There is very little reduction in variable costs for plant C in relation to plant B and the economy of scale is due largely to more effective use of fixed factors such as land, buildings, machinery, equipment, and management. Except for the possible addition of a third shift, expansion in the output of plant C would require an almost proportional expansion in equipment and labor.

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<sup>4</sup> Over a period of time the benefits from economy of scale would be reflected more in the form of lower prices and possible expansion in output than in an increase in rate of return in excess of opportunity costs on the invested capital. Nevertheless, rate of return with a fixed selling price does show the advantages of economy of scale.

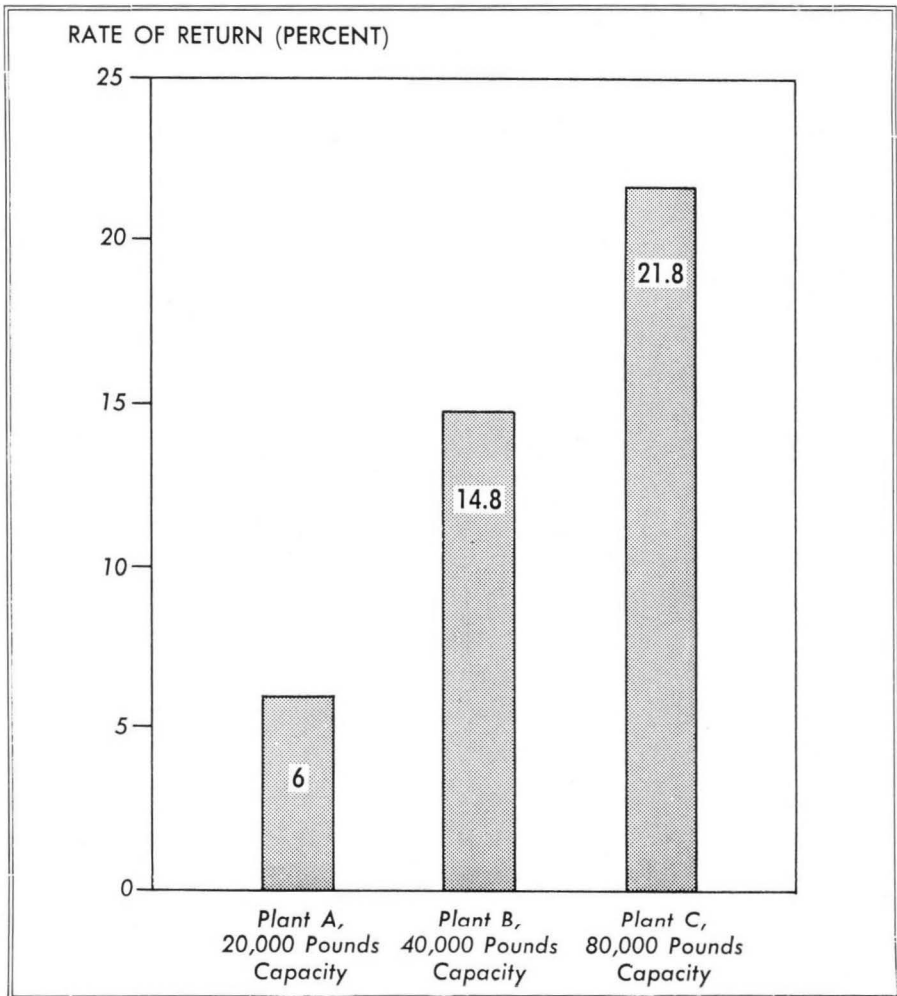


FIGURE 1. Comparative rates of return on capital investment, plants A, B, and C; f.o.b. Honolulu price, 12.88 cents per 6-ounce can; 118-day operating season.

With machinery currently in use, expansion of plant capacity beyond that of plant C would permit some increase in efficiency, but a proportionally smaller increase than in expanding from plant B to plant C. In passion fruit processing, as indicated previously, variable costs are large in relation to fixed costs. Nevertheless, with greater efficiency in the use of fixed factors through expansion, per unit fixed costs may be reduced sufficiently to permit considerable economy.

Whereas the economic models were developed from actual data supplied by commercial plants, none of the models is an exact representation of an existing commercial plant. Yet the effects of changes in various factors as illustrated for the models would be generally applicable to plants of somewhat different size and combination. In fact, a well-designed model, through elimination of special conditions tending to exist in actual commercial plants, should afford a better basis for comparison than a case study of an individual plant.

### Price

Both f.o.b. Honolulu and West Coast retail prices would be affected less by scale, other conditions being the same, than would the rate of return, providing that benefits from economy of scale were absorbed as a greater return to capital rather than to bring about a reduction in price. Actually, with an elastic consumer demand which characterizes passion fruit juice with moderate distribution, benefits might well be greater through price reduction and expanded output with consequent greater aggregate returns to the industry.<sup>5</sup> Theoretically, capital would then flow into passion fruit processing to the point where returns to capital so invested declined to the level of returns in alternative investments.

In maintaining a break-even operation at a 6 percent rate of return, plant A could sell frozen passion fruit juice at 12.88 cents per 6-ounce can f.o.b. Honolulu and retail it at 21 cents per can on the West Coast (figure 2). Studies of the mainland market potential indicate 21 cents to be a competitive price in relation to prices of mainland frozen juice concentrates.<sup>6, 7</sup> Comparative prices according to the calculations in table 1 would be 12.04 cents and 19.75 cents for plant B and 11.58 cents and 19.08 cents for plant C. Actual minimum retail prices would likely be rounded off to 20 cents or 2 for 39 cents for the product of plant B and 19 cents for the product of plant C.

Although these differences appear small, the 2 cent difference at the retail level might well determine the success or failure of the industry in a highly competitive market.

<sup>5</sup> Scott, Frank S., Jr., *Frozen Passion Fruit Juice—An Appraisal of the Mainland Market Potential*, Agricultural Economics Report 25, Hawaii Agricultural Experiment Station, December, 1955, pp. 13–16.

<sup>6</sup> *Ibid.*

<sup>7</sup> Scott, Frank S., Jr., *An Analysis of Market Development for Frozen Passion Fruit Juice*, Agricultural Economics Bulletin 11, Hawaii Agricultural Experiment Station, June, 1958.



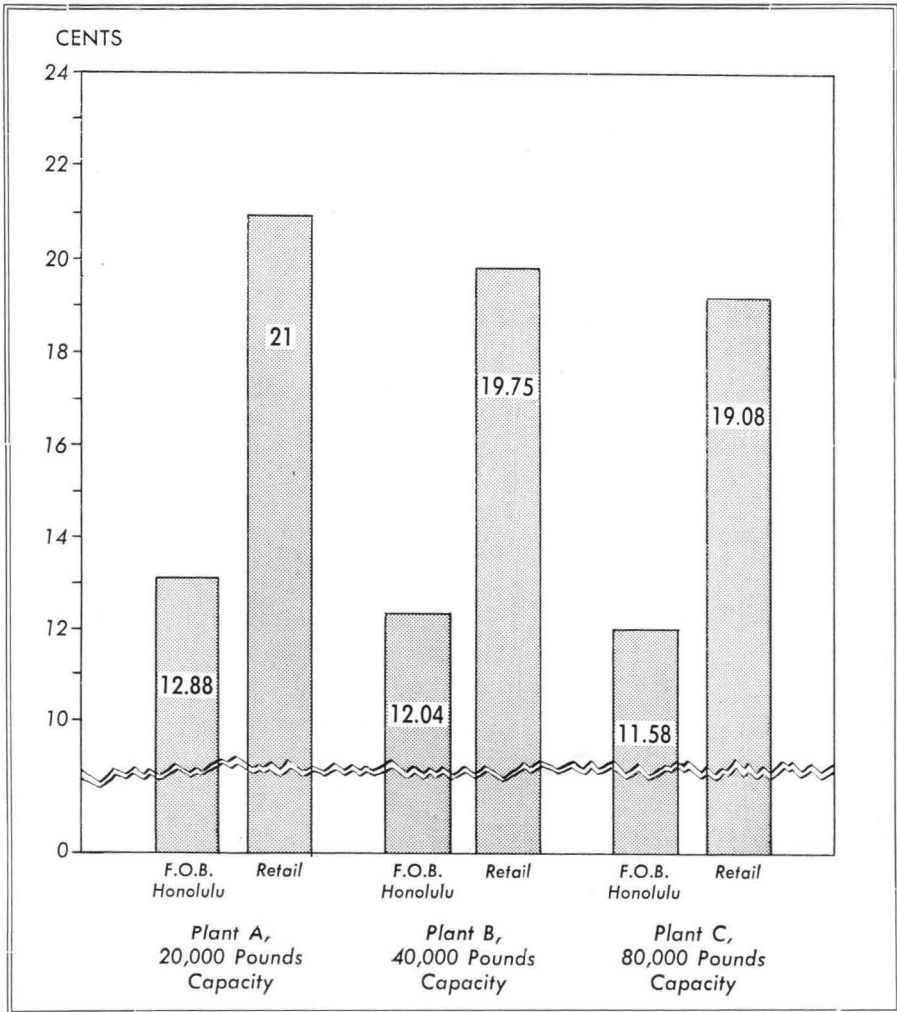


FIGURE 2. Comparative f.o.b. Honolulu and West Coast retail prices per 6-ounce can of frozen passion fruit juice, permitting a 6 percent return on processor's capital investment, plants A, B, and C.

### LENGTH OF PROCESSING SEASON

The exact length of harvest season for passion fruit has not been definitely established. However, the present production period appears to allow for about 118 full days from late June to mid-February with peak operations during August and September. Inasmuch as processing plants thus far have not been able to use all of the passion fruit produced and have to a considerable extent

geared their purchases to their output, processing has not been fully coordinated with the seasonal production pattern. With an assured market for all passion fruit produced, the length of the processing season would be expected to coincide more nearly with seasonality of production.

Through lack of care of the vineyards, the season would, of course, fall short of the estimated 118 days. But with better cultural practices and selection of varieties, there is indication that the production season could be extended.

Commercial passion fruit processing plants also process frozen guava nectar. This does not, however, significantly extend the processing season inasmuch as the guava harvest coincides with that of passion fruit. The manufacture of certain other juices, such as papaya, citrus, or punch, might extend the operating season and provide greater use of plant facilities. There is little diversification as yet, however, in plants producing frozen passion fruit juice in 6-ounce cans and such a study is beyond the scope of this report.

### **Rate of Return**

The effect of length of season on rate of return has been computed for a range of 82 to 136 days as shown in tables 3, 4, and 5 and figure 3. All other factors are taken from table 1 and adjusted only in accordance with the effects of length of season on costs and returns of the processing operation. At 118 full days of operation, which was the base used in table 1, costs and returns are identical to those in table 1.

The effects of length of season on rate of return would be expected to be proportionately greater for small plants than for large plants because of the proportionately greater per unit cost of factors other than raw materials. On the other hand, the actual increase is greater for the larger plants because of a greater rate of return at all levels of output within the range in length of season used in the study coupled with a larger base output.

For plant A, the calculated rate of return on capital investment ranges from 0.9 percent with only 82 full days of operation to 8.6 percent with 136 days of operation. Whereas the increase in rate of return per additional day of operation is approximately the same in the aggregate at any level, it is proportionately greater percentagewise at the lower levels because of the relationship to a smaller base.



Sorting out unusable fruit prior to final washing in Honolulu.

TABLE 3. Effect of length of processing season on passion fruit processor's rate of return to capital, plant A, capacity of 20,000 pounds per day; f.o.b. Honolulu price, 12.88 cents per 6-ounce can; West Coast retail price, 21 cents

Item	Number of full days of operation during processing season									
	82	88	94	100	106	112	118	124	130	136
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
<i>Annual costs</i>										
Buildings.....	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800	1,800
Equipment.....	3,233	3,233	3,233	3,233	3,233	3,233	3,233	3,233	3,233	3,233
Salaries.....	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
Wages.....	11,940	12,550	13,160	13,770	14,380	14,990	15,600	16,210	16,820	17,430
Workmen's compensation.....	215	226	237	248	259	270	281	292	303	314
Repairs and maintenance.....	1,390	1,492	1,593	1,695	1,797	1,898	2,000	2,102	2,204	2,306
Cans.....	36,884	39,582	42,281	44,980	47,679	50,378	53,076	55,775	58,474	61,173
Cartons.....	4,864	5,220	5,576	5,932	6,288	6,644	7,000	7,356	7,712	8,068
Chemicals and detergents.....	492	528	564	600	636	672	708	744	780	816
Storage.....	21,526	23,101	24,676	26,251	27,826	29,401	30,976	32,551	34,126	35,701
Insurance on buildings.....	450	450	450	450	450	450	450	450	450	450
Insurance on stock.....	293	315	337	359	381	403	425	447	469	491
Taxes on gross sales.....	1,968	2,112	2,256	2,400	2,544	2,688	2,832	2,976	3,120	3,264
Taxes on improvements.....	800	800	800	800	800	800	800	800	800	800
Utilities: telephone.....	480	480	480	480	480	480	480	480	480	480
lights.....	300	310	320	330	340	350	360	370	380	390
power for machinery...	560	600	640	680	720	760	800	840	880	920
water.....	102	103	104	105	106	107	108	109	110	111
Advertising and promotion.....	3,444	3,696	3,948	4,200	4,452	4,704	4,956	5,208	5,460	5,712
Sugar.....	30,340	32,560	34,780	37,000	39,220	41,440	43,660	45,880	48,100	50,320
Raw fruit.....	69,700	74,800	79,900	85,000	90,100	95,200	100,300	105,400	110,500	115,600
Total annual costs (not including interest on capital investment) ...	208,781	221,958	235,135	248,313	261,491	274,668	287,845	301,023	314,201	327,379
Gross returns at 12.88 cents per 6-ounce can f.o.b. Honolulu (21 cents West Coast retail) .....	211,169	226,620	242,072	257,523	272,974	288,426	303,877	319,328	334,780	350,231
Net returns.....	2,388	4,662	6,937	9,210	11,483	13,758	16,032	18,305	20,579	22,852
Rate of return (percent) .....	0.9	1.7	2.6	3.4	4.3	5.1	6.0	6.8	7.7	8.6

TABLE 4. Effect of length of processing season on passion fruit processor's rate of return to capital, plant B, capacity of 40,000 pounds per day; f.o.b. Honolulu price, 12.88 cents per 6-ounce can; West Coast retail price, 21 cents

Item	Number of full days of operation during processing season									
	82	88	94	100	106	112	118	124	130	136
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
<i>Annual costs</i>										
Buildings.....	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Equipment.....	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
Salaries.....	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000	18,000
Wages.....	16,929	17,641	18,353	19,064	19,776	20,488	21,200	21,912	22,624	23,336
Workmen's compensation.....	305	317	330	343	356	369	382	394	407	420
Repairs and maintenance.....	2,084	2,237	2,389	2,542	2,695	2,847	3,000	3,152	3,305	3,457
Cans.....	73,766	79,164	84,561	89,959	95,356	100,754	106,151	111,549	116,947	122,344
Cartons.....	9,728	10,440	11,152	11,864	12,576	13,288	14,000	14,712	15,423	16,135
Chemicals and detergents.....	984	1,056	1,128	1,200	1,272	1,344	1,416	1,488	1,560	1,632
Storage.....	43,052	46,202	49,352	52,502	55,652	58,802	61,952	65,102	68,253	71,403
Insurance on buildings.....	700	700	700	700	700	700	700	700	700	700
Insurance on stock.....	591	634	677	720	764	807	850	893	936	979
Taxes on gross sales.....	3,936	4,224	4,512	4,800	5,088	5,376	5,664	5,952	6,240	6,528
Taxes on improvements.....	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Utilities: telephone.....	720	720	720	720	720	720	720	720	720	720
lights.....	300	310	320	330	340	350	360	370	380	390
power for machinery.....	667	716	765	814	862	911	960	1,009	1,057	1,106
water.....	178	179	181	183	185	186	188	190	191	193
Advertising and promotion.....	6,888	7,392	7,896	8,400	8,904	9,408	9,912	10,416	10,920	11,424
Sugar.....	60,680	65,120	69,560	74,000	78,440	82,880	87,320	91,760	96,200	100,640
Raw fruit.....	139,400	149,600	159,800	170,000	180,200	190,400	200,600	210,800	221,000	231,200
Total annual costs (not including interest on capital investment) ...	386,008	411,752	437,496	463,241	488,986	514,730	540,475	566,219	591,963	617,707
Gross returns at 12.88 cents per 6-ounce can f.o.b. Honolulu (21 cents West Coast retail) .....	422,338	453,240	484,144	515,046	545,948	576,852	607,754	638,656	669,560	700,462
Net returns.....	36,330	41,488	46,648	51,805	56,962	62,122	67,279	72,437	77,597	82,755
Rate of return (percent) .....	8.0	9.2	10.3	11.4	12.6	13.7	14.8	16.0	17.1	18.3

TABLE 5. Effect of length of processing season on passion fruit processor's rate of return to capital, plant C, capacity of 80,000 pounds per day; f.o.b. Honolulu price, 12.88 cents per 6-ounce can; West Coast retail price, 21 cents

Item	Number of full days of operation during processing season									
	82	88	94	100	106	112	118	124	130	136
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
<i>Annual costs</i>										
Buildings.....	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400	2,400
Equipment.....	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500	3,500
Salaries.....	19,800	19,800	19,800	19,800	19,800	19,800	19,800	19,800	19,800	19,800
Wages.....	28,047	29,573	31,099	32,624	34,149	35,675	37,200	38,725	40,251	41,776
Workmen's compensation.....	505	533	560	587	615	642	670	697	725	752
Repairs and maintenance.....	2,780	2,983	3,186	3,390	3,593	3,797	4,000	4,204	4,407	4,610
Cans.....	147,534	158,329	169,124	179,919	190,714	201,509	212,304	223,099	233,894	244,689
Cartons.....	19,457	20,881	22,305	23,729	25,153	26,576	28,000	29,424	30,847	32,271
Chemicals and detergents.....	1,968	2,112	2,256	2,400	2,544	2,688	2,832	2,976	3,120	3,264
Storage.....	86,104	92,404	98,704	105,004	111,304	117,604	123,904	130,204	136,504	142,805
Insurance on buildings.....	700	700	700	700	700	700	700	700	700	700
Insurance on stock.....	1,182	1,268	1,354	1,441	1,527	1,614	1,700	1,786	1,873	1,959
Taxes on gross sales.....	7,872	8,448	9,024	9,600	10,176	10,752	11,328	11,904	12,480	13,056
Taxes on improvements.....	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Utilities: telephone.....	720	720	720	720	720	720	720	720	720	720
lights.....	600	620	640	660	680	700	720	740	760	780
power for machinery.....	1,335	1,432	1,530	1,627	1,725	1,822	1,920	2,018	2,115	2,213
water.....	330	333	336	339	342	345	348	351	354	357
Advertising and promotion.....	13,776	14,784	15,792	16,800	17,808	18,816	19,824	20,832	21,840	22,848
Sugar.....	121,360	130,240	139,120	148,000	156,880	165,760	174,640	183,520	192,400	201,280
Raw fruit.....	278,800	299,200	319,600	340,000	360,400	380,800	401,200	421,600	442,000	462,400
Total annual costs (not including interest on capital investment) ...	739,970	791,460	842,950	894,440	945,930	997,420	1,048,910	1,100,400	1,151,890	1,203,380
Gross returns at 12.88 cents per 6-ounce can f.o.b. Honolulu (21 cents West Coast retail) .....	844,676	906,480	968,288	1,030,092	1,091,896	1,153,704	1,215,508	1,277,312	1,339,120	1,400,924
Net returns.....	104,706	115,020	125,338	135,652	145,966	156,284	166,598	176,912	187,230	197,544
Rate of return (percent) .....	13.7	15.1	16.4	17.8	19.1	20.5	21.8	23.2	24.5	25.9

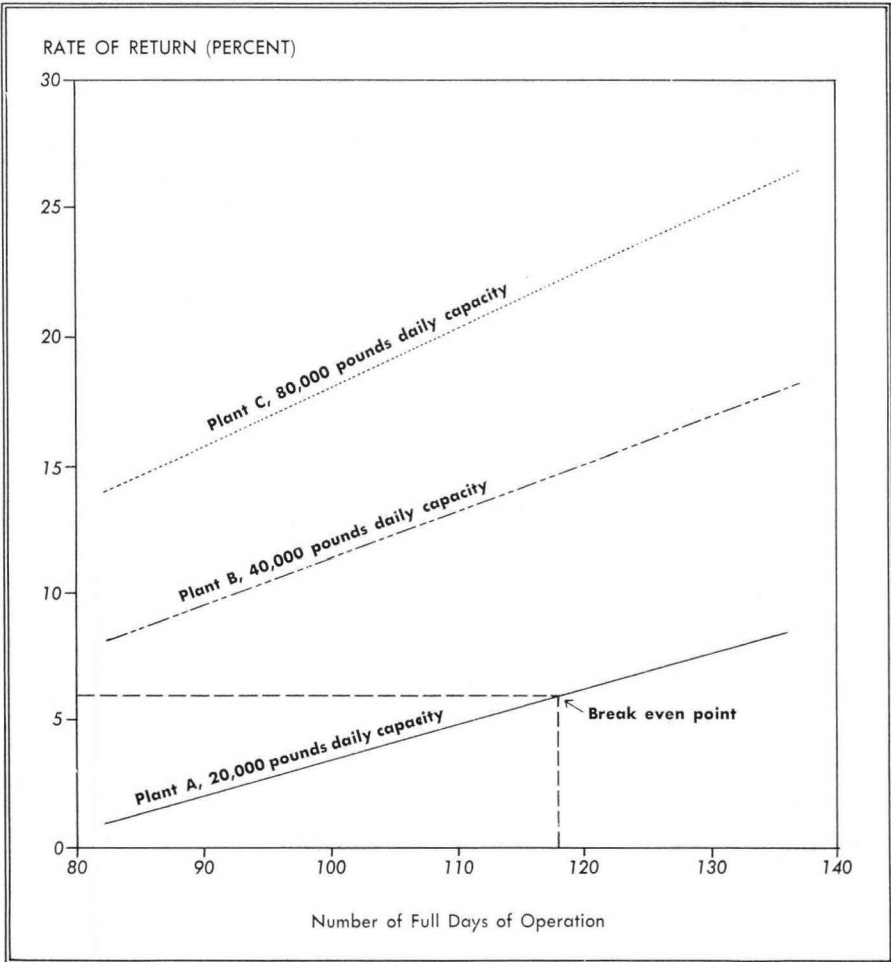


FIGURE 3. Effect of length of processing season on processor's rate of return to capital investment, plants A, B, and C; f.o.b. Honolulu price, 12.88 cents per 6-ounce can.

Rate of return for plant B ranges from 8.0 percent for 82 days to 18.3 percent for 136 days. For plant C, the rate of return under the same conditions ranges from 13.7 to 25.9.

For all model plants the length of processing season has a considerably greater effect on rate of return than does scale of operation. In considering capacity alone, plant B which has double the capacity of plant A has a rate of return 3.6 times as great. But through increasing plant A's operating season from 82 to 130 days or 1.66



times, the rate of return increased from 0.9 percent to 8.6 percent or 9.6 times. Similar patterns hold true for plants B and C but with the absolute increase in rate of return being greater as the size of plant is increased as compared with a greater proportional return for the small plant.

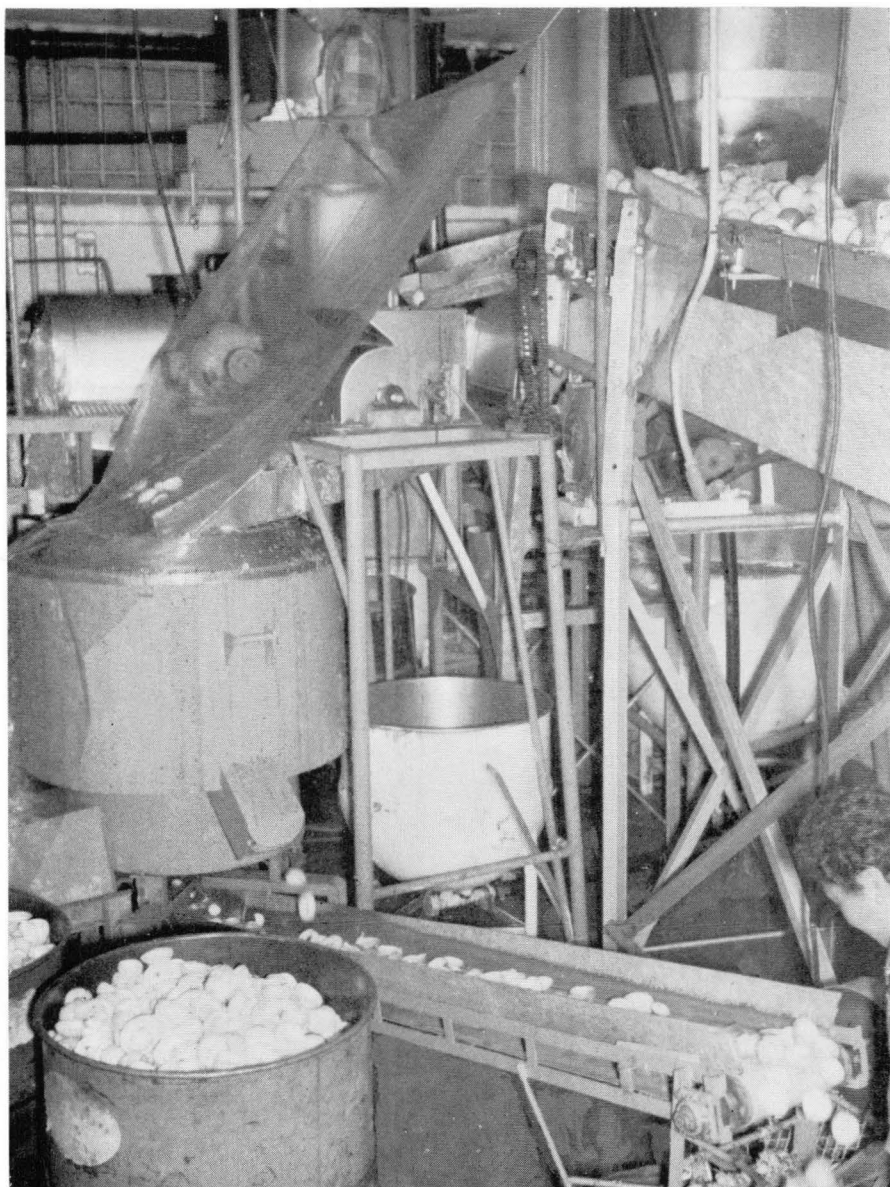
### **Price**

Assuming a fixed rate of return of 6 percent, which investment capital might be expected to earn elsewhere, length of the processing season would have an important effect on both the retail and wholesale prices at which frozen passion fruit juice could be offered. The effect of length of processing season on price is shown for plants A, B, and C in tables 6, 7, and 8, respectively, and in figure 4.

As was true with regard to the effect of length of season on rate of return, the effect on the price at which the juice could be offered for sale is proportionately greater for the small plant. The base operating period of 118 days would permit selling the frozen juice at 12.88 cents per 6-ounce can (\$3.09 per case of 24 6-ounce) f.o.b. Honolulu and 21.0 cents to West Coast consumers. With an operating period of only 82 days, it would be necessary to receive 13.7 cents per can f.o.b. Honolulu in order to return 6 percent on the investment. At this f.o.b. Honolulu price, the frozen passion fruit juice would be expected to retail at 22 cents on the West Coast. With the maximum projected operating season of 136 days, the product could be sold for 12.6 cents per 6-ounce can f.o.b. Honolulu and retail for 20.5 cents per 6-ounce can on the West Coast and still yield a 6 percent return on the capital investment.

Plant B under the above conditions would permit an f.o.b. Honolulu price of 12.6 cents and a West Coast retail price of 20.5 cents per 6-ounce can with an annual processing season of 82 days and 11.9 cents and 19.5 cents, respectively, with a processing season of 136 days.

For plant C, length of season has considerably less effect on price within the 82- to 136-day range than is true for the smaller plants. With a daily capacity of four times that of plant A, the absorption of fixed costs is much greater. Other conditions being the same as in the base model in table 1, an operating period of 82 days would permit an f.o.b. Honolulu price of 11.96 cents and a West Coast



Centrifuge for separating passion fruit rinds from juice in Honolulu.

TABLE 6. Effect of length of processing season on f.o.b. Honolulu cost and West Coast retail price of frozen passion fruit juice in 6-ounce cans, plant A, capacity of 20,000 pounds of raw fruit per day

Item	Number of full days of operation during processing season									
	82	88	94	100	106	112	118	124	130	136
Total costs (not including interest on capital investment) .....	\$208,781	\$221,958	\$235,135	\$248,313	\$261,491	\$274,668	\$287,845	\$301,022	\$314,201	\$327,379
Interest on capital investment .....	\$16,032	\$16,032	\$16,032	\$16,032	\$16,032	\$16,032	\$16,032	\$16,032	\$16,032	\$16,032
Total costs .....	\$224,813	\$237,990	\$251,167	\$264,345	\$277,523	\$290,700	\$303,877	\$317,054	\$330,233	\$343,411
Number of cases .....	68,333	73,333	78,333	83,333	88,333	93,333	98,333	103,333	108,333	113,333
Costs per case (24 6-oz.), f.o.b.										
Honolulu .....	\$3.29	\$3.25	\$3.21	\$3.17	\$3.14	\$3.11	\$3.09	\$3.07	\$3.05	\$3.03
Price per 6-ounce can, f.o.b.										
Honolulu .....	13.71¢	13.54¢	13.37¢	13.21¢	13.08¢	12.96¢	12.88¢	12.79¢	12.71¢	12.62¢
Retail price, West Coast .....	22.17¢	21.92¢	21.67¢	21.42¢	21.25¢	21.08¢	21.00¢	20.83¢	20.67¢	20.58¢

TABLE 7. Effect of length of processing season on f.o.b. Honolulu cost and West Coast retail price of frozen passion fruit juice in 6-ounce cans, plant B, capacity of 40,000 pounds of raw fruit per day

Item	Number of full days of operation during processing season									
	82	88	94	100	106	112	118	124	130	136
Total costs (not including interest on capital investment) .....	\$86,008	\$411,752	\$437,496	\$463,241	\$488,986	\$514,730	\$540,475	\$566,219	\$591,963	\$617,707
Interest on capital investment .....	\$27,205	\$27,205	\$27,205	\$27,205	\$27,205	\$27,205	\$27,205	\$27,205	\$27,205	\$27,205
Total costs .....	\$413,213	\$438,957	\$464,701	\$490,446	\$516,191	\$541,935	\$567,680	\$593,424	\$619,168	\$644,912
Number of cases .....	136,666	146,666	156,666	166,666	176,666	186,666	196,666	206,666	216,666	226,666
Costs per case (24 6-oz.), f.o.b.										
Honolulu .....	\$3.02	\$2.99	\$2.97	\$2.94	\$2.92	\$2.90	\$2.89	\$2.87	\$2.86	\$2.85
Price per 6-ounce can, f.o.b.										
Honolulu .....	12.58¢	12.46¢	12.37¢	12.25¢	12.17¢	12.08¢	12.04¢	11.96¢	11.92¢	11.87¢
Retail price, West Coast .....	20.50¢	20.37¢	20.21¢	20.04¢	19.96¢	19.83¢	19.75¢	19.58¢	19.54¢	19.50¢

TABLE 8. Effect of length of processing season on f.o.b. Honolulu cost and West Coast retail price of frozen passion fruit juice in 6-ounce cans, plant C, capacity of 80,000 pounds of raw fruit per day

Item	Number of full days of operation during processing season									
	82	88	94	100	106	112	118	124	130	136
Total costs (not including interest on capital investment) .....	\$739,970	\$791,460	\$842,950	\$894,440	\$945,930	\$997,420	\$1,048,910	\$1,100,400	\$1,151,890	\$1,203,380
Interest on capital investment.....	\$45,829	\$45,829	\$45,829	\$45,829	\$45,829	\$45,829	\$45,829	\$45,829	\$45,829	\$45,829
Total costs.....	\$785,799	\$837,289	\$888,779	\$940,269	\$991,759	\$1,043,249	\$1,094,739	\$1,146,229	\$1,197,719	\$1,249,209
Number of cases.....	273,332	293,332	313,332	333,332	353,332	373,332	393,332	413,332	433,332	453,332
Costs per case (24 6-oz.), f.o.b.										
Honolulu.....	\$2.87	\$2.85	\$2.84	\$2.82	\$2.81	\$2.79	\$2.78	\$2.77	\$2.76	\$2.75
Price per 6-ounce can, f.o.b.										
Honolulu.....	11.96¢	11.87¢	11.83¢	11.75¢	11.71¢	11.62¢	11.58¢	11.54¢	11.50¢	11.46¢
Retail price, West Coast.....	19.58¢	19.50¢	19.42¢	19.33¢	19.25¢	19.12¢	19.08¢	19.00¢	18.96¢	18.92¢

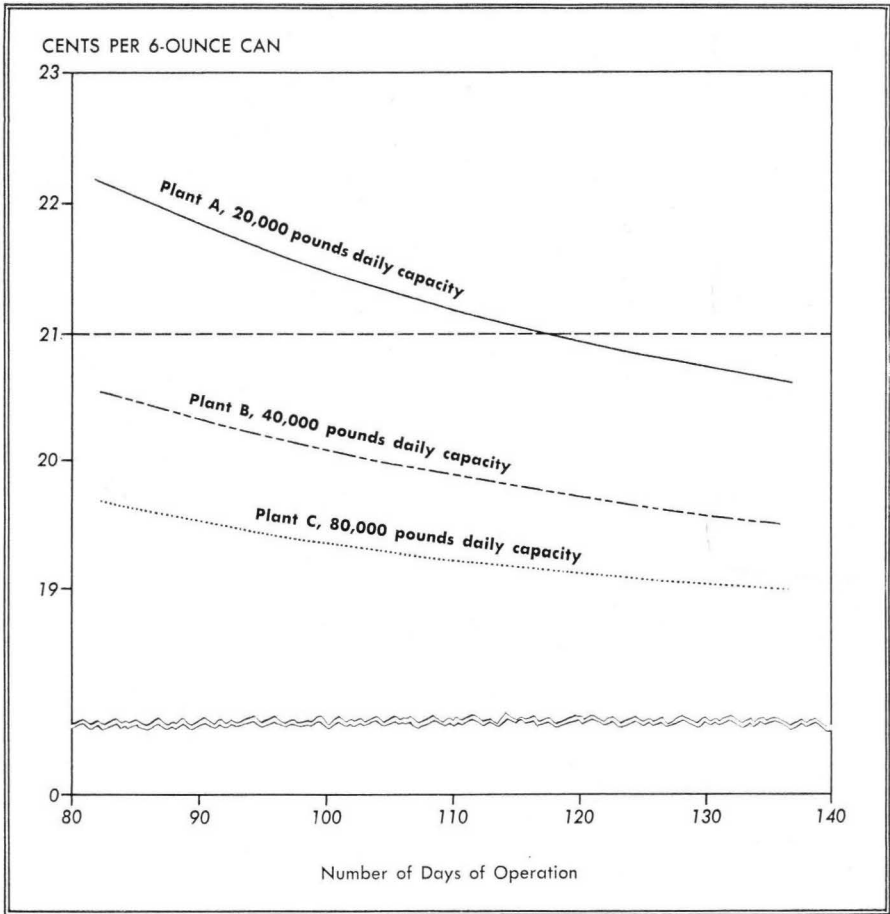
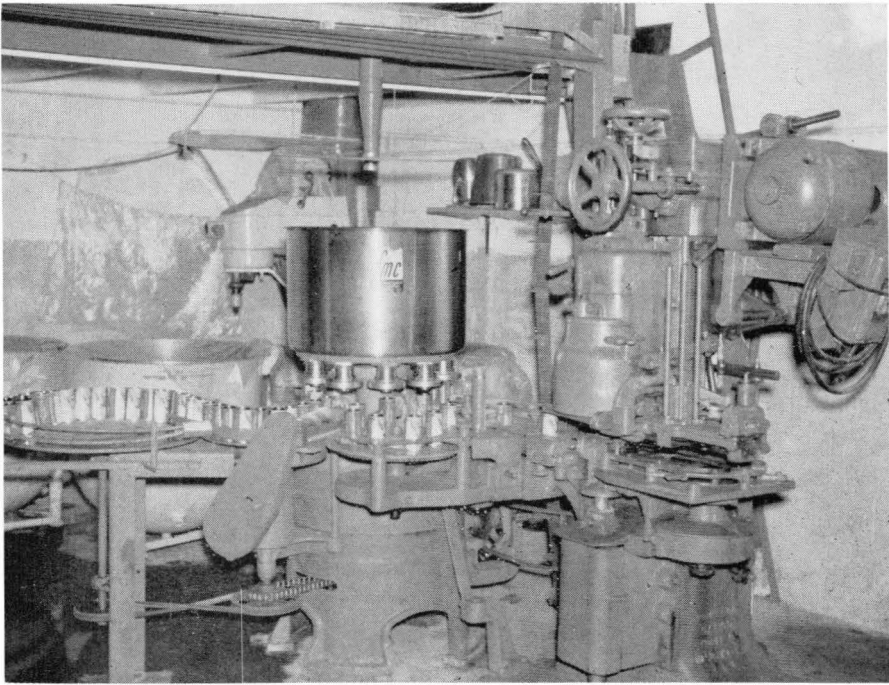


FIGURE 4. Effect of length of processing season on West Coast retail price of frozen passion fruit juice in 6-ounce cans, plants A, B, and C.

retail price of about 19.5 cents per 6-ounce can for plant C. With a season of 136 days, the f.o.b. Honolulu price would be 11.46 cents and the West Coast retail price, approximately 19 cents per 6-ounce can.

Because price must be sufficient to embody all costs, the effect of length of operating season on price is less than on rate of return, which is a residual.



Filling machine for 6-ounce cans in Honolulu.

## **EFFECT OF NET JUICE YIELD**

### **On Rate of Return to Capital**

Passion fruit varies markedly in juice yield. Whereas table 1 determinations are based on a net yield of 30 percent from raw fruit prevailing under commercial conditions at the time of the study, the University of Hawaii Food Processing Laboratory has extracted juice yields of over 40 percent from high yielding varieties. It is reasonable to assume that through varietal selection and better handling, net juice yields might be increased to 40 percent. Thus in order to determine the effect of juice yield on the profitability of passion fruit processing, net profits have been calculated on the basis of a net juice yield within the assumed reasonable range of 28 to 40 percent, with other conditions remaining the same as for the basic calculations in table 1.

With price held constant in order to determine the effect of juice yield on profitability as shown in table 9 and figure 5, the rate of

TABLE 9. Effect of juice yield on passion fruit processor's rate of return to capital, plant A, capacity of 20,000 pounds per day; cost of raw fruit, 4¼¢ per pound f.o.b. plant; f.o.b. Honolulu price, 12.88 cents per 6-ounce can

Item	Percent net yield of juice from raw fruit												
	28	29	30	31	32	33	34	35	36	37	38	39	40
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Total costs other than raw juice.....	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545
Total cost of raw juice to processor.....	107,464	103,759	100,300	97,065	94,031	91,182	88,500	85,971	83,583	81,324	79,184	77,154	75,225
Total costs (not including return to capital).....	295,009	291,304	287,845	284,610	281,576	278,727	276,045	273,516	271,128	268,869	266,729	264,699	262,770
Gross returns to processor at 12.88 cents per 6-ounce can f.o.b. Honolulu.....	303,877	303,877	303,877	303,877	303,877	303,877	303,877	303,877	303,877	303,877	303,877	303,877	303,877
Net returns.....	8,868	12,573	16,032	19,267	22,301	25,150	27,832	30,361	32,749	35,008	37,148	39,178	41,107
Rate of return on capital investment (percent).....	3.3	4.7	6.0	7.2	8.3	9.4	10.4	11.4	12.3	13.1	13.9	14.7	15.1



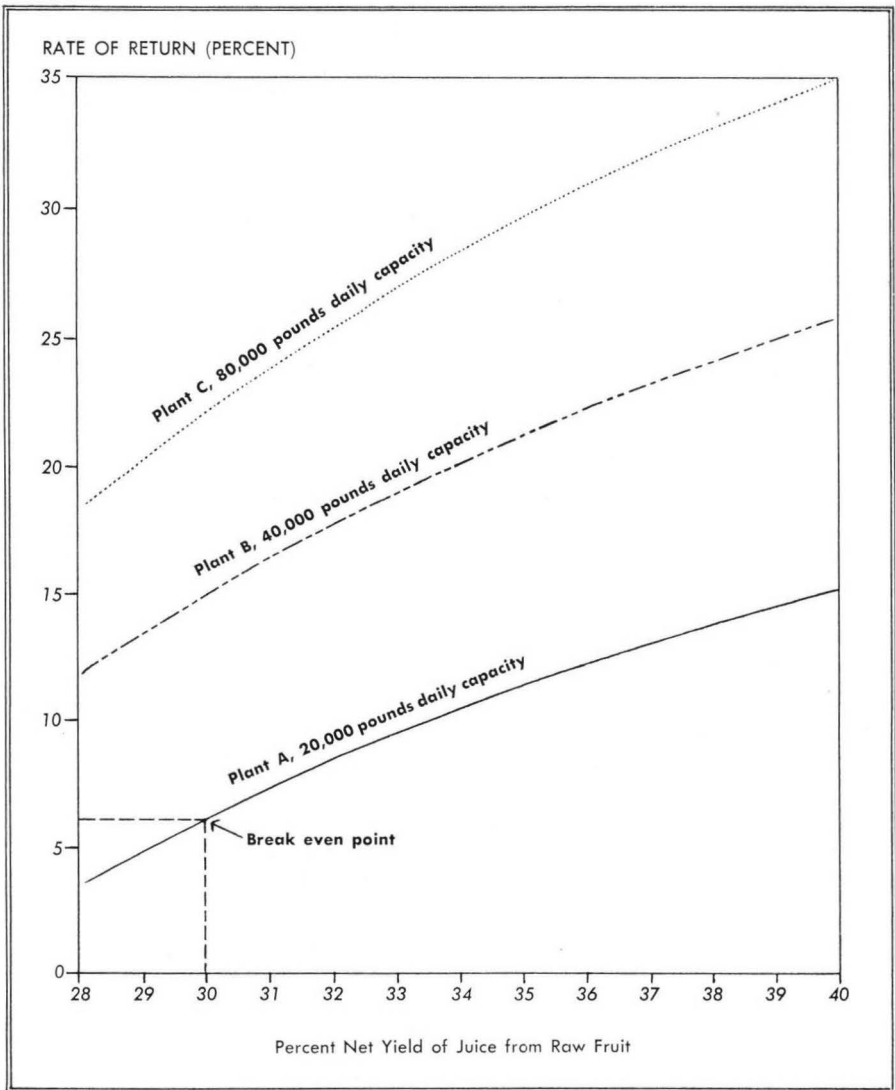


FIGURE 5. Effect of net juice yield on processor's rate of return to capital investment; plants A, B, and C; price to processor, 12.88 cents per 6-ounce can; West Coast retail price, 21 cents per 6-ounce can.

return on capital investment for plant A would range from 3.3 percent at a 28 percent juice yield to 15.4 percent for a 40 percent yield.

Because of the higher ratio of variable to fixed costs for the larger plants, the effect of juice yield on profitability would have an even

TABLE 10. Effect of juice yield on passion fruit processor's rate of return to capital, plant B, capacity of 40,000 pounds per day; cost of raw fruit,  $4\frac{1}{4}\epsilon$  per pound f.o.b. plant; f.o.b. Honolulu price, 12.88 cents per 6-ounce can

Item	Percent net yield of juice from raw fruit												
	28	29	30	31	32	33	34	35	36	37	38	39	40
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Total costs other than raw juice.....	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875
Total cost of raw juice to processor.....	214,928	207,518	200,600	194,130	188,062	182,364	177,000	171,942	167,166	162,648	158,368	154,308	150,450
Total costs (not including return to capital) .....	554,803	547,393	540,475	534,005	527,937	522,239	516,875	511,817	507,041	502,523	498,243	494,183	490,325
Gross returns to processor at 12.88 cents per 6-ounce can f.o.b. Honolulu.....	607,754	607,754	607,754	607,754	607,754	607,754	607,754	607,754	607,754	607,754	607,754	607,754	607,754
Net returns.....	52,951	60,361	67,279	73,749	79,817	85,515	90,879	95,937	100,713	105,231	109,511	113,571	117,429
Rate of return on capital investment (percent) .....	11.7	13.3	14.8	16.3	17.6	18.9	20.0	21.2	22.2	23.2	24.2	25.0	25.9

TABLE 11. Effect of juice yield on passion fruit processor's rate of return to capital, plant C, capacity of 80,000 pounds per day; cost of raw fruit, 4¼¢ per pound f.o.b. plant; f.o.b. Honolulu price, 12.88 cents per 6-ounce can

Item	Percent net yield of juice from raw fruit												
	28	29	30	31	32	33	34	35	36	37	38	39	40
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Total costs other than raw juice.....	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710
Total cost of raw juice to processor.....	429,856	415,036	401,200	388,260	376,124	364,728	354,000	343,884	334,332	325,296	316,736	308,616	300,900
Total costs (not including return to capital) .....	1,077,566	1,062,746	1,048,910	1,035,970	1,023,834	1,012,438	1,001,710	991,594	982,042	973,006	964,446	956,326	948,610
Gross returns to processor at 12.88 cents per 6-ounce can f.o.b. Honolulu.....	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508
Net returns.....	137,942	152,762	166,598	179,538	191,674	203,070	213,798	223,914	233,466	242,502	251,062	259,182	266,898
Rate of return on capital investment (percent) .....	18.1	20.0	21.8	23.5	25.1	26.6	28.0	29.3	30.6	31.7	32.9	33.9	34.9

greater impact on the profitability of the larger plants as can be determined by comparing tables 10 and 11 with table 9 and by observing figure 5.

It is of significance that juice yield has an even greater effect on profitability of processing than does length of season. This may be observed by comparing the appropriate tables and figures in this section with those in the preceding section.

### **On Price**

Whereas in the short run additional profits might be realized in the form of greater dividends or plowed back into the business for further expansion, in the long run the various firms, under reasonably competitive conditions, would be expected to expand to the point where the return to capital would be in line with that of alternative investments. Under such conditions the benefits of greater economy might be expected to be absorbed in the form of a lower retail price, which would be necessary in order to move the greater output off the market.

If all of the benefits of higher juice yield were to be reflected in lower retail prices, the output of any of the three plant models could be retailed at 2 cents per 6-ounce can less at a juice yield of 40 percent than at 28 percent as shown in tables 12, 13, and 14 and figure 6.

TABLE 12. Effect of juice yield on West Coast retail price of frozen passion fruit juice, assuming 6 percent return on capital investment, plant A, capacity of 20,000 pounds per day

Item	Percent net yield of juice from raw fruit												
	28	29	30	31	32	33	34	35	36	37	38	39	40
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Cos's other than raw juice.....	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545
Cost of raw juice.....	107,464	103,759	100,300	97,065	94,031	91,182	88,500	85,971	83,583	81,324	79,184	77,154	75,225
Return to capital investment.....	16,032	16,032	16,032	16,032	16,032	16,032	16,032	16,032	16,032	16,032	16,032	16,032	16,032
Total costs to processor.....	311,041	307,336	303,877	300,642	297,608	294,759	292,077	289,548	287,160	284,901	282,761	280,731	278,802
Cost f.o.b. Honolulu:													
Per case, dollars.....	3.16	3.13	3.09	3.06	3.03	3.00	2.97	2.94	2.92	2.90	2.88	2.85	2.84
Per dozen, dollars.....	1.58	1.56	1.55	1.53	1.52	1.50	1.48	1.47	1.46	1.45	1.44	1.42	1.42
Per 6-ounce can, cents.....	13.17	13.04	12.88	12.75	12.62	12.50	12.38	12.25	12.17	12.08	12.00	11.88	11.83
Price f.o.b. warehouse in San Francisco:													
Per case, dollars.....	3.52	3.49	3.45	3.42	3.39	3.36	3.33	3.30	3.28	3.26	3.24	3.21	3.20
Per dozen, dollars.....	1.76	1.74	1.72	1.71	1.70	1.68	1.66	1.65	1.64	1.63	1.62	1.60	1.60
Per 6-ounce can, cents.....	14.67	14.54	14.38	14.25	14.12	14.00	13.88	13.75	13.67	13.58	13.50	13.38	13.33
Retail selling price:													
Per case, dollars.....	5.12	5.09	5.04	4.99	4.94	4.90	4.85	4.81	4.79	4.76	4.71	4.68	4.66
Per dozen, dollars.....	2.56	2.54	2.52	2.50	2.47	2.45	2.42	2.40	2.40	2.38	2.36	2.34	2.33
Per 6-ounce can, cents.....	21.33	21.21	21.00	20.79	20.58	20.42	20.21	20.04	19.96	19.83	19.62	19.50	19.42

TABLE 13. Effect of juice yield on West Coast retail price of frozen passion fruit juice, assuming 6 percent return on capital investment, plant B, capacity of 40,000 pounds per day

Item	Percent net yield of juice from raw fruit												
	28	29	30	31	32	33	34	35	36	37	38	39	40
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Costs other than raw juice.....	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875
Cost of raw juice.....	214,928	207,518	200,600	194,130	188,062	182,364	177,000	171,942	167,166	162,648	158,368	154,308	150,450
Return to capital investment.....	27,205	27,205	27,205	27,205	27,205	27,205	27,205	27,205	27,205	27,205	27,205	27,205	27,205
Total costs to processor.....	582,008	574,598	567,680	561,210	555,142	549,444	544,080	539,022	534,246	529,728	525,448	521,388	517,530
Cost f.o.b. Honolulu:													
Per case, dollars.....	2.96	2.92	2.89	2.85	2.82	2.79	2.77	2.74	2.72	2.69	2.67	2.65	2.63
Per dozen, dollars.....	1.48	1.46	1.44	1.42	1.41	1.40	1.38	1.37	1.36	1.34	1.34	1.32	1.32
Per 6-ounce can, cents.....	12.33	12.17	12.04	11.88	11.75	11.62	11.54	11.42	11.33	11.21	11.12	11.04	10.96
Price f.o.b. warehouse in San Francisco:													
Per case, dollars.....	3.32	3.28	3.25	3.21	3.18	3.15	3.13	3.10	3.08	3.05	3.03	3.01	2.99
Per dozen, dollars.....	1.66	1.64	1.62	1.60	1.59	1.58	1.56	1.55	1.54	1.52	1.52	1.50	1.50
Per 6-ounce can, cents.....	13.83	13.67	13.54	13.38	13.25	13.12	13.04	12.92	12.83	12.71	12.62	12.54	12.46
Retail selling price:													
Per case, dollars.....	4.84	4.79	4.74	4.68	4.64	4.59	4.56	4.52	4.49	4.44	4.41	4.39	4.36
Per dozen, dollars.....	2.42	2.40	2.37	2.34	2.32	2.30	2.28	2.26	2.24	2.22	2.20	2.20	2.18
Per 6-ounce can, cents.....	20.17	19.96	19.75	19.50	19.33	19.12	19.00	18.83	18.71	18.50	18.38	18.29	18.17

TABLE 14. Effect of juice yield on West Coast retail price of frozen passion fruit juice, assuming 6 percent return on capital investment, plant C, capacity of 80,000 pounds per day

Item	Percent net yield of juice from raw fruit												
	28	29	30	31	32	33	34	35	36	37	38	39	40
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Costs other than raw juice.....	647,710	647,710	647,170	647,710	647,710	647,710	647,710	647,710	647,170	647,710	647,710	647,710	647,710
Cost of raw juice.....	429,856	415,036	401,200	388,260	376,124	364,728	354,000	343,884	334,332	325,296	316,736	308,616	300,900
Return to capital investment.....	45,829	45,829	45,829	45,829	45,829	45,829	45,829	45,829	45,829	45,829	45,829	45,829	45,829
Total costs to processor.....	1,123,395	1,108,575	1,094,739	1,081,799	1,069,663	1,058,267	1,047,539	1,037,423	1,027,871	1,018,835	1,010,275	1,002,155	994,439
Cost f.o.b. Honolulu:													
Per case, dollars.....	2.86	2.82	2.78	2.75	2.72	2.69	2.66	2.64	2.61	2.59	2.57	2.55	2.53
Per dozen, dollars.....	1.43	1.41	1.39	1.38	1.36	1.34	1.33	1.32	1.30	1.30	1.28	1.28	1.26
Per 6-ounce can, cents.....	11.92	11.75	11.60	11.46	11.33	11.21	11.08	11.00	10.88	10.79	10.71	10.62	10.54
Price f.o.b. warehouse in San Francisco:													
Per case, dollars.....	3.22	3.18	3.14	3.11	3.08	3.05	3.02	3.00	2.97	2.95	2.93	2.91	2.89
Per dozen, dollars.....	1.61	1.59	1.57	1.56	1.54	1.52	1.51	1.50	1.48	1.48	1.46	1.46	1.44
Per 6-ounce can, cents.....	13.42	13.25	13.08	12.96	12.83	12.71	12.58	12.50	12.38	12.29	12.21	12.12	12.04
Retail selling price:													
Per case, dollars.....	4.69	4.64	4.58	4.54	4.49	4.44	4.40	4.38	4.34	4.30	4.28	4.24	4.21
Per dozen, dollars.....	2.34	2.32	2.29	2.27	2.24	2.22	2.20	2.19	2.17	2.15	2.14	2.12	2.10
Per 6-ounce can, cents.....	19.54	19.33	19.08	18.92	18.71	18.50	18.33	18.25	18.08	17.92	17.83	17.67	17.54



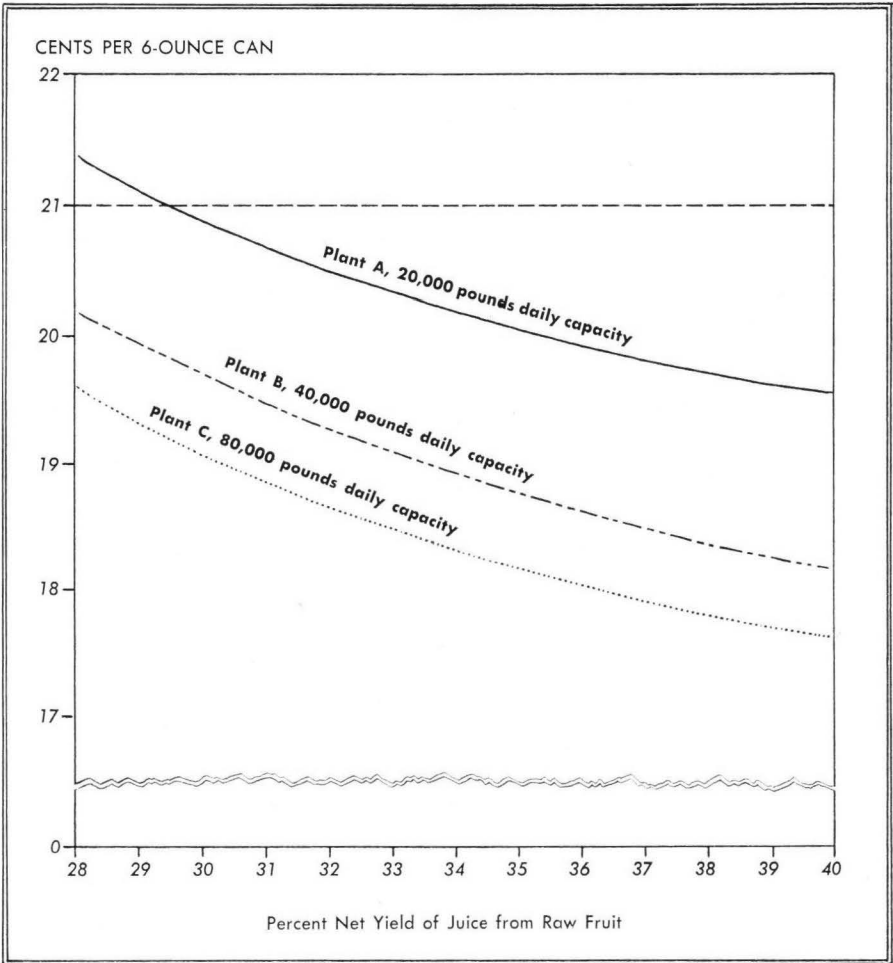


FIGURE 6. Effect of net juice yield on West Coast retail price of frozen passion fruit juice in 6-ounce cans, plants A, B, and C, allowing 6 percent return on capital investment.

### EFFECT OF COST OF RAW FRUIT

#### On Rate of Return to Capital

As indicated previously, plant A provides a 6 percent or break-even return on investment under conditions shown in table 1. This assumes a cost of  $4\frac{1}{4}$  cents per pound for raw fruit, f.o.b. processing plant. Any deviation from this price would have a very marked effect on rate of return inasmuch as raw fruit constitutes the great-

TABLE 15. Effect of cost of raw fruit on passion fruit processor's return to capital investment, plant A, capacity of 20,000 pounds per day; retail price, 21 cents per 6-ounce can; f.o.b. Honolulu price, 12.88 cents per 6-ounce can

Item	Cost of raw fruit, f.o.b. processing plant, Honolulu												
	3¢	3¼¢	3½¢	3¾¢	4¢	4¼¢	4½¢	4¾¢	5¢	5¼¢	5½¢	5¾¢	6¢
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Total cost of raw fruit to processor.....	70,800	76,700	82,600	88,500	94,400	100,300	106,200	112,100	118,000	123,900	129,800	135,700	141,600
Processing costs other than raw fruit.....	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545
Total costs (not including return to capital).....	258,345	264,245	270,145	276,045	281,945	287,845	293,745	299,645	305,545	311,445	317,345	323,245	329,145
Gross returns to processor at 12.88 cents per 6-ounce can f.o.b. Honolulu.....	303,877	303,877	303,877	303,877	303,877	303,877	303,877	303,877	303,877	303,877	303,877	303,877	303,877
Net returns.....	45,532	39,632	33,732	27,832	21,932	16,032	10,132	4,232	-1,668	-7,568	-13,468	-19,368	-25,268
Rate of return on capital investment (percent).....	17.0	14.8	12.6	10.4	8.2	6.0	3.8	1.6	-0.6	-2.8	-5.0	-7.2	-9.5

TABLE 16. Effect of cost of raw fruit on passion fruit processor's return to capital investment, plant B, capacity of 40,000 pounds per day; retail price, 21 cents per 6-ounce can; f.o.b. Honolulu price, 12.88 cents per 6-ounce can

Item	Cost of raw fruit, f.o.b. processing plant, Honolulu													
	3¢	3¼¢	3½¢	3¾¢	4¢	4¼¢	4½¢	4¾¢	5¢	5¼¢	5½¢	5¾¢	6¢	
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Total cost of raw fruit to processor.....	141,600	153,400	165,200	177,000	188,800	200,600	212,400	224,200	236,000	247,800	259,600	271,400	283,200	
Processing costs other than raw fruit.....	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	
Total costs (not including return to capital).....	481,475	493,275	505,075	516,875	528,675	540,475	552,275	564,075	575,875	587,675	599,475	611,275	623,075	
Gross returns to processor at 12.88 cents per 6-ounce can f.o.b. Honolulu.....	607,754	607,754	607,754	607,754	607,754	607,754	607,754	607,754	607,754	607,754	607,754	607,754	607,754	
Net returns.....	126,279	114,479	102,679	90,879	79,079	67,279	55,479	43,679	31,879	20,079	8,279	-3,521	-15,321	
Rate of return on capital investment (percent) .....	27.8	25.2	22.6	20.0	17.4	14.8	12.2	9.6	7.0	4.4	1.8	-0.8	-3.4	

est single cost in passion fruit processing and amounts to 34.8 percent of all costs in the base model for plant A.

As illustrated in table 15, a  $\frac{1}{4}$  cent per pound change in cost of raw fruit to the processor would amount to a 2.2 percent change in rate of return on capital investment. Whereas a raw fruit cost of 3 cents per pound f.o.b. plant would allow for a 17 percent return, a doubling of the price to 6 cents would result in a return of minus 9.5, other conditions remaining the same.

Under the conditions assumed in this analysis, the larger the plant the greater the effect of the price of raw fruit on profit as a result of lower fixed costs in relation to variable costs per unit of output. This, of course, is exactly opposite what was true with regard to the effects of length of season, which, if expanded, would tend to reduce per unit fixed costs in relation to per unit variable costs. Thus whereas plant B yields a rate of return of 14.8 percent at a raw fruit cost of  $4\frac{1}{4}$  cents, the return would be 27.8 percent at a cost of 3 cents and  $-3.4$  percent at a cost of 6 cents for raw fruit (table 16). For plant C, the return is 21.8 percent at a cost of  $4\frac{1}{4}$  cents and would range from 37.3 percent at a cost of 3 cents to 0.2 percent at a cost of 6 cents per pound of raw fruit (table 17 and figure 7).

### **On Price**

A  $\frac{1}{4}$  cent change in the cost of raw fruit would have a noticeable effect on the selling price of the frozen juice, but far less effect than on rate of return since, as mentioned earlier, rate of return is a residual and the selling price is based on an aggregate of costs. For plant A, each  $\frac{1}{4}$  cent *per pound* change in the cost of raw fruit would result in a  $\frac{1}{4}$  cent change in f.o.b. Honolulu price and a  $\frac{1}{3}$  cent change in the West Coast retail price *per 6-ounce can* of frozen passion fruit juice (table 18).

The effect of cost of raw fruit on price would be approximately the same for plants B and C as for plant A (tables 19 and 20 and figure 8).

TABLE 17. Effect of cost of raw fruit on passion fruit processor's return to capital investment, plant C, capacity of 80,000 pounds per day; retail price, 21 cents per 6-ounce can; f.o.b. Honolulu price, 12.88 cents per 6-ounce can

Item	Cost of raw fruit, f.o.b. processing plant, Honolulu												
	3¢	3¼¢	3½¢	3¾¢	4¢	4¼¢	4½¢	4¾¢	5¢	5¼¢	5½¢	5¾¢	6¢
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Total cost of raw fruit to processor.....	283,200	306,800	330,400	354,000	377,600	401,200	424,800	448,400	472,000	495,600	519,200	542,800	566,400
Processing costs other than raw fruit	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710
Total costs (not including return to capital) .....	930,910	954,510	978,110	1,001,710	1,025,310	1,048,910	1,072,510	1,096,110	1,119,710	1,143,310	1,166,910	1,190,510	1,214,110
Gross returns to processor at 12.88 cents per 6-ounce can f.o.b. Honolulu.....	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508	1,215,508
Net returns.....	284,598	260,998	237,398	213,798	190,198	166,598	142,998	119,398	95,798	72,198	48,598	24,998	1,398
Rate of return on capital investment (percent) .....	37.3	34.2	31.1	28.0	24.9	21.8	18.7	15.6	12.5	9.5	6.4	3.3	0.2

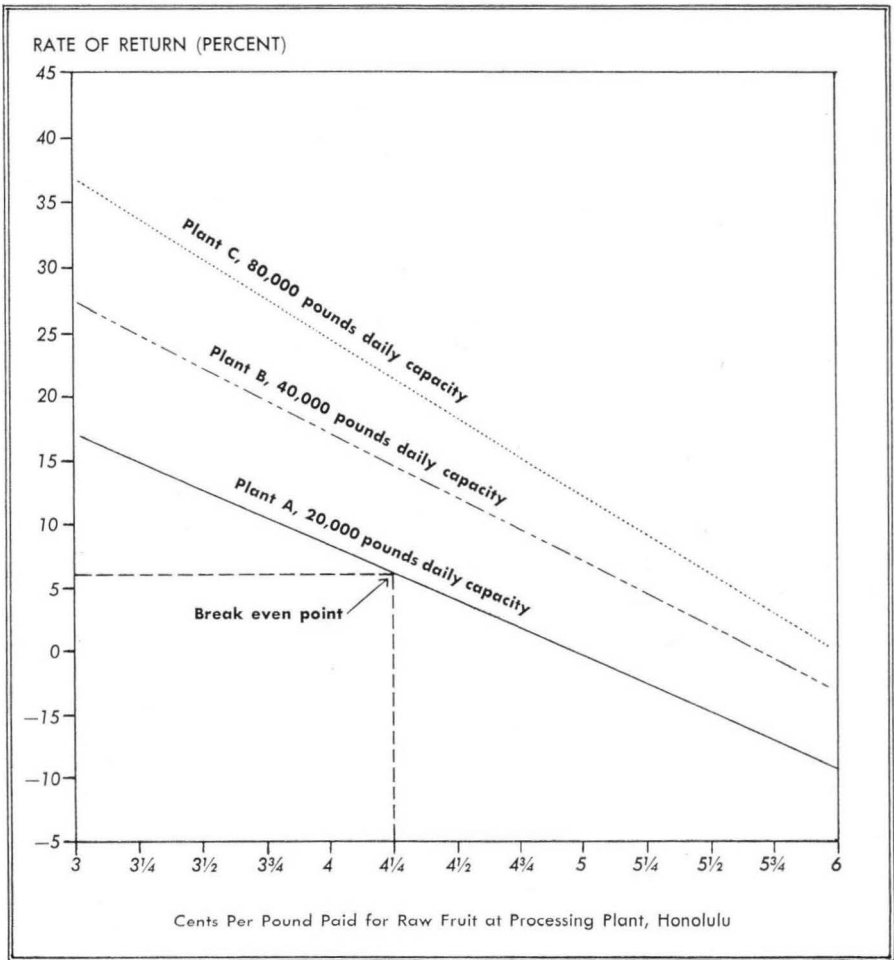


FIGURE 7. Effect of f.o.b. Honolulu cost of raw fruit on passion fruit processor's return on capital investment; plants A, B, and C; West Coast retail price, 21 cents per 6-ounce can.

**EFFECT OF HONOLULU-WEST COAST FREIGHT RATE**

The shipping cost between Honolulu and the West Coast, although not under the control of the processor except perhaps through economies of volume shipments, is an important item in the determination of the West Coast retail price. The standard used in the base model, in line with current rates, is 11 1/2 cents per 6-ounce can. A 1/2 cent increase in freight added to the f.o.b. West Coast wholesale cost would have a slightly greater than 1/2 cent

TABLE 18. Effect of cost of raw fruit on f.o.b. Honolulu and West Coast retail price of frozen passion fruit juice, assuming 6 percent return on capital investment, plant A, capacity of 20,000 pounds per day

Item	Cost of raw fruit, f.o.b. processing plant, Honolulu												
	3¢	3¼¢	3½¢	3¾¢	4¢	4¼¢	4½¢	4¾¢	5¢	5¼¢	5½¢	5¾¢	6¢
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Costs other than raw fruit.....	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545	187,545
Cost of raw fruit.....	70,800	76,700	82,600	88,500	94,400	100,300	106,200	112,100	118,000	123,900	129,800	135,700	141,600
Return to capital investment...	16,032	16,032	16,032	16,032	16,032	16,032	16,032	16,032	16,032	16,032	16,032	16,032	16,032
Total costs to processor.....	274,377	280,277	286,177	292,077	297,977	303,877	309,777	315,677	321,577	327,477	333,377	339,277	345,177
Cost f.o.b. Honolulu:													
Per case, dollars.....	2.79	2.85	2.91	2.97	3.03	3.09	3.15	3.21	3.27	3.33	3.39	3.45	3.51
Per dozen, dollars.....	1.40	1.43	1.46	1.49	1.52	1.55	1.58	1.61	1.64	1.67	1.70	1.73	1.76
Per 6-ounce can, cents.....	11.63	11.88	12.13	12.38	12.63	12.88	13.13	13.38	13.63	13.88	14.13	14.38	14.63
	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>	<i>Dollars</i>
Shipping cost, Honolulu to warehouse in San Francisco, per case.....	.36	.36	.36	.36	.36	.36	.36	.36	.36	.36	.36	.36	.36
Price f.o.b. San Francisco, per case <sup>a</sup> .....	3.15	3.21	3.27	3.33	3.39	3.45	3.51	3.57	3.63	3.69	3.75	3.81	3.87
Brokerage 6 percent of price f.o.b. San Francisco, per case.....	.19	.19	.20	.20	.20	.21	.21	.21	.22	.22	.22	.23	.23
Price to wholesaler, per case.....	3.34	3.40	3.47	3.53	3.59	3.66	3.72	3.78	3.85	3.91	3.97	4.04	4.10
Wholesale markup, 10 percent, per case <sup>b</sup> .....	.33	.34	.35	.35	.36	.37	.37	.38	.38	.39	.40	.40	.41
Price to retailer, per case.....	3.67	3.74	3.82	3.88	3.95	4.03	4.09	4.16	4.23	4.30	4.37	4.44	4.51
Retail markup, 25 percent, per case.....	.92	.94	.96	.97	.99	1.01	1.02	1.04	1.06	1.08	1.09	1.11	1.13
Retail selling price:													
Per case, dollars.....	4.59	4.68	4.78	4.85	4.94	5.04	5.11	5.20	5.29	5.38	5.46	5.55	5.64
Per dozen, dollars.....	2.30	2.34	2.39	2.42	2.47	2.52	2.56	2.60	2.64	2.69	2.73	2.78	2.82
Per 6-ounce can, cents.....	19.12	19.50	19.92	20.21	20.58	21.00	21.29	21.67	22.04	22.42	22.75	23.12	23.50

<sup>a</sup> Three months of mainland storage charged to processor's cost f.o.b. warehouse, Honolulu.

<sup>b</sup> Assumed average for different types of distributing service varying from 5 percent to 20 percent.



TABLE 19. Effect of cost of raw fruit on f.o.b. Honolulu and West Coast retail price of frozen passion fruit juice, assuming 6 percent return on capital investment, plant B, capacity of 40,000 pounds per day

Item	Cost of raw fruit, f.o.b. processing plant, Honolulu													
	3¢	3¼¢	3½¢	3¾¢	4¢	4¼¢	4½¢	4¾¢	5¢	5¼¢	5½¢	5¾¢	6¢	
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Costs other than raw fruit.....	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875	339,875
Cost of raw fruit.....	141,600	153,400	165,200	177,000	188,800	200,600	212,400	224,200	236,000	247,800	259,600	271,400	283,200	
Return to capital investment...	27,205	27,205	27,205	27,205	27,205	27,205	27,205	27,205	27,205	27,205	27,205	27,205	27,205	
Total costs to processor.....	508,680	520,480	532,280	544,080	555,880	567,680	579,480	591,280	603,080	614,880	626,680	638,480	650,280	
Cost f.o.b. Honolulu:														
Per case, dollars.....	2.59	2.65	2.71	2.77	2.83	2.89	2.95	3.01	3.07	3.13	3.19	3.25	3.31	
Per dozen, dollars.....	1.29	1.32	1.35	1.38	1.41	1.44	1.47	1.50	1.53	1.56	1.59	1.62	1.65	
Per 6-ounce can, cents.....	10.79	11.03	11.28	11.53	11.78	12.04	12.28	12.53	12.78	13.03	13.28	13.53	13.78	
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	
Shipping cost, Honolulu to warehouse in San Francisco, per case.....	.36	.36	.36	.36	.36	.36	.36	.36	.36	.36	.36	.36	.36	
Price f.o.b. San Francisco, per case <sup>a</sup> .....	2.95	3.01	3.07	3.13	3.19	3.25	3.31	3.37	3.43	3.49	3.55	3.61	3.67	
Brokerage 6 percent of price f.o.b. San Francisco, per case	.18	.18	.18	.19	.19	.20	.20	.20	.21	.21	.21	.22	.22	
Price to wholesaler, per case.....	3.13	3.19	3.25	3.32	3.38	3.45	3.51	3.57	3.64	3.70	3.76	3.83	3.89	
Wholesale markup, 10 percent, per case <sup>b</sup> .....	.31	.32	.33	.33	.34	.34	.35	.36	.36	.37	.38	.38	.39	
Price to retailer, per case.....	3.44	3.51	3.58	3.65	3.72	3.79	3.86	3.93	4.00	4.07	4.14	4.21	4.28	
Retail markup, 25 percent, per case.....	.86	.88	.90	.91	.93	.95	.96	.98	1.00	1.02	1.03	1.05	1.07	
Retail selling price:														
Per case, dollars.....	4.30	4.39	4.48	4.56	4.65	4.74	4.82	4.91	5.00	5.09	5.17	5.26	5.35	
Per dozen, dollars.....	2.15	2.19	2.24	2.28	2.32	2.37	2.41	2.46	2.50	2.54	2.58	2.63	2.68	
Per 6-ounce can, cents.....	17.92	18.29	18.67	19.00	19.38	19.75	20.08	20.46	20.83	21.21	21.54	21.92	22.29	

<sup>a</sup> Three months of mainland storage charged to processor's cost f.o.b. warehouse, Honolulu.

<sup>b</sup> Assumed average for different types of distributing service varying from 5 percent to 20 percent.

TABLE 20. Effect of cost of raw fruit on f.o.b. Honolulu and West Coast retail price of frozen passion fruit juice, assuming 6 percent return on capital investment, plant C, capacity of 80,000 pounds per day

Item	Cost of raw fruit, f.o.b. processing plant, Honolulu												
	3¢	3¼¢	3½¢	3¾¢	4¢	4¼¢	4½¢	4¾¢	5¢	5¼¢	5½¢	5¾¢	6¢
	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars	Dollars
Costs other than raw fruit.....	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710	647,710
Cost of raw fruit.....	283,200	306,800	330,400	354,000	377,600	401,200	424,800	448,400	472,000	495,600	519,200	542,800	566,400
Return to capital investment.....	45,829	45,829	45,829	45,829	45,829	45,829	45,829	45,829	45,829	45,829	45,829	45,829	45,829
Total costs to processor.....	976,739	1,000,339	1,023,939	1,047,539	1,071,139	1,094,739	1,118,339	1,141,939	1,165,539	1,189,139	1,212,739	1,236,339	1,259,939
Cost f.o.b. Honolulu:													
Per case, dollars.....	2.48	2.54	2.60	2.66	2.72	2.78	2.84	2.90	2.96	3.02	3.08	3.14	3.20
Per dozen, dollars.....	1.24	1.27	1.30	1.33	1.36	1.39	1.42	1.45	1.48	1.51	1.54	1.57	1.60
Per 6-ounce can, cents	10.35	10.60	10.85	11.10	11.35	11.60	11.85	12.10	12.35	12.60	12.85	13.10	13.35
Shipping cost, Honolulu to warehouse in San Francisco, per case.....	.36	.36	.36	.36	.36	.36	.36	.36	.36	.36	.36	.36	.36
Price f.o.b. San Francisco, per case <sup>a</sup> .....	2.84	2.90	2.96	3.02	3.08	3.14	3.20	3.26	3.32	3.38	3.44	3.50	3.56
Brokerage 6 percent of price f.o.b. San Francisco, per case.....	.17	.17	.18	.18	.18	.19	.19	.20	.20	.20	.21	.21	.21
Price to wholesaler, per case.....	3.01	3.07	3.14	3.20	3.26	3.33	3.39	3.46	3.52	3.58	3.65	3.71	3.77
Wholesale markup, 10 percent, per case <sup>b</sup> .....	.30	.31	.31	.32	.33	.33	.34	.35	.35	.36	.36	.37	.38
Price to retailer, per case.....	3.31	3.38	3.45	3.52	3.59	3.66	3.73	3.81	3.87	3.94	4.01	4.08	4.15
Retail markup, 25 percent, per case.....	.83	.84	.86	.88	.90	.92	.93	.95	.97	.98	1.00	1.02	1.04
Retail selling price:													
Per case, dollars.....	4.14	4.22	4.31	4.40	4.49	4.58	4.66	4.76	4.84	4.92	5.01	5.10	5.19
Per dozen, dollars.....	2.07	2.11	2.16	2.20	2.24	2.29	2.33	2.38	2.42	2.46	2.50	2.55	2.60
Per 6-ounce can, cents	17.25	17.58	17.96	18.33	18.71	19.08	19.42	19.83	20.17	20.50	20.88	21.25	21.62

<sup>a</sup> Three months of mainland storage charged to processor's cost f.o.b. warehouse, Honolulu.

<sup>b</sup> Assumed average for different types of distributing service varying from 5 percent to 20 percent.

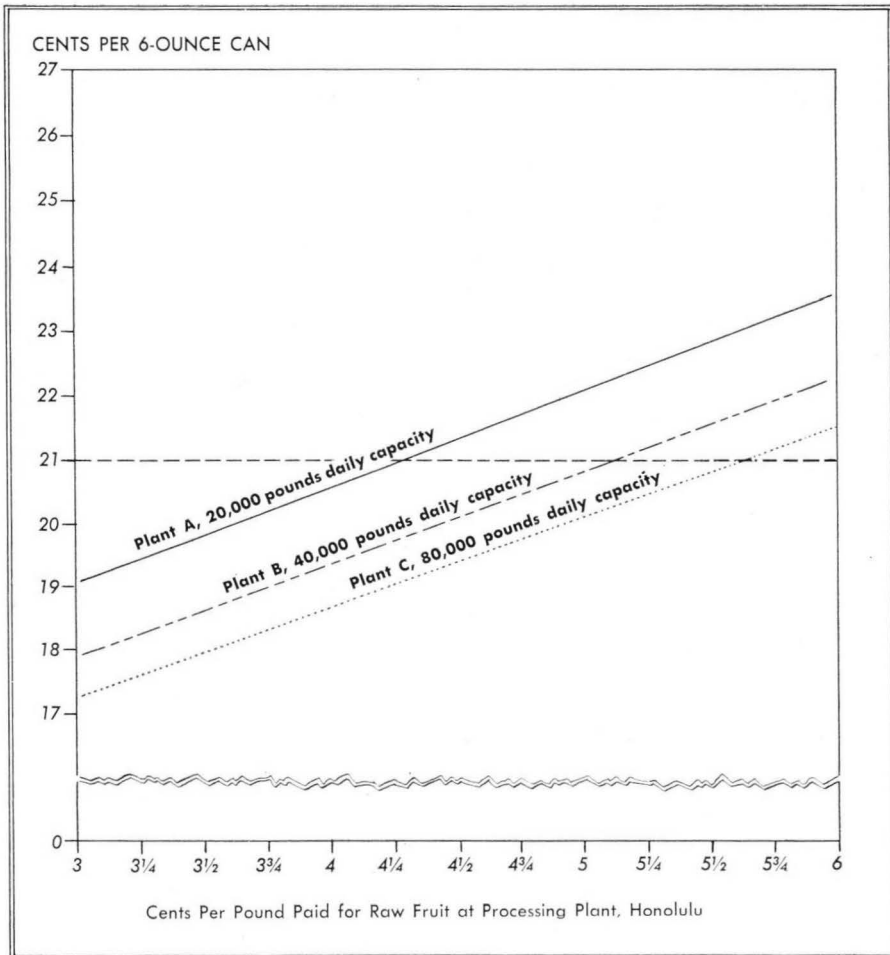


FIGURE 8. Effect of f.o.b. Honolulu cost of raw fruit on minimum retail sales price of frozen passion fruit juice concentrate in West Coast markets, allowing 6 percent return on processor's capital investment; plants A, B, and C.

effect at the retail level because of the higher base on which wholesale and retail markup would be determined. Under actual conditions a  $\frac{1}{2}$  cent increase in cost per 6-ounce can to the retailer would be absorbed by some retailers in the form of a lower markup rather than through a price increase to the consumer. Other retailers would be expected to increase the price by  $\frac{1}{2}$  cent per can where two cans are sold for a given price or a full 1 cent per can for single unit purchases.

## EFFECT OF OTHER COSTS ON RATE OF RETURN AND SELLING PRICE

The effects of increases or decreases in cost of cans, sugar, or variable labor on rate of return and retail price would compare with the effects of a change in cost of raw fruit in proportion to the aggregate costs of these items in relation to the aggregate cost of raw fruit.

As indicated in table 21, where the cost of raw fruit represents 34.8 percent of all costs of plant A, a 10 percent decrease in the cost of that item alone from the basic cost in table 1 would result in an additional rate of return of 3.7 percent or permit two-thirds of a cent decrease in the West Coast retail price per 6-ounce can of frozen passion fruit juice. A 10 percent reduction in the price of 6-ounce cans, representing only one-half as great a total cost as raw fruit, would result in only one-half as much increase in rate of return or reduction in retail price. A 10 percent reduction in the cost of variable labor, representing only 5.4 percent of total costs, would increase the rate of return by only 0.6 percent with no change in selling price or provide for a reduction in the West Coast retail price of only one-tenth of a cent per 6-ounce can with no change in rate of return. Actually, with such a small fraction as this, the retail price might well remain the same in the short run, thus permitting the processor to increase his rate of return rather than reduce the f.o.b. Honolulu price. In instances where the difference is considerably greater, such as in the case of the cost of raw fruit, absorption of the advantages of the decreased variable costs would depend upon elasticity of demand as well as upon the "stickiness" of marketing margins and the cost-price structure of the industry.

As was true with regard to the cost of raw fruit, the strictly variable costs would have a somewhat greater effect on actual change in rate of return as plant capacity is increased and fixed costs become of less importance in relation to variable costs.

The effect of a reduction in labor costs on rate of return or price would, of course, depend on the extent to which the labor cost varies directly with output. Greater economy in use of labor through scale of operation would tend to result in a proportionately smaller effect on either rate of return or reduction in price in large plants than in small plants.

Wholesale and retail markups, although of major importance in determining the retail selling price, are generally beyond the

TABLE 21. Effect of a 10 percent change in the price of raw fruit, tins, sugar, and plant labor, on processor's rate of return and West Coast retail price of frozen passion fruit juice, plants A, B, and C

Cost factor	Plant A, 20,000 pounds daily capacity				Plant B, 40,000 pounds daily capacity				Plant C, 80,000 pounds daily capacity			
	Aggregate base cost <sup>a</sup>	Percent of total costs	Actual increase in rate of return with 10 percent decrease in cost from base model	Decrease in West Coast retail price with 10 percent decrease in cost from base model	Aggregate base cost <sup>a</sup>	Percent of total costs	Actual increase in rate of return with 10 percent decrease in cost from base model	Decrease in West Coast retail price with 10 percent decrease in cost from base model	Aggregate base cost <sup>a</sup>	Percent of total costs	Actual increase in rate of return with 10 percent decrease in cost from base model	Decrease in West Coast retail price with 10 percent decrease in cost from base model
	<i>Dollars</i>	<i>Percent</i>	<i>Absolute change in rate</i>	<i>Fraction of a cent</i>	<i>Dollars</i>	<i>Percent</i>	<i>Absolute change in rate</i>	<i>Fraction of a cent</i>	<i>Dollars</i>	<i>Percent</i>	<i>Absolute change in rate</i>	<i>Fraction of a cent</i>
Raw fruit.....	100,300	34.8	3.7	.67	200,600	37.1	4.4	.62	401,200	38.2	5.3	.62
Six-ounce tins.....	53,076	17.4	1.9	.34	106,152	18.6	2.2	.31	212,304	19.1	2.6	.31
Sugar.....	43,666	15.2	1.6	.29	87,320	16.2	1.9	.27	174,640	16.6	2.3	.27
Labor (not including management and office force).....	15,600	5.4	.6	.10	21,200	3.9	.5	.06	37,200	3.5	.5	.06

<sup>a</sup> Taken from base models in table 1.

control of the processor and are, therefore, not treated in this report except as necessary costs in determining the effects of items over which the processor has more control.

### SUMMARY AND CONCLUSIONS

At the present stage of development of passion fruit processing, the greatest opportunities for further economy appear to be through increasing scale of operation, extension of the processing season, and through reduced f.o.b. plant costs of raw fruit.

In this analysis, effects of changing variable costs were synthesized for three plant models with daily capacities of 20,000 pounds, 40,000 pounds, and 80,000 pounds. Basic data were derived from factor requirements of existing plants.

Based on machinery requirements, labor utilization, and costs as used in the synthesized models, it would require a plant of 20,000 pounds daily capacity in operation 118 days annually to yield a rate of return of 6 percent and permit retailing frozen passion fruit juice at 21 cents per 6-ounce can on the West Coast.

Under the same conditions but with a per unit reduction in machinery and labor costs as a result of economy of scale, the 40,000-pound plant would yield a rate of return of 14.8 percent and the 80,000-pound plant, a return of 21.8 percent.

Allowing a fixed rate of return of 6 percent, the cost structure for the 40,000-pound plant would permit a West Coast retail price of  $19\frac{3}{4}$  cents and for the 80,000-pound plant, a price of 19 cents as compared with 21 cents for the 20,000-pound plant.

Inasmuch as nearly 90 percent of the costs in processing frozen passion fruit juice are variable, the opportunities for increased profits through economy of scale, although significant, are not as great as through per unit reduction of certain variable costs.

There is opportunity for considerable economy in passion fruit processing through extending the *length of the processing season*. Whereas the 20,000-pound plant, under the conditions indicated, yields a return of 6 percent under 118 days of operation, it would yield only 0.9 percent with a minimum of 82 days and 8.6 percent with a maximum season of 136 days. For plant B, the rate of returns under the same conditions would range from 8.0 to 18.3 and for plant C, 13.7 to 25.9. Because of the proportionately greater cost of fixed factors, length of operating season has a greater relative effect on returns for the small plant than for a larger plant with lower per unit overhead costs.

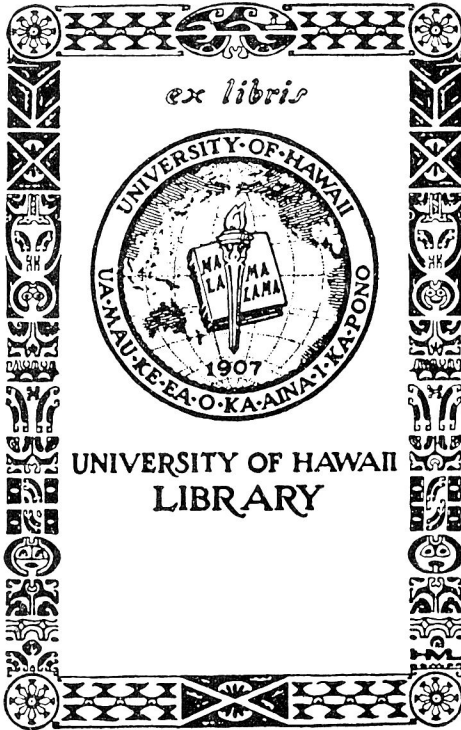
*Cost of raw fruit*, representing over  $\frac{1}{3}$  of all costs, has a marked effect on the profitability of passion fruit processing. With a plant of 20,000 pounds daily capacity, a  $\frac{1}{4}$  cent per pound change in the cost of raw fruit to the processor would amount to a 2.2 per cent change in the rate of return to capital, other conditions being the same. The larger the plant and the lower the per unit overhead cost, the greater the effect of the cost of raw fruit on profit.

High profits would, of course, be expected to encourage greater output through expansion in the output of present firms or through attracting new firms into the business. This would be expected to result in lower prices and force profits toward a rate more nearly equal to that of alternative returns on capital investment.

If the benefits of lower cost of raw fruit were to be reflected in lower prices, the effect would be less percentagewise than on rate of return since the rate of return is a residual and the selling price is based largely on aggregate costs. For the plant of 20,000 pounds capacity, a  $\frac{1}{4}$  cent per pound reduction in the price of fruit would permit a  $\frac{1}{3}$  cent reduction in the West Coast retail price.

The effects of changing costs of other variable factors on rate of return and retail price would compare with the effects of a change in cost of raw fruit in proportion to the per unit cost of these items in relation to the per unit cost of raw fruit.

The analysis on which this publication is based does not indicate conclusively that a plant of somewhat less than 20,000 pounds daily capacity would be unprofitable under conditions given in the study. It does, however, demonstrate that a plant of 20,000 pounds capacity could yield a 6 percent return to capital, allow sufficient funds for market development, and permit selling the frozen juice at 13 cents per 6-ounce can f.o.b. Honolulu or retailing it at a competitive price of 21 cents on the West Coast. The analysis reveals considerable opportunity for increasing profit or reducing product prices through extending the length of the processing season and buying raw materials, especially fruit, at more economic prices. Because of the apparent elasticity of consumer demand for frozen passion fruit juice, economy of processing might well result in lower retail prices, expanded output, and consequently greater retail sales. An above normal profit over a period of time would be expected to attract added investment capital and result in an expansion of operations to the point where the rate of return is in line with that of other investment opportunities.





**UNIVERSITY OF HAWAII  
COLLEGE OF AGRICULTURE  
HAWAII AGRICULTURAL EXPERIMENT STATION  
HONOLULU, HAWAII**

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**LAURENCE H. SNYDER**  
President of the University

**MORTON M. ROSENBERG**  
Dean of the College of Agriculture  
and  
Director of the Hawaii Agricultural  
Experiment Station