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aHD1751  
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no. 78

# PRODUCING FRESH TOMATOES IN CALIFORNIA AND BAJA CALIFORNIA: Costs and Competition

G. A. Zepp  
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U.S. Department of Agriculture  
Economics, Statistics, and Cooperatives Service

ESCS-7 8

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<b>REPORT DOCUMENTATION PAGE</b>	<b>1. REPORT NO.</b> ESCS-78	<b>2.</b>	<b>3. Recipient's Accession No.</b>
<b>4. Title and Subtitle</b> PRODUCING FRESH TOMATOES IN CALIFORNIA AND BAJA CALIFORNIA: COSTS AND COMPETITION			<b>5. Report Date</b> February 1980
<b>7. Author(s)</b> G. A. Zepp and R. L. Simmons			<b>6.</b>
<b>9. Performing Organization Name and Address</b> NATIONAL ECONOMICS DIVISION ECONOMICS, STATISTICS, AND COOPERATIVES SERVICE U.S. DEPARTMENT OF AGRICULTURE WASHINGTON, D.C. 20250			<b>8. Performing Organization Rept. No.</b> ESCS-78
<b>12. Sponsoring Organization Name and Address</b>			<b>10. Project/Task/Work Unit No.</b>
			<b>11. Contract(C) or Grant(G) No.</b> (C) (G)
			<b>13. Type of Report &amp; Period Covered</b>
			<b>14.</b>
<b>15. Supplementary Notes</b>			
<b>16. Abstract (Limit: 200 words)</b> Exports of fresh tomatoes from Baja California, Mexico, increased dramatically from 1975 through 1977, and competed directly with U.S. fresh tomato producers in California. Comparison of production costs in the two areas indicates that the Baja producers operate with higher total costs than California producers, but that Baja-produced tomatoes sell at a higher price in the U.S. market, which offsets the cost disadvantage. High costs and high risk combine to make unlikely much future expansion of fresh tomato exports from Baja California to the United States.			
<b>FILE COPY</b> Economic Analysis F&V, AMS			
<b>17. Document Analysis</b>			
<b>a. Descriptors</b>			
Competition	Profits		
Expenses	Risk		
International trade	Tomatoes		
Production			
<b>b. Identifiers/Open-Ended Terms</b>			
California	Vine-ripened tomatoes		
Cost disadvantage			
Mature green tomatoes			
Mexico			
<b>c. COSATI Field/Group</b> 02-B, 05-C, and 06-H			
<b>18. Availability Statement</b> Available from: NATIONAL TECHNICAL INFORMATION SERVICE 5285 Port Royal Road, Springfield, Virginia 22161		<b>19. Security Class (This Report)</b>	<b>21. No. of Pages</b>
		<b>20. Security Class (This Page)</b>	<b>22. Price</b>

## SUMMARY

Fresh tomatoes cost less to produce on a pound-for-pound basis in California than in Baja California, Mexico. Baja operators incurred production and marketing costs of 21.4 cents per pound in 1978 for export tomatoes versus 18.8 cents per pound for California vine-ripes and 14.6 cents per pound for California mature greens. The U.S. tariff and other marketing costs beyond the packinghouse for Baja tomatoes provided the margin of advantage held by southern California vine-ripe producers. California mature green tomato producers have a small cost advantage over Baja producers, even before adding the tariff and additional marketing charges. Total costs for Baja tomatoes included 2 cents per pound for tariff and 2 cents per pound for transportation to the U.S. border and crossing charges--costs that California producers do not incur.

Baja producers, however, receive a higher average price for their exported tomatoes. The price difference offsets the cost advantage of California producers. The net returns were about the same in both Baja and California, at 7 cents per pound.

Baja exports of fresh tomatoes to the United States doubled between 1975 and 1977, from 17,000 metric tons to 34,000, then declined slightly in 1978. Currently, Baja fresh tomato exports amount to about 10 percent of the California crop, the heaviest volumes arriving during the late summer and fall. Southern California producers ship vine-ripe tomatoes, and northern California growers ship mature green tomatoes during the same period. High production costs, limited availability of good water, disease problems, weather extremes (both hot and cold), and uncertain market prices make future substantial expansion of tomato exports from the Baja area very unlikely.

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## ACKNOWLEDGMENTS

This study was jointly planned and financed by the Agricultural Marketing Service, Foreign Agricultural Service, and Economics, Statistics, and Cooperatives Service. The Economics, Statistics, and Cooperatives Service directed the research.





# Producing Fresh Tomatoes in California and Baja California: Costs and Competition

G. A. Zepp and R. L. Simmons<sup>1</sup>

## INTRODUCTION

California and the Baja California region of Mexico compete directly in fresh tomato production during September, October, November, and December. Baja's increased exports of fresh tomatoes to the United States since 1975 raise questions about whether Baja tomatoes will account for increasingly larger shares of the late summer and fall market now supplied largely by California. This study examines costs of producing and marketing fresh tomatoes in Baja and in California and assesses future production trends of fresh tomatoes in the two areas.

Tomato exports from Baja to the United States declined from 1977 to 1978 after 3 years of increase. A resumption of increasing exports of tomatoes is unlikely because of production problems in Baja (saline irrigation water and unreliable weather) and the cost advantage that California enjoys over Baja in producing and marketing fresh tomatoes for the U.S. market.

California supplies an important share of U.S. fresh tomatoes during late spring, summer, and fall. California producers shipped 7,535,000 hundredweight (cwt) of fresh tomatoes in 1978, or 34 percent of all tomatoes produced in the United States (table 1). Gross receipts from the sale of California tomatoes totaled \$141 million.

Figure 1 shows the major production areas for fresh tomatoes in California. Harvesting begins during mid-April in the Imperial Valley, and moves north as the season progresses, as far as the northern San Joaquin and Sacramento Valleys. Production continues until cold weather sets in, when harvesting again moves to the southern areas of the State. California's season usually closes with the end of the fall crop in San Diego County around the middle of December.

This report deals with the part of the California production competing directly with tomatoes imported from Baja. Most Baja-produced tomatoes arrive in the United States during September, October, and November. California areas shipping during the late summer and fall months include: northern San Joaquin Valley, Merced County, southern Salinas Valley, Ventura County, and San Diego County.

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Table 1--Fresh tomatoes: California and U.S. acreage, yield, production, and value

Season and area <u>1/</u>	Harvested area				Yield per acre			
	1975	1976	1977	1978	1975	1976	1977	1978
	-----Acres-----				-----Cwt-----			
Winter:								
California	--	--	--	--	--	--	--	--
United States <u>2/</u>	10,100	13,100	7,300	12,800	310	215	145	175
Spring:								
California	2,100	3,500	4,200	3,900	202	202	164	218
United States <u>2/</u>	28,400	33,300	36,470	34,620	153	170	154	173
Summer:								
California	16,500	15,500	14,700	15,600	240	250	275	280
United States <u>2/</u>	62,800	60,020	56,910	57,170	136	140	143	149
Fall:								
California	11,800	10,400	10,700	11,300	210	200	230	205
United States <u>2/</u>	22,800	21,200	23,400	24,700	215	226	210	215
Total:								
California	30,400	29,400	29,600	30,800	226	227	243	245
United States <u>2/</u>	124,100	127,620	124,080	129,290	168	170	159	171
	-----Production-----				-----Value-----			
	1975	1976	1977	1978	1975	1976	1977	1978
	-----1,000 cwt-----				-----1,000 dollars-----			
Winter:								
California	--	--	--	--	--	--	--	--
United States <u>2/</u>	3,131	2,817	1,059	2,240	65,751	60,284	27,216	40,320
Spring:								
California	424	706	688	850	15,803	18,470	12,929	28,181
United States <u>2/</u>	4,336	5,668	5,622	5,989	90,533	102,906	103,041	143,894
Summer:								
California	3,960	3,875	4,043	4,368	61,776	70,138	87,329	72,509
United States <u>2/</u>	8,518	8,407	8,126	8,534	142,534	143,902	168,261	154,788
Fall:								
California	2,478	2,080	2,461	2,317	42,374	49,296	55,865	40,548
United States <u>2/</u>	4,912	4,791	4,912	5,299	90,210	109,830	106,645	93,843
Total:								
California	6,862	6,661	7,192	7,535	119,953	137,904	156,123	141,238
United States <u>2/</u>	20,897	21,683	19,719	22,062	389,028	416,922	405,163	432,845

-- = Not reported.

1/ Months included in the seasons are: Winter, January-March; Spring, April-June; Summer, July-September; Fall, October-December. 2/ Excludes Hawaii.

Source: [5].

Tomato production in Baja requires irrigation. Baja has two major irrigated areas: Mexicali, just south of the U.S. border, has about 175,000 hectares irrigated from wells and from the Colorado River; the San Quintin area, on Baja's west coast, has 25,000 to 30,000 hectares irrigated solely from wells (fig. 1). <sup>2/</sup> The San Quintin area supplies most of the fresh tomatoes currently exported to the United States from Baja. Fresh tomatoes also grow in the southern Baja Peninsula; one producer near La Paz trucks tomatoes the 850 miles to Tijuana for export to the United States during the fall.

Climate and soils in Mexicali are similar to those in the Imperial Valley of California, which supplies fresh tomatoes during May and June. However, hot desert conditions in these areas do not favor tomato production in the summer and fall, and cold weather precludes tomato production during the winter.

The San Quintin area of Baja consists of three separate zones: San Quintin Valley, with about 3,000 hectares of staked tomatoes; Camalu Valley with about 600 hectares of tomatoes; and Colonia Guerrero, with about 400 hectares of tomatoes.

The San Quintin Valley covers an area roughly 30 kilometers long and 10 kilometers wide. It lies on the Pacific coast and has essentially flat land, with some noncultivable boggy areas. The soil is a fertile, medium brown, fairly heavy silt loam. Eight to 10 inches of rain fall annually in a seasonal pattern. Colonia Guerrero lies about 10 kilometers north of San Quintin and is much smaller. Its production conditions are similar to those in the San Quintin valley. Camalu lies a few kilometers farther to the north and is smaller than Colonia Guerrero.

Baja exports arrive in the United States primarily through Tijuana. Good roads put the San Quintin area only 6 to 7 hours' driving time from the U.S. border.

#### TOMATO SHIPMENTS

Data on volume of shipments show the relative importance of the two areas as suppliers of fresh tomatoes and show the monthly pattern of production in each area (table 2). Baja shipments of fresh tomatoes, the major portion arriving between September and November, amount to about 10 percent of California shipments.

Baja's tomato exports to the United States doubled between 1975 and 1977, from 17,000 to 34,000 metric tons. Although some fresh tomato shipments enter the United States from Baja during every month of the year, the largest volumes arrive in the late summer and fall months. Baja volume grows gradually after April and May, reaches a peak during September and October, tapers off during December and January, and reaches a low in February and March.

California shipments follow a pattern similar to that of the Baja exports, reaching a peak in late summer, and then declining to a low in March and April. Table 3 indicates the monthly distribution of shipments from the major supply areas in California. The spring season begins in the Imperial Valley and in San Diego County during May and June. By July, tomatoes are being shipped from the San Joaquin Valley and Merced and Monterey Counties. Harvests in the northern San Joaquin Valley, Monterey County, Ventura County, and San Diego County continue through September and October. By November and December, most California tomatoes come from San Diego County. Baja exports to the United States coincide with harvests from the latter four areas of California.

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<sup>2/</sup> One hectare = 2.471 acres.

Figure 1

# Principal Growing Areas for Fresh Tomatoes in California, and Baja California, Mexico

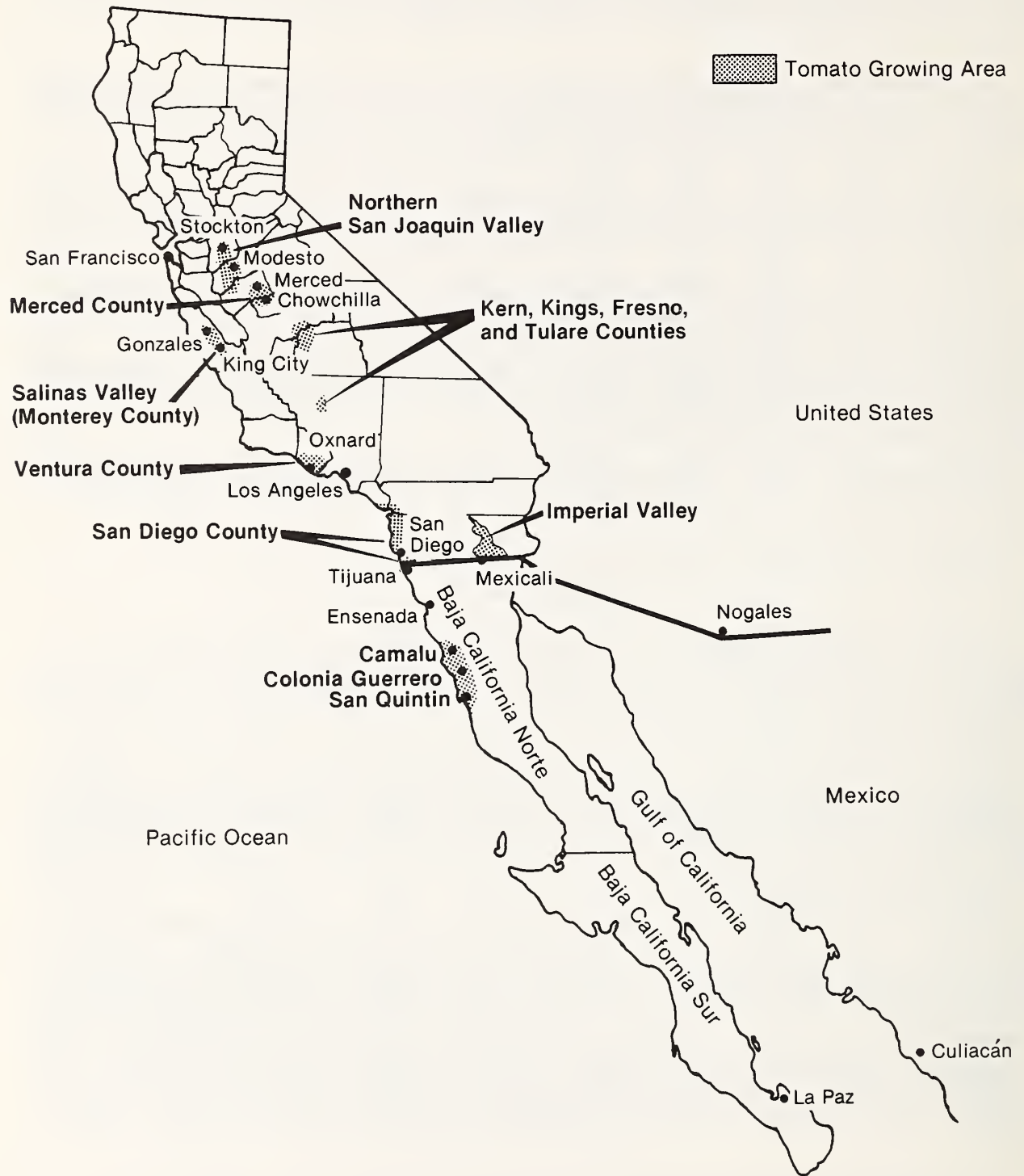


Table 2--Shipments of fresh tomatoes from California and Baja 1/

Month	1975		1976		1977		1978	
	California	Baja	California	Baja	California	Baja	California	Baja
	----- Carlots and carlot equivalents 2/-----						10,000 pounds 3/	
January	53	32	77	45	98	44	73	213
February	2	11	--	27	29	38	--	84
March	1	11	--	51	--	85	--	126
April	--	16	--	41	6	21	--	284
May	33	43	93	15	171	21	1,188	161
June	967	36	1,586	74	1,406	60	7,215	336
July	3,034	41	4,019	26	3,133	142	16,398	834
August	2,401	94	2,318	66	3,046	211	13,922	723
September	3,932	104	3,060	75	3,705	292	13,181	1,581
October	4,089	213	3,440	308	3,965	459	16,341	1,213
November	1,409	188	1,112	377	1,472	342	5,674	968
December	606	136	327	147	554	167	935	252
Total	16,527	925	16,032	1,253	17,585	1,882	74,927	6,699
	<u>10,000-pound units 4/</u>							
Total	68,049	3,700	65,677	5,012	70,926	7,528	74,927	6,699
	<u>Metric tons 5/</u>							
Total	308,668	16,780	297,909	22,730	321,718	34,140	339,867	30,381

-- = None reported.

1/ Baja data include pink and light red tomatoes, cherry tomatoes, and a small amount of tomatillo (Mexican ground cherry).

2/ California data are reported in carlots and carlot equivalents, averaging about 40,000 pounds. Baja data are reported in 40,000 pound carlot equivalents.

3/ The Federal-State Market News Service reported shipments in carlot units prior to January 1, 1978, and in 10,000-pound units subsequent to that date.

4/ Unpublished estimates by the Federal-State Market News Service, Sacramento, Calif.

5/ One metric ton = 2,204.6 pounds.

Source: [6].

Table 3--California shipments of fresh tomatoes, by district, 1977 1/

Month	Northern San Joaquin Valley	Merced County	Central and Southern San Joaquin Valley	Monterey County	Imperial Valley	San Diego County	Ventura- Oxnard district	Los Angeles- Orange County	Total California
January	--	--	--	--	--	98	--	--	98
February	--	--	--	--	--	29	--	--	29
March	--	--	--	--	--	--	--	--	--
April	--	--	--	--	6	--	--	--	6
May	--	--	--	--	116	17	--	--	133
June	--	20	171	--	673	133	--	2	999
July	339	633	1,265	167	182	877	2	72	3,537
August	327	144	185	786	--	813	315	71	2,641
September	502	--	36	1,435	--	684	488	32	3,177
October	1,688	--	14	1,056	--	1,403	597	2	4,760
November	298	--	1	--	--	989	181	--	1,469
December	1	--	--	--	--	660	62	--	723
Total	3,155	797	1,672	3,444	977	5,703	1,645	179	17,572

-- = Not reported.

1/ Data for 1978 are not available because 1977 was the last year in which data for San Diego County, the Ventura-Oxnard district, and Los Angeles-Orange County were reported separately in [2].

Source: [2].

Two types of California tomatoes are harvested--vine ripens and mature greens--and each type is grown with different cultural methods. Vine-ripe tomatoes remain on the vine until they start turning color before being harvested. Mature green tomatoes are mature fruit when packed and shipped, but have not yet started to show color change. Vine-ripe producers generally practice more intensive cultivation than do growers of mature green tomatoes, using more hand labor and incurring higher production expenses per acre. Yields and gross receipts per acre also run higher for vine-ripe than for mature green tomatoes. The following section considers the two types of tomato cultures separately.

### Vine-Ripe Tomatoes

San Diego and Ventura Counties grow principally pole tomatoes marketed as vine-ripened fruit. Pole tomato production derives its name from the stakes used to support the plants upright. The vines may be picked numerous times as the fruit ripens, and harvesting may extend over several months.

San Diego County has three separate harvest periods, or crops [3]. <sup>3/</sup> A spring crop accounts for about 30 percent of the county's tomato acreage, a small summer crop provides about 5 percent, and a large fall crop makes up about 65 percent. Actually, harvesting from the three crops overlaps, and shipments from the county continue uninterrupted from June through December. Harvesting in Ventura County begins by the first of August and continues into November. Ventura County shipments usually decline to a very low level in December.

San Diego County's major tomato production areas lie south of the city of San Diego, some within sight of the Mexican border. Several small areas sit north of the city along the Pacific coast, in small arable areas near Del Mar, Carlsbad, San Luis Rey River, and Camp Pendleton. Ventura County production lies in the Oxnard Plain, near the town of Oxnard.

Soils and climate in San Diego County accommodate a large number of fruit and vegetable crops, but tomatoes are the most important, both in terms of total acreage and total value. Tomatoes account for nearly half of the vegetable acreage in San Diego County. Numerous high-value crops compete with tomatoes for land in Ventura County. As a consequence, land rents in this area run \$30 to \$50 per acre per month, depending on the land's location and any accompanying improvements.

San Diego County producers grew 6,330 acres of fresh tomatoes during 1978 (table 4). Plots of individual growers ranged from less than 25 acres to over 100 acres. Ventura County reported 2,544 acres producing fresh tomatoes in 1978. Approximately 15 growers produce most of the fresh market tomatoes in the county. Production per acre runs 28 to 30 tons in San Diego County and about 18 tons in Ventura County. San Diego County's fresh tomato crop returns about \$60 million gross value, while Ventura County's crop returns about \$20 million.

San Diego County growers plant their fall crop of tomatoes during June and July; the spring crop is planted during February. Tomatoes harvested during the summer and fall are planted in the spring and summer. Most planting is done by hand, with farmworkers setting out bare-root seedlings. The San Diego area grows principally a variety of tomato called VF 6718, which is resistant to alternaria stem canker, a serious disease problem in southern California.

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<sup>3/</sup> Underscored numbers in brackets refer to sources listed at the end of this report.



Table 4--Acreage, production and value of fresh tomatoes, selected California counties

Item	Vine ripe		Mature green			
	San Diego County	Ventura County	Merced County	Monterey County	San Joaquin County	Stanislaus County
	<u>Acres</u>					
Area harvested:						
1975	5,555	2,761	3,260	4,910	4,163	2,800
1976	5,255	2,925	2,159	4,000	2,530	3,190
1977	5,430	2,479	2,896	4,165	3,240	2,280
1978	6,330	2,544	3,300	4,395	4,900	1,800
	<u>Tons</u>					
Production:						
1975	165,615	48,428	17,454	84,135	43,090	29,400
1976	172,110	50,076	16,803	40,355	22,087	23,900
1977	131,335	47,101	25,435	57,235	36,000	23,900
1978	141,817	40,450	24,612	56,500	47,900	20,300
	<u>1,000 dollars</u>					
Value:						
1975	56,374	17,434	4,073	18,573	11,952	8,085
1976	55,886	20,832	4,481	10,161	6,891	8,544
1977	63,332	20,018	8,767	15,336	11,952	8,604
1978	55,547	14,481	6,760	12,150	12,693	5,075

Sources: [3, 4, 8, 9, 10, 11].

In Ventura County, planting begins in April and is done either by direct seeding or by setting transplants. Growers planted several varieties during the 1978 season, but had problems with alternaria stem canker. The industry will probably move toward the VF 6718 variety in the future, since it is resistant to that disease.

Plants are spaced 16 to 18 inches apart in rows spaced 5 feet center-to-center, with about 5,000 to 6,000 plants per acre. Stakes and twine support the tomato vines. Sisal binder twine, strung along both sides of the plant and wrapped around 5-foot high redwood stakes, located between every second plant, hold the stakes in place. The tomatoes are tied in the above manner five to seven times during the season as they grow taller.

Tomato growers in San Diego County fertilize with a combination of animal and chemical fertilizers. A typical fertilization program consists of applying 1 ton of composted chicken manure per acre in a furrow several inches to the side of the row just before planting (some growers substitute 15 to 20 cubic yards of raw chicken manure disked into the soil during preplant soil preparation), and supplemented during the growing season with 300 pounds each of nitrogen, phosphorus, and potassium, in liquid form, mixed in with the irrigation water.

In Ventura County, fertilization consists mainly of supplying nitrogen, since the soil generally contains substantial amount of phosphorus and potassium. A typical fertilization program includes 100 pounds of nitrogen mixed into the soil before planting, and 20 to 30 pounds of phosphorus applied at planting. Sidedressing, or applying the fertilizer through the irrigation water, provides an additional 100 to 200 pounds of nitrogen as the plants grow. A total of 200 pounds of nitrogen is applied on heavier soils, and up to 300 pounds on lighter soils.

Because of the high cost of water, up to \$200 per acre-foot, San Diego County growers try to minimize water needs by irrigating tomatoes with drip irrigation.<sup>4/</sup> With drip irrigation, water seeps through porous tubing placed near or in the plant root zone. Drip irrigation requires less water than other irrigation methods because only the soil in the root zone receives water and water is not lost through seepage from irrigation canals and ditches. Drip irrigation has also increased the yield per acre. Tomatoes in this area require about 2 acre-feet of water for a total cost of up to \$400 per acre. Most irrigation water in San Diego County comes from the Colorado River.

Irrigation water in Ventura County comes from wells located in or near the tomato field, and water costs per acre-foot are less than in San Diego County. Ventura County growers use the furrow method to irrigate, in which water flows through irrigation ditches between the rows of tomato plants.

Tomato fruit worms and russet mites present the greatest insect problems in growing vine-ripe tomatoes in California. Nematodes, too, may be a problem, requiring soil fumigation during soil preparation. Fusarium wilt, verticillium wilt, and alternaria stem canker are tomato disease problems, controlled through use of disease-resistant varieties. A fungicide spray program controls other tomato disease problems.

Growers contract out most of the pest control application to commercial pest control firms, which recommend when to spray and what material to apply. San Diego County growers typically apply 8 to 10 spray applications per season for insect and disease control. In addition, growers incorporate herbicide into the soil for weed control, and, in some cases, apply a soil fumigant during soil preparation for control of soil-borne diseases and insects. Ventura County tomatoes generally require about four to five insecticide/fungicide sprays per season and a soil fumigant during preplant soil preparation.

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<sup>4/</sup> An acre-foot is the volume of water that would cover an acre of ground 1 foot deep (325,851 gallons).

Harvesting of the San Diego fall crop begins in September and continues into December, when cold weather shuts down the operations. In Ventura County, picking begins in August and continues through November. Vine-ripe tomatoes are picked after they start changing color. They are placed into 30-pound field boxes or bulk containers for transport to the packing shed. Picking takes place two to three times a week during the periods of heaviest production.

Fruit is washed, waxed, graded, and sized at the packinghouse. The larger tomatoes, 5 x 6 size and larger, are handpacked into two-layer flats holding about 20 pounds, and smaller sized fruit are packed into three-layer lugs holding about 30 pounds; buyers occasionally request 6 x 6 size tomatoes in the two-layer flats. <sup>5/</sup> Growers typically achieve a packout of 75 percent two-layer and 25 percent three-layer packages. Some growers, however, report as high as 80 percent of their packout being 20-pound cartons, while others report as low as 60 percent 20-pound cartons. Total packout tends to be reported in cartons per acre, treating a 20-pound pack and a 30-pound pack similarly.

Yields range from 15 to 30 tons per acre, depending on the season and location. In San Diego County, a typical yield would be 30 tons, or about 2,600 packages. <sup>6/</sup> In Ventura County, yields tend to be smaller, at 1,800 to 2,200 packages per acre. Ventura County yields were low in 1978 due to unfavorable weather conditions.

### Mature Green Tomatoes

Fresh tomatoes harvested as mature greens are harvested before starting to change color. Mature green production in California is almost wholly from ground-grown, or bush-type tomatoes. Monterey County and the northern San Joaquin Valley account for most of the mature green production marketed during the fall. Merced County growers produce mature green tomatoes, but shipping from this area generally ceases by September 1. However, some Merced growers indicate that they plan to extend their harvesting into September and October in the future.

#### Area, Yields, Production, and Value

Monterey County production lies between the towns of Gonzales and King City, in the southern Salinas Valley. Forty to fifty growers raise about 4,000 acres of fresh tomatoes valued at about \$15 million annually (table 4); individual plots range from less than 30 acres up to several hundred. Four packinghouses handle all the Monterey County production.

Fresh production in the northern San Joaquin Valley is located around Stockton and Modesto in San Joaquin and Stanislaus Counties. The area devoted to tomatoes average about 6,000 acres although total acreage varies from year to year. Some growers in this area produce both fresh and processing tomatoes. An estimated 50 growers account for most of the fresh market production. A few growers have 40 acres or less, but individual acreages range up to 500 to 600 acres of tomatoes for fresh market.

Merced County production lies mainly between the towns of Merced and Chowchilla. Thirty to forty growers operate in this area producing a fresh tomato crop with a value of between \$4 million and \$8 million on about 3,000 acres. Individual plots range from 40 acres up to 500 to 600.

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<sup>5/</sup> The 6x6 and 5x6 size designations are widely used in the industry and correspond closely, although not exactly, to the large (2-17/32 to 2-28/32" diameter) and extra large (2-28/32 to 3-15/32" diameter) sizes, respectively, as defined in [7].

<sup>6/</sup> To convert yield in tons to yield in packages, a package size that averaged 22.5 pounds was used (75 percent 20-pound packages and 25 percent 30-pound packages).

Yields vary widely from year to year and among growers within a given year. Growers report packouts per acre from 400 to 1,200 30-pound cartons. Packouts in the Monterey County area tend to be higher than in the San Joaquin Valley area. The yield selected for the cost analysis in this study was 800 30-pound cartons packed out (12 tons per acre).

### Production Practices

Production practices are similar for all three areas producing mature greens. Planting is done by both direct seeding and transplanting. Some growers transplant seedlings in order to reduce seed costs when planting some of the more expensive hybrid varieties. Growers sometimes transplant early in the season so their crop will mature earlier.

The fertilization program usually consists of incorporating 200 to 400 pounds of preplant fertilizer, such as 8-24-0 or 9-30-0. <sup>7/</sup> Some growers use a complete fertilizer, such as 6-20-20 or 5-17-17, for their preplant application. An additional 100 to 150 pounds of actual nitrogen is sidedressed (applied to the irrigation water) during plant growth.

Growers use both chemical and mechanical means to control weeds. A preemergence herbicide usually is incorporated during preplant soil preparation. In some cases, a postemergence herbicide is also applied. Hand hoeing and mechanical cultivation supplement the chemical weed control.

Spraying is required to control the tomato fruit worm, the principal insect problem. Fungicides for disease control usually are applied jointly with the insecticides. Growers contract with commercial firms for most pesticide application.

Most producers irrigate by furrow irrigation, although some sprinkler-type systems are used too. Tomatoes require between 2-1/2 and 3-1/2 acre-feet of irrigation water in these areas. A crop will be irrigated about 10 times during the course of the season, requiring about 25 hours of irrigation labor. Irrigation water costs about \$12 per acre-foot.

Harvesting commences by August 1 in Monterey County and continues through October. Harvesting begins in July in the northern San Joaquin area, with the largest volume harvested and marketed during late September, October, and November. In the past, most harvesting in the Merced area has been completed by September 1, but some growers there may extend the season by scheduling plantings to have fruit mature over a longer period of time and later in the season.

Harvesting consists of handpicking the tomatoes into plastic buckets. The tomatoes are then dumped into bulk crates or gondolas for transport to the packing shed. A few growers are experimenting with mechanical harvesting of fresh tomatoes, and anticipate switching to machine harvesting over the next several years. Mechanical harvesting destroys the vines, and is, therefore, a once-over operation.

The plants are usually picked twice during the season. Growers may harvest only once if the market price is low, while some growers may try to obtain a third picking if the market price is high. In a few cases, growers may salvage some fresh market tomatoes by selling the unharvested crop to a tomato processor. Such salvage operations are not always possible, as processors may have all the processing tomatoes they can handle, and may not want to bother with the fresh market varieties.

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<sup>7/</sup> The numbers represent the percentages of nitrogen, phosphorus, and potassium, respectively, in the fertilizer mixture.

A packer grades, sizes, waxes, packs, and sells the tomatoes. Packers may also be growers, but they often represent independent businesses. Typically, 60 to 80 percent of the fruit delivered to the packing shed is packed and sold--the remainder being culled and discarded. The 30-pound carton serves as the standard package for shipping mature green fruit. The packinghouse takes care of selling the fruit and usually charges the grower a percentage of the sale price for the service. Some buyers request that their mature green tomatoes be placed in ripening rooms, to initiate coloring, prior to shipment. The buyer pays the cost for this service.

### Costs of Production

The costs used below represent those for the 1978 fall crop and were estimated by using a budgeting approach. Yields used in the budget estimates were selected as typical for above average growers. Actual yields for any given crop year may be higher or lower than those used in the budgets, because of unusual weather or market conditions.

#### Vine-Ripe Tomatoes

Vine-ripe tomato costs in table 5 are estimated as the weighted average of costs for San Diego and Ventura Counties, weighted by each area's percentage of the total volume of fresh tomatoes shipped from the two areas during 1975-77 (76 percent for San Diego County, and 24 percent for Ventura County).

The total cost for vine-ripe tomatoes was \$4.22 per package. The vine-ripe package cost is for a composite of 75 percent two-layer flats and 25 percent three-layer lugs. Labor, the most expensive single cost item, accounted for more than one-third of the growing cost, most of the picking cost, and nearly one-fourth of the packing cost. Staking and tying, as well as multiple picking of vine-ripe fruit, both highly labor-consuming activities, incur large expenditures. Pest control expenditures and irrigation water costs are other major preharvest expense items in vine-ripe production.

#### Mature Green Tomatoes

Mature green tomato costs (table 6) are based on a budget developed for central California (Monterey, Merced, Stanislaus, and San Joaquin Counties), for fresh tomatoes shipped during late summer and fall. These areas use similar production practices and have similar costs.

Harvesting, packing, and selling mature green tomatoes cost \$4.38 per 30-pound carton. Labor was the largest single expense item. Land rental, another big cost item, was more for mature green tomatoes than for vine-ripes because the land rent in the mature green growing areas includes some of the costs for irrigation facilities and water.

Total growing costs for mature green tomatoes are about one-third those for growing vine-ripe tomatoes, but mature green yields, too, are only about one-third the vine-ripe yields. Hence, growing costs per carton packed out are nearly equal for the two types of fruit. The harvesting operation and the packing and marketing operations cost about the same per carton for the two types of production.

### BAJA PRODUCTION OF FRESH TOMATOES

The three principal Baja production areas (San Quintin Valley, Camalu Valley, and Colonia Guerrero) have about 600 farmers with average land holdings of 50 to 60 hectares of irrigated land. Most farms have 20 to 25 hectares, while a few large farms go up to

Table 5--Costs for producing and marketing vine-ripe pole tomatoes in California,  
1978 fall crop 1/

Cost item	Cost
	<u>Dollars/acre</u>
Preharvest:	
Land rent	184.56
Machine services	59.37
Labor	947.27
Fertilizer	131.80
Pest control	391.20
Other purchased inputs	
Water	311.20
Plants	120.00
Stakes, strings, and gloves	215.00
Other	136.80
Administrative cost	149.83
Interest on operating capital (9 percent for 5 months)	98.30
Total preharvest	2,745.33
Yield per acre:	
2,456 packages (75 percent two-layer flats, 25 percent three-layer lugs)	
	<u>Dollars/package <sup>2/</sup></u>
Total preharvest	1.12
Harvest:	
Picking	.85
Hauling	.10
Total harvest	.95
Packing and marketing:	
Labor	.48
Machinery	.39
Pallets	.22
Boxes	.58
Other purchased supplies	.08
Administrative cost	.10
Selling cost	.30
Total packing and marketing	2.15
Total costs	4.22

1/ Weighted average of costs for San Diego County (76 percent) and Ventura County (24 percent). Budgets showing details for individual cost items are presented in the appendix.

2/ Composite of two-layer flat and three-layer lugs with average weight of about 22.5 pounds.

Table 6--Costs for producing and marketing mature green tomatoes in California,  
1978 fall crop 1/

Cost item	Cost
	<u>Dollars/acre</u>
Preharvest:	
Land rent	250.00
Machine services	66.90
Labor	307.32
Fertilizer	69.00
Pest control	95.00
Other purchased inputs	
Water	35.00
Seed	20.00
Administrative cost	50.59
Interest on operating capital (9 percent for 5 months)	32.37
Total preharvest	926.18
Yield per acre: 800 30-pound cartons	<u>Dollars/30-lb carton</u>
Total preharvest	1.16
Harvest:	
Picking	.86
Hauling	.10
Total harvest	.96
Packing and marketing:	
Labor	.49
Machinery	.42
Pallets	.23
Boxes	.63
Other purchased supplies	.08
Administrative cost	.11
Selling cost	.30
Total packing and marketing	2.26
Total costs	4.38

1/ A budget showing details for individual cost items is presented in the appendix.

1,000 hectares. Major crops besides tomatoes are potatoes, peppers for domestic markets, small grains, and, to a small extent, brussels sprouts.

The total population of the State is just over 1 million people, which is insufficient to provide the necessary seasonal labor required for tomato production. Tomato pickers from Oaxaca (in southern Mexico) and packing plant personnel from Culiacan (across the Gulf of California from La Paz) are brought to Baja during the season to supplement locally available labor. While the transportation of workers to Baja raises costs, availability of labor is not an impediment to increased vegetable production since additional workers are readily available from other areas.

### Vine-Ripe Tomatoes

Vine-ripe tomatoes are grown on 3,000 to 4,000 hectares in the three principal valleys. Total production, indicated by shipment to the United States (table 2), increased substantially from 1975 to 1977, but decreased in 1978. Cold weather and disease problems in 1978 reduced yields that season. The volume of export shipments generally peaks during October or November. The 1978 season, however, was an exception, as volume peaked during September.

Usually tomato yields are slightly lower in Baja than in Mexico's winter production area around Culiacan. A good yield in Baja would be 20 to 25 tons of export tomatoes per hectare, while in Culiacan 30 tons would be more typical of a good yield [12].

Fifty to seventy producers grow tomatoes in the three areas, and about 40 packing plants handle the packing. Most producers have relatively small operations--20 hectares being typical. A few growers have quite large operations, with plantings of up to several hundred hectares. The producers include "pequenos propietarios" (private independent producers) and "ejidatarios" (landless farmers who lease land and receive preferential tax and credit treatment from the Government). The ejidatarios, with small operations, normally combine into cooperatives for the packing activities and some of the production activities. The larger producers frequently own their own packing facilities.

### Production Practices

Soil preparation customarily begins with subsoiling (some growers subsoil twice) followed by disking (two or three times), harrowing, and leveling. Growers plant tomatoes in the latter part of June for picking during the period October 15 to December 31. Larger growers generally plant seed directly. Hills of about five seeds are spaced at 15-inch intervals. After the seedlings emerge, workers remove all but one plant per hill, leaving about 15,000 plants per hectare. Some smaller growers purchase seedling plants in California at 3.5 cents per plant, giving a total seedling cost of about \$200 per acre. Direct seeding is more economical, if technology and management practices permit. One pound of good hybrid seed, costing \$300 to \$400, can plant about 6 acres, giving a seed cost of \$50 to \$70 per acre.

The predominant plant variety is Ace-55, which grows to a height of 30 to 36 inches and produces a high proportion of large, uniform fruit. The plants grow somewhat smaller than the varieties in Culiacan. Ace-55 requires pruning and judicious removal of dead leaves during harvest.

Dug wells provide the irrigation water for Baja tomatoes. Irrigation wells average 100 to 200 feet deep, and are usually cased with a 12-inch diameter bore. Such wells furnish between 3 and 16 liters per second of quite salty water. Because of the recent proliferation of wells, the water table has dropped, and the quality of the water has deteriorated in San Quintin and Camalu due to salt infiltration. The Secretariat of Water Resources and Irrigation now controls additional drilling through a permit system.



The critical water situation is stimulating a change from gravity flow to drip irrigation, which conserves water and triples the area that can be irrigated from a well. With drip irrigation, flexible plastic hoses convey the water from the well to the field. Smaller hoses, with tiny holes at 15-inch intervals, carry the water to the plants' roots. Some producers pipe water from wells several miles away to enable them to develop new lands and rotate their crops.

Cultivation consists of about 10 passes with a small tractor and cultivator, plus some hand weeding. The high salt content of the water makes frequent mixing of the soil necessary to avoid damaging salt accumulations near the surface. Fieldworkers arrange the irrigation tubes, cut weeds, remove dead leaves and branches, and arrange the plants on the twine supports several times during the growing season. The tomatoes need 10 to 12 irrigations during the season.

Large stakes (5 to 6 feet long) placed every 2 to 3 meters, and several smaller stakes (3 to 4 feet long) between the larger ones, support the plants. Four or five twines at various levels hold the plants upright. Stakes are imported from Sinaloa at a cost of 22 cents per large stake and 6.6 cents per small stake (as wood is very scarce in Baja).

Tomatoes are fertilized with 200 to 300 pounds of nitrogen and 200 to 300 pounds of phosphorous, mostly in the forms of urea and triple-super phosphate. Potassium phosphate also may be applied.

Nematodes and diseases, principally mosaic, viruses (such as fusarium) and Tizon (*alternaria solani*), present management problems. Growers can control Tizon by applying fungicides, but the only effective control of viruses is to use plants genetically resistant to the viruses.

Crop rotations are neither widely nor systematically practiced because of land and water shortages. Tomatoes may be planted 2 or 3 years successively on the same soil. This practice contributes to both salt and disease buildups in the soil.

Workers handpick tomatoes every other day during the peak of the season and less frequently at other times. They pick the fruit into plastic bags or buckets, and then dump them into boxes. Trucks carry the boxes from the field to the loading docks at the packing shed, where packinghouse workers unload the tomatoes.

Most of the packing plants are small, rudimentary, and have few mechanical aids. A few larger plants, 10 to 15, have mechanical sizers, overhead carton conveyors, and generally modern equipment. Most are single-product plants, since tomatoes are the only export crop in the area.

Packinghouse workers handpick the export quality tomatoes into two-layer flats, weighing about 20 pounds each, or into three-layer lugs weighing about 30 pounds--the two-layer flat being the more common package. About two-thirds of the tomatoes go to the export market. The remainder are shipped to the domestic market in bulk packages. No precooling of export tomatoes is necessary, since daytime temperatures average 60°F or less at that time of year, and the trip to Tijuana takes only 7 to 8 hours.

### Export Operations

After grading and packing, tomatoes for export must be hauled to Tijuana and processed across the border to the United States. During the 1978/79 season, transportation from San Quintin to Tijuana cost 31 cents per two-layer flat for 1,500 to 1,600 flats per truckload, or about \$460 per load.

The trucks arrive at the Mexican side of the border in Tijuana where Mexican customs brokers prepare papers and documents needed for exporting. This costs \$30 to \$50 per truck on the Mexican side.

The trucks proceed to the border where inspectors from the California Division of Plant Quarantine examine the fruit for insects and diseases on a 2-percent sample basis. Then Federal-State quality inspectors check a randomly selected sample for compliance with size and quality requirements. Inspection costs 4 cents per box, about \$60 per truckload.

On the U.S. side of the border, a customs broker clears the trucks through customs by filling out the necessary forms, computing the tariffs and charges, and getting the necessary stamps, approvals, and signatures. These services cost \$25 to \$28 per truck. After final approval, the truck moves on to the distributor's warehouse in Chula Vista, about 10 miles north of the border, where the truck is unloaded to return to Baja.

### Costs of Production

Preharvest production costs totaled \$1,632.43 per acre or \$1.44 per two-layer flat in Baja (table 7). Baja tomato growers export about 65 percent of the packed-out yield and send 35 percent to Mexican domestic markets. However, no data are available on the value of Baja tomatoes sold domestically. For the purpose of allocating joint costs, 15 percent of the preharvest production and harvesting costs were allocated to tomatoes sold in the Mexican domestic markets. <sup>8/</sup> After allocating 15 percent of the preharvest cost to domestic sales, costs for growing export tomatoes came to \$1.22 per 20 pounds.

Harvesting costs 36 cents per 20-pound package. Total packing and marketing costs amounted to \$2.70, of which 81 cents represented costs beyond the packinghouse for transport to the U.S. border, crossing fees, and tariff. Total for all costs f.o.b. (free on board) Chula Vista was \$4.28 per 20-pound package.

The cost of producing and marketing tomatoes in Baja is higher than the costs for Culiacan, the major Mexican export production region during the winter and spring. Higher input prices in Baja than in Culiacan are one source of these higher costs. The minimum wage during October 1978 in Baja, for example, was \$5.12 per day, compared with \$4.82 in Culiacan. Stakes too cost more in Baja (22 cents each) compared with 13 cents in Culiacan.

### COMPETITIVE POSITIONS OF CALIFORNIA AND BAJA

Numerous factors contribute to determining the competitive position of Baja and California in tomato production. Returns which the land, water, labor, and other resources used in tomato production can earn in other uses, the risks associated with growing the tomatoes, quality differences in the tomatoes from each area, and other considerations, too, are important. However, costs of production, prices received, and net returns from tomato production are the most important considerations and are examined further below.

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<sup>8/</sup> Tomato prices on the Mexican domestic market are considerably lower than those on the U.S. market, because the tomatoes sold in the home market usually are smaller, low-value fruit. Analysis of prices received on the domestic market for tomatoes from the Culiacan area indicated that Mexican domestic sales accounted for about 15 percent of total sales value [12]. The same proportion appeared to be representative for the values of domestic sales for tomatoes in Baja.

Table 7--Costs of producing and marketing staked tomatoes in Baja California, 1978/79 <sup>1/</sup>

Cost item	Cost	Cost charged to export tomatoes <sup>2/</sup>
	<u>Dollars/acre</u>	
Preharvest:		
Land rent	177.26	150.67
Machine services	263.20	223.72
Labor	368.10	312.89
Fertilizer	150.61	128.02
Pest control	177.19	150.61
Other purchased inputs	351.40	298.69
Administrative cost	66.94	56.90
Interest on operating capital (12 percent for 5 months)	77.73	66.07
Total preharvest	1,632.43	1,387.57
Export yield per acre: 1,134 two-layer flats	<u>Dollars/20-lb carton</u>	
Total preharvest	1.44	1.22
Harvest:		
Picking	.38	
Hauling	.04	
Total	.42	.36
Packing and marketing:		
Labor	N.A.	.17
Machinery	N.A.	.24
Cartons	N.A.	.61
Other packing supplies	N.A.	.14
Administrative cost	N.A.	.13
Selling cost:		
Transport to Tijuana	N.A.	.31
Crossing charges	N.A.	.08
Tariff	N.A.	.42
Sales commission	N.A.	.60
Total packing and marketing	N.A.	2.70
Total costs	N.A.	4.28

N.A. = Not applicable.

<sup>1/</sup> The budget showing details for individual cost items is presented in the appendix.

<sup>2/</sup> The total of joint costs for preharvest and harvesting were prorated among export tomatoes (85 percent) and tomatoes marketed in Mexico (15 percent).

## Cost Comparisons

Fresh tomato production costs less in California, on a pound-for-pound basis, than in Baja (table 8). Cost comparisons on a per package basis indicate that California vine-ripe tomatoes have a very small cost advantage over Baja tomatoes, but that Baja producers have a small per package cost advantage over the California mature green producers. However, differences in package sizes and in the type of tomatoes produced among areas make direct cost comparisons difficult. The Baja cost of \$4.28 is for a two-layer flat averaging 20 pounds, whereas the California vine-ripe costs are for a composite of two-layer flats and three-layer lugs (the two combined averaging 22.5 pounds), and its mature green costs are those for a 30-pound carton.

The most appropriate direct comparison would be between the Baja two-layer flat and the California vine-ripe composite pack. Total costs for the two are almost the same--\$4.28 for the Baja two-layer flat versus \$4.22 for the California vine-ripe composite pack. Growing and marketing cost less in California than in Baja, while harvesting costs less in Baja than in California.

The tariff on Baja-produced tomatoes provides the margin of advantage for the California producers of vine-ripe tomatoes. Costs for Baja tomatoes include a 42-cent tariff per two-layer flat, an amount which makes costs almost equal in the two areas.

Since the California packout includes some three-layer lugs of vine-ripe tomatoes, the average value of the composite pack may be greater than the average value of Baja two-layer flats. To obtain greater comparability among areas, costs were converted to a per-pound equivalent. This conversion results in a California vine-ripe tomato cost of 18.8 cents per pound, versus 21.4 cents for Baja vine-ripes. Baja still maintained a harvesting cost advantage, but it was not enough to offset the advantage attributable to California's lower preharvest and marketing costs.

Baja's two-layer flats of vine-ripe tomatoes showed a 10-cent per package cost advantage over California's 30-pound carton of mature greens. On a pound-for-pound basis, the outcome of this comparison changes to a cost advantage for California mature green tomatoes. California mature green tomatoes cost 14.6 cents per pound to grow, harvest, and market, versus 21.4 cents for Baja vine-ripes. Although California mature greens cost substantially less on a pound-for-pound basis than Baja's vine-ripe tomato costs,

Table 8--Estimated costs for growing, harvesting, and marketing fresh tomatoes in California and Baja California, Mexico, 1978 fall crop

Cost item	Baja California, Mexico		California			
	Vine ripe	Vine ripe	Vine ripe		Mature green	
:	Dollars per two-layer flat	Cents per pound	Dollars per composite pack <sup>1/</sup>	Cents per pound	Dollars per 30-lb. carton	Cents per pound
Preharvest	1.22	6.1	1.12	5.0	1.16	3.9
Harvesting	.36	1.8	.95	4.2	.96	3.2
Marketing	2.70	13.5	2.15	9.6	2.26	7.5
Total	4.28	21.4	4.22	18.8	4.38	14.6

<sup>1/</sup> Composite pack consists of weighing 75 percent 20-pound carton and 25 percent 30-pound carton for average of about 22.5 pounds.

the difference probably overstates California's cost advantage. A pound of mature greens, on average, would have a lower selling price than a pound of Baja vine-ripes. The California mature green cost, which would produce an amount of tomatoes equivalent, in value, to a pound of Baja vine-ripe tomatoes, lies within the 21.9 to 14.6 cent range--probably about 17 to 19 cents per pound.

#### Net Returns Advantage

Price data for the fall months of 1977 and 1978 indicate differences in the average prices received for tomatoes from Baja and California (table 9). <sup>9/</sup> In fact, a price advantage for Baja tomatoes completely offset the cost advantage held by California growers, making net returns per pound about the same in all areas. Baja's tomato price averaged about 2.9 cents per pound higher than the California vine-ripe price. The Baja price premium was even higher when compared with the California mature green tomato average price. Net returns per pound were about 7 cents per pound for all other areas.

Baja enjoyed the price premium for vine-ripe tomatoes during the 1977 and 1978 seasons because it shipped a higher percentage of its tomatoes during high-price periods, while California shipped a smaller proportion of its vine-ripe tomatoes during these periods. When the Baja and California vine-ripe prices were compared on a week-by-week basis, not weighting by volume of shipments, the two areas received about equal prices. The simple average prices were 28.8 cents per pound for Baja and 28.2 cents per pound for California.

#### POTENTIAL FOR EXPANSION IN BAJA

Continued substantial expansion of tomato exports from Baja does not seem very likely. Baja does not have a cost advantage over California, and operates under considerable uncertainty with respect to weather, disease buildup, and saltwater intrusion into its irrigation water supplies.

In terms of the total land, labor, and water resources, San Quintin has the potential to expand its tomato acreage substantially, but only by displacing other crops. However, the most effective limit on further expansion is the number of operators with (1) sufficient land and water resources to practice adequate crop rotation, (2) adequate management skills, and (3) the financial resources required to survive the risk of frequent large losses. Unfavorable weather, extensive disease and pest problems, and severe price fluctuations combine to make tomato production for export a risky enterprise.

The temperature in San Quintin is often too cool for tomatoes between October and December. Cold spells retard production and reduce yields; hard freezes cause heavy losses every 4 to 5 years. Some producers are considering the possibility of planting under plastic in January for production in the spring and early summer.

The difficulty in rotating crops, due to the inability to match water supplies with land, may lead to intractable disease problems for many of the smaller producers. Many new producers, too, do not have the technical expertise to grow and export tomatoes successfully. Many fields produce diseased, stunted plants with very low yields of undersized tomatoes.

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<sup>9/</sup> Only 2 years of price data were available for tomatoes from Baja. The 1977 season represented one with relatively high tomato prices, and 1978 a season with relatively low tomato prices.

Table 9--Expected net returns to tomato production in California and Baja California, Mexico, 1977/78 season

Item	Baja		California			
	Vine ripe		Vine ripe	Mature green		
<u>Cents per pound</u>						
Average price	1/	28.6	1/	25.7	2/	21.8
Total cost of production	3/	21.4		18.8		14.6
Net return		7.2		6.9		7.2

1/ Average of those 1977 and 1978 season prices reported in [6] for the September 1 to December 31 period, weighted 75 percent for 4x5 to 5x6 size tomato prices and 25 percent for 6x6 size tomato prices.

2/ Average of those 1977 and 1978 season prices reported in [6] for the September 1 to December 31 period, weighted 75 percent for extra large size tomato prices and 25 percent for large size tomato prices.

3/ From table 8.

Market conditions in the United States are not considered particularly good for Baja tomatoes between October and December due to competition with California. Bad weather in California sometimes yields high prices and large profits for Baja producers, but if California has a normal or good production year, profits from Baja producers are small. The 1977 season, for example, was profitable for Baja tomato growers, because heavy rains in California reduced yields there and market prices were generally high. Considerable expansion of tomato plantings followed in 1978 from the previous good year. However, the 1978 season produced bad results and heavy financial losses. High winds and temperature during the early part of the season reduced yields and rendered plants susceptible to disease. Also, production was heavy in other Mexican areas competing for the domestic market, and prices were very low for domestic sales--sometimes too low to cover transport cost to domestic markets. Some producers, as a result, may shift to less risky alternatives in the future.

Baja's competitive position in export tomatoes may further deteriorate as more California growers switch to mechanical harvesting. Processing tomatoes have been harvested mechanically for a number of years in California. Mechanical harvesting of fresh tomatoes in California is in the beginning stage although most fresh tomatoes still are hand harvested and all vine-ripe tomatoes are picked by hand. Experimentation with mechanical harvesting has been underway for several years, modifying processing tomato harvesters to handle mature green fruit without bruising them, and to develop varieties, cultural practices, and postharvest handling procedures for mechanically harvested fresh tomatoes. More and more growers of fresh tomatoes are harvesting their crops mechanically, and some people in the industry feel that mechanized harvesting is inevitable.

As California moves toward more mechanical harvesting of mature greens, total cost for mature green production may show an even greater advantage over Baja vine-ripe production. Mature green production may also replace some of the vine-ripe production in California, particularly vine-ripe production in Ventura County, where other crops compete intensely for available land. It appears that vine-ripe production in the San Diego area, however, is firmly entrenched, given the present and likely future market price and production cost relationships during the fall months. San Diego County growers have a marketing advantage in being able to produce late season tomatoes and receive

a relatively high price. Further, the high cost of water and land in this area appears to give the cost advantage to pole-type production where very high yields per acre can be attained.

## CONCLUSIONS

California fresh market tomato growers have a cost advantage over Baja growers in production of vine-ripe tomatoes between October and December--about 2 cents per pound for vine-ripe tomatoes and 6 cents per pound for mature green tomatoes. Export costs such as transportation to Tijuana, crossing charges, and tariffs provide California with the margin of advantage it enjoys.

Baja is unlikely to expand its exports of tomatoes to the United States during the fall much beyond present levels. Baja producers may in fact reduce exports below 1977 and 1978 season levels in the future. High production costs, limited availability of good water, disease problems, weather extremes, and uncertain markets all contribute to making tomato growing in Baja a very risky enterprise.

Adoption of mechanical harvesting of mature green tomatoes in California could further enhance California's cost advantage over Baja. It could also cause some realignment of the supply patterns in California, with less production of vine-ripe tomatoes and more of mature greens.

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## APPENDIX--ESTIMATING COSTS OF PRODUCTION IN CALIFORNIA AND BAJA

Cost estimates for producing and marketing tomatoes were developed for three areas in California and Baja. Similar estimating procedures were used in both regions so the estimates would be comparable. Costs were based on prices and production techniques typical for the fall of 1978. Total cost included all expenses f.o.b. the packinghouse for California production and f.o.b. Chula Vista, Calif., for Baja production.

Costs represent those an average or better than average manager would incur in a typical year. Some growers, of course, have higher costs, while others have lower costs. In addition, costs in any one year may be unusually high or low due to unique growing conditions, market conditions, unusual insect or disease problems, or other factors occurring during that season.

No cost estimate serves all purposes for which costs may be needed. Each use requires a unique estimate. For example, shortrun costs, which a grower might compare against receipts in deciding whether to harvest during periods of low prices, differ from the accounting costs he would use to calculate net returns at the end of the season. Accounting costs, in turn, can differ from those a grower uses in planning whether to produce tomatoes or some other crop. Cost estimates in this study are long-run total costs, and are appropriate for comparing the cost competitive position of two production areas such as California and Baja. They may be higher than costs developed for other purposes, in that they consist of all costs, including an imputed value for returns on equity production capital and on other owned resources.

### Procedures

A budgeting technique was used for estimating costs. The budget specifies typical amounts of inputs and services such as fertilizer, seed, pesticides, machinery hours, and man-hours. The amounts and kinds of specific inputs specified in the budgets were selected to represent typical costs. Representative unit prices are multiplied by the number of units of each input to arrive at costs for that item. Labor costs are estimated by multiplying total hours of labor use times labor cost per hour (wages plus fringe benefits). Machinery costs are calculated in a similar way by multiplying hours of use by hourly costs (ownership and operating costs). In addition, overhead charges (administrative expenses) were apportioned to each budget for the crop's share of general expenses associated with operation of the firm.

### Definition of Terms

Preharvest costs include all expenses such as fertilizers, pesticides, seed, labor and machine services, land rental, administrative costs, and interest on operating capital used in raising the crop to the harvest stage. In most cases, the costs are sunk or fixed by the time the crop is harvested. Although the grower needs to recoup all his costs to break even, he generally views preharvest costs as fixed in making the harvest decision.

Harvesting costs include picking costs and expenses associated with hauling the produce to the packing shed. These may sometimes be considered as variable costs at harvesttime. As such, the grower's expected market price must be at least high enough to cover picking costs plus packing and selling costs if the crop is to be harvested profitably.

Packing costs include all expenses for grading and packing. It, too, is generally considered a variable cost in making the harvest decision.

Selling cost is the commission paid to a salesman who finds a buyer for the produce. This, too, is generally considered a variable cost in making the harvest decision.

Administrative expenses represent the crop's share of overhead costs such as telephone, secretarial, and bookkeeping expenses, corporate officers' salaries, administrative vehicles, grower organization fees and dues, travel expenses, and other miscellaneous expenses not directly allocated to a specific crop. Preharvest administrative expenses were estimated as 4.5 percent of noninterest costs. No administrative costs were charged against harvesting.

Land rental was the charge for use of the land, and it was based on the current typical charge for land leased for vegetables. It was assumed that the landlord paid the property taxes, drainage district taxes, and any other fixed landownership costs. Capital costs for permanent irrigation facilities such as wells and canals were assumed, also, to be incurred by the landlord. Costs for maintaining these facilities during the current crop year were included in preharvest costs.

Interest on operating capital was the charge for use of operating capital. It was calculated at the rate of 9 percent per year for 5 months.

### California Cost Estimates

Three tomato budgets are reported here--San Diego County vine-ripe tomato production, Ventura County vine-ripe tomato production, and central California mature green tomato production. Each itemized budget is followed immediately by the labor and machinery use documentation and a working table used to estimate machinery costs. Appendix table 10 contains documentation of hourly machinery costs for California.

The technical coefficients (such as crop yield, and related quantities of labor, machine services, and materials used, etc.) represent those for progressive producers. The estimates evolved from discussions with growers, State extension service and research specialists, and others familiar with the particular crop; secondary data sources were also consulted. Estimates of representative prices were based on discussions with growers and input suppliers.

Appendix table 1--Estimated cost for growing, harvesting, and marketing vine-ripe pole tomatoes in San Diego County, Calif., 1978 fall crop

Item	Description	Cost
		<u>Dollars/acre</u>
<b>Preharvest:</b>		
Fertilizer	: 1 ton composted chicken manure	50.00
	: liquid fertilizer applied with irrigation water	95.00
Plants	: 6,000 at \$0.02 each	120.00
Replacement stakes	: 500 stakes at \$0.25 each	125.00
String and gloves	:	90.00
Herbicide	:	20.00
Insecticide and fungicide	: Custom application, 10 times at \$40 each for application and materials	400.00
Drip line	: 9,000 feet at \$0.02 per foot	180.00
Water	: 2 acre-feet at \$200 per foot	400.00
Tractor labor	: 6.15 hours at \$5.52 per hour	33.95
Irrigation labor	: 12 hours at \$4.88 per hour	58.56
Other cultural labor	: 167.25 hours at \$4.43 per hour	740.91
Supervisory labor	: 20 hours at \$6.21 per hour	124.20
Land rental	: \$150 per acre	150.00
Machinery costs	: Ownership	20.77
	: Operation	30.73
Administrative costs	: 6 percent of noninterest expense	158.35
Interest on operating capital	: \$2,776.72 at 9 percent for 5 months	104.13
Total preharvest	:	2,901.60
Average yield per acre 2600 packages	: (75% 2-layer flats, 25% 3-layer lugs)	
		<u>Dollars/package</u>
Total preharvest	:	1.11
<b>Harvest:</b>		
Picking	: \$0.85 per carton, packed out	.85
Hauling	: \$0.10 per carton, packed out	.10
Total harvest	:	.95
<b>Packing and marketing:</b>		
Labor	:	.48
Machinery, equipment, buildings	:	.39
Pallets	:	.22
Cartons	:	.58
Miscellaneous supplies	:	.08
Administrative	:	.10
Selling	:	.30
Total packing and marketing	:	2.15
Total costs	:	4.21

Appendix table 2--Estimated hours of equipment and labor required to perform each operation for growing vine-ripe pole tomatoes in San Diego County, Calif., 1978 season

Operation	Equipment used	Times over	Hourly requirements per acre under cultivation					
			Equipment (excluding tractors)	Tractor (65 hp)	Tractor (120 hp)	Tractor labor	Other labor	
							Hours	
Pull and store stakes from old crop	Wagon	1	1.00	1.00	N.A.	1.25	30.00	
Disk	13.5 foot disk	4	1.60	N.A.	1.60	2.00	N.A.	
Level land	12-foot land plane	1	.50	N.A.	.50	.60	N.A.	
Furrowing	Lister	2	.40	.4	N.A.	.50	N.A.	
Apply manure	Side dressing	1	.25	.25	N.A.	.30	N.A.	
Lay drip line	Small tractor	1	N.A.	.80	N.A.	1.00	1.00	
Lay out stakes	Stake wagon	1	.20	.20	N.A.	.25	1.25	
Set and drive stakes	Hand labor	1	N.A.	N.A.	N.A.	N.A.	20.00	
Install wire	Hand labor	1	N.A.	N.A.	N.A.	N.A.	5.00	
Planting	Hand labor	1	N.A.	N.A.	N.A.	N.A.	10.00	
Apply preplant herbicide	Sprayer	1	.20	.20	N.A.	.25	N.A.	
Tie plants (5 times)	Hand labor	5	N.A.	N.A.	N.A.	N.A.	50.00	
Irrigation		N.A.	N.A.	N.A.	N.A.	N.A.	1/12.00	
Prune plants	Hand labor	2	N.A.	N.A.	N.A.	N.A.	30.00	
Other cultural labor		N.A.	N.A.	N.A.	N.A.	N.A.	20.00	
Total		N.A.	N.A.	2.85	2.10	6.15	167.25	

N.A. = Not applicable.

1/ Charged separately in the budget. Not included in "other labor" total.

Appendix table 3--Estimated machinery and equipment costs per acre for vine-ripe pole tomatoes in San Diego County, Calif., 1978 fall crop

Item	Time used	Cost per hour		Total cost	
		Ownership	Operation	Ownership	Operation
	Hours	Dollars			
Wagon	1.2	0.95	0.34	1.14	0.41
Disk, 13.5 feet	1.6	2.88	2.40	4.61	3.84
Land plane	.5	4.61	1.92	2.31	.96
Lister	.4	.58	.48	.23	.19
Fertilizer attachment	.25	2.16	1.80	.54	.45
Sprayer	.20	2.42	1.68	.48	.34
65-horsepower tractor	2.85	1.55	4.47	4.42	12.74
120-horsepower tractor	2.10	3.35	5.62	7.04	11.80
Total	N.A.	N.A.	N.A.	20.77	30.73

N.A. = Not applicable.

Appendix table 4--Estimated costs for growing, harvesting, and marketing vine-ripe pole tomatoes in Ventura County, Calif., 1978 fall crop

Item	Description	Cost
		<u>Dollars/acre</u>
Preharvest:		
Fumigation	: 15 gallons Telone II at \$6.67 per gallon	100.00
Fertilizer	: 300 pounds nitrogen, 25 pounds phosphorus	90.00
Plants	: 6,000 at \$0.02 per plant	120.00
Replacement stakes	: 500 stakes at \$0.25 each	125.00
String and gloves	:	90.00
Insecticide and fungicide	: 5 custom application at \$40 each for materials and application	200.00
Water	: 2-acre feet at \$15 per acre-foot	30.00
Tractor labor	: 14.11 hours at \$5.52 per hour	77.89
Other cultural labor	: 152 hours at \$4.43 per hour	673.36
Irrigation labor	: 8 hours at \$4.88 per hour	39.04
Supervisory labor	: 20 hours at \$6.21 per hour	124.20
Land rental	: 7 months at \$42 per month	294.00
Machinery costs	: Ownership	41.91
	: Operation	68.81
Administrative costs	: 6 percent of noninterest expenses	124.45
Interest on operating capital	: \$2,156.75 at 9 percent for 5 months	80.88
Total preharvest	:	2,279.54
Average yield per acre 2000 packages		
	: (75% 2-layer flats, 25% 3-layer lugs)	
		<u>Dollars/package</u>
Total preharvest	:	1.14
Harvest:		
Picking	: \$0.85 per carton packed out	.85
Hauling	: \$0.10 per carton packed out	.10
Total harvest	:	.95
Packing and marketing:		
Labor	:	.48
Machinery, equipment, buildings	:	.39
Pallets	:	.22
Cartons	:	.58
Miscellaneous supplies	:	.08
Administrative	:	.10
Selling	:	.30
Total packing and marketing	:	2.15
Total costs	:	4.24

Appendix table 5--Estimated hours of equipment and labor required to perform each operation for growing vine-ripe pole tomatoes in Ventura County, Calif., 1978 fall crop

Operation	Equipment used	Times over	Hourly requirements per acre under cultivation			
			Equipment : (excluding tractor)	Tractor : (150 hp)	Tractor : Labor	Tractor : Other
			-----Hours-----			
Remove and store stakes for old crop	Hand labor	1	N.A.	N.A.	N.A.	30.0
Disk and roll refuse	13.5-foot disk and roller	2	0.38	0.38	0.48	N.A.
Subsoil	5-shank subsoiler	1/2	.18	.18	.22	N.A.
Plow	90-inch wide, 2-way	1	.30	.30	.38	N.A.
Disk and roll	13.5-foot disk and roller	2	.38	.38	.48	N.A.
Level land	Land plane	1	.42	.42	.52	N.A.
Furrow for irrigation	Lister	1	.20	.20	.25	N.A.
Pre-irrigate	Hand labor	1	N.A.	N.A.	N.A.	2.0
Drag harrow	20-foot drag harrow	3	.39	.39	.48	N.A.
Spring tooth harrow	20-foot wide	2	.26	.26	.33	N.A.
Plant	3-row planter	1	.30	.30	.36	N.A.
Cultivate	3-row cultivator	2	.44	.44	.55	N.A.
Sidedress fertilizer	4-row hopper	1	.25	.25	.31	N.A.
Cultivate on furrow	Cultivator	5	3.00	3.00	3.75	N.A.
Thin and hoe	Hand labor	2	N.A.	N.A.	N.A.	12.0
Hoe	Hand labor	1	N.A.	N.A.	N.A.	6.0
Prune	Hand labor	2	N.A.	N.A.	N.A.	30.0
Set and drive stakes	Wagon and stake driver	1	4.80	4.80	6.00	6.0
Tie plants	Hand labor	6	N.A.	N.A.	N.A.	54.0
Irrigate	Hand labor	4	N.A.	N.A.	N.A.	1/ 8.0
Other cultural labor	Hand labor	1	N.A.	N.A.	N.A.	12.0
Total		N.A.	N.A.	8.99	14.11	152.0

N.A. = Not applicable.

1/ Charged separately in the budget. Not included in "other labor" total.

Appendix table 6--Estimated machinery and equipment cost per acre for vine-ripe pole tomatoes in Ventura County, Calif., 1978 fall crop

Item	Time used	Cost per hour		Total cost	
		Ownership	Operation	Ownership	Operation
	Hours	-----Dollars-----			
13.5-foot disk	: 0.76	2.88	2.40	2.19	1.82
Subsoiler	: .18	2.88	2.40	.52	.43
Plow	: .30	2.88	2.40	.86	.72
Land plane	: .42	4.61	1.92	1.94	.80
Lister	: .20	.58	.48	.12	.10
Drag harrow	: .39	1.05	.72	.41	.28
Spring tooth harrow	: .26	2.52	2.10	.66	.55
Planter	: .30	.86	.60	.26	.18
Cultivator	: 3.44	.97	.82	3.34	2.82
Fertilizer hopper	: .25	2.16	1.80	.54	.45
Wagon	: 4.80	.95	.34	4.56	1.63
Stake driver	: 4.80	.60	.42	2.88	2.02
65-horsepower tractor	: 8.99	1.55	4.47	13.93	40.19
150-horsepower tractor	: 2.31	4.20	7.28	9.70	16.82
Total	: N.A.	N.A.	N.A.	41.91	68.81

N.A. = Not applicable.



Appendix table 7--Estimated costs for growing, harvesting, and marketing mature green tomatoes in California, 1978 fall crop

Item	Description	Cost
		<u>Dollars/acre</u>
Preharvest:		
Fumigation	Fumigant	20.00
Fertilizer	400 pounds starter	37.00
	100 pounds nitrogen sidedress at	
	\$0.27 per pound	27.00
	Custom application	5.00
Seed	1 pound per acre at \$20 per pound	20.00
Herbicide	Material (Tillam)	17.50
	Application (custom)	12.50
Insecticide and fungicide	Three custom applications at \$15 each	
	for materials and application	45.00
Irrigation water	3.5 acre-feet at \$10 per acre-foot	35.00
Machinery costs	Ownership	30.54
	Operation	36.36
Tractor labor	6.64 hours at \$5.52 per hour	36.65
Irrigation labor	20 hours at \$4.88 per hour	97.60
Other cultural labor	28.91 hours at \$4.43 per hour	128.07
Supervisory labor	7.25 hours at \$6.21 per hour	45.00
Land rental	\$250 per acre	250.00
Administrative cost	6 percent of noninterest expenses	50.59
Interest on operating capital	\$863.27 at 9 percent for 5 months	32.37
Total preharvest		926.18
Average yield per acre	800 30-pound cartons	
		<u>Dollars/carton</u>
Total preharvest		1.16
Harvest:		
Picking	\$0.02 per pound gross, 70 percent	
	packout = \$.02857 per net pound =	
	\$0.86 per 30-pound box	0.86
Hauling	\$0.10 per box packed out	.10
Total harvest		.96
Packing and marketing:		
Labor		.49
Machinery, equipment, buildings		.42
Pallets		.23
Cartons		.63
Miscellaneous supplies		.08
Administrative		.11
Selling		.30
Total packing and marketing		2.26
Total costs		4.38

Appendix table 8--Estimated hours of equipment and labor required to perform each operation for growing mature green tomatoes in California, 1978 fall season

Operation	Equipment used	Times over	Hourly requirements per acre under cultivation				
			Equipment : (excluding tractor)	Tractor : (65 hp)	Tractor : (120 hp)	Tractor : Other labor	
-----Hours-----							
Disk	13.5-foot disk	3	0.90	N.A.	0.90	1.08	N.A.
Subsoil	13-foot subsoiler	2	1.00	N.A.	1.00	1.25	N.A.
Level land	Land plane (12 feet x 60 feet)	2	1.00	N.A.	1.00	1.25	N.A.
Harrow	18-foot spring tooth	1	0.12	N.A.	.12	.15	N.A.
List and slope beds	Bedding tool bar	1	.50	N.A.	.50	.62	N.A.
Seeding	3-row seed planter	1	.33	0.33	N.A.	.41	0.41
Cultivate	3-row cultivator	3	1.50	1.50	N.A.	1.88	N.A.
Thin	Hand labor	1	N.A.	N.A.	N.A.	N.A.	15.00
Hoe and weed	Hand labor	N.A.	N.A.	N.A.	N.A.	N.A.	7.50
Irrigation labor	Hand labor	N.A.	N.A.	N.A.	N.A.	N.A.	1/ 20.00
Other cultural labor	Hand labor	N.A.	N.A.	N.A.	N.A.	N.A.	6.00
Total		N.A.	N.A.	1.83	3.52	6.64	28.91

N.A. = Not applicable.

1/ Charged separately in the budget. Not included in "other labor" total.

Appendix table 9--Estimated machinery and equipment costs per acre for mature green crop tomatoes in California, 1978/79 season

Item	Time used	Cost per hour		Total cost	
		Ownership	Operation	Ownership	Operation
	Hours	Dollars			
13.5-foot disk	: 0.90	2.88	2.40	2.59	2.16
Subsoiler	: 1.00	2.88	2.40	2.88	2.40
Land plane	: 1.00	4.61	1.92	4.61	1.92
Spring tooth harrow	: .12	2.52	2.10	.30	.25
Lister	: .50	.58	.48	.29	.24
Planter	: .33	.86	.60	.28	.20
Cultivator	: 1.50	.97	.82	1.46	1.23
65-horsepower tractor	: 1.83	1.55	4.47	2.84	8.18
120-horsepower tractor	: 3.52	3.35	5.62	11.79	19.78
Irrigation equipment (\$3.50/acre ownership)	: N.A.	N.A.	N.A.	3.50	N.A.
Total	: N.A.	N.A.	N.A.	30.54	36.36

N.A. = Not applicable.

Appendix table 10--Description and estimated cost of equipment used in tomato production in California, 1978

Item	Initial cost	Total depre- ciation	Annual use <sup>1/</sup>	Total service life <sup>2/</sup>	Costs per hour		
					Fixed <sup>3/</sup>	Variable <sup>4/</sup>	Total
	-----Dollars-----		-----Hours-----		-----Dollars-----		
Tractor, 150 horse- power	: 35,000	: 31,500	: 1,200	: 12,000	: 4.20	: 7.28	: 11.48
Tractor, 120 horse- power	: 26,000	: 23,400	: 1,000	: 12,000	: 3.35	: 5.62	: 8.97
Tractor, 65 horse- power	: 12,000	: 10,800	: 1,000	: 12,000	: 1.55	: 4.47	: 6.02
Disk	: 5,000	: 4,500	: 250	: 2,500	: 2.88	: 2.40	: 5.28
Roller	: 3,500	: 3,150	: 250	: 2,500	: 2.02	: 1.68	: 3.70
Subsoiler	: 5,000	: 4,500	: 250	: 2,500	: 2.88	: 2.40	: 5.28
Plow	: 5,000	: 4,500	: 250	: 2,500	: 2.88	: 2.40	: 5.28
Land plane	: 8,000	: 7,200	: 250	: 2,500	: 4.61	: 1.92	: 6.53
Furrower, lister	: 1,000	: 900	: 250	: 2,500	: .58	: .48	: 1.06
Spring tooth harrow	: 3,500	: 3,150	: 200	: 2,000	: 2.52	: 2.10	: 4.62
Drag harrow	: 1,200	: 1,080	: 130	: 1,950	: 1.05	: .72	: 1.77
4-row seeder	: 2,100	: 1,890	: 350	: 2,500	: .86	: .60	: 1.46
Cultivator	: 1,700	: 1,530	: 250	: 2,500	: .97	: .82	: 1.79
Stake wagon	: 2,800	: 2,520	: 333	: 5,000	: .95	: .34	: 1.29
Sprayer	: 4,200	: 3,780	: 250	: 2,500	: 2.42	: 1.68	: 4.10
Ditcher	: 2,400	: 2,160	: 250	: 2,500	: 1.38	: 1.15	: 2.53
Stake driver	: 500	: 450	: 120	: 1,200	: .60	: .42	: 1.02
Fertilizer hopper	: 3,000	: 2,700	: 200	: 2,000	: 2.16	: 1.80	: 3.96

1/ Salvage value based on 10 percent of new cost.

2/ Estimated wear out life = (years on farm) x (annual usage); based on [1, p.333].

3/ Fixed costs include depreciation and a charge for interest, taxes, housing, and insurance. Hourly depreciation is derived by dividing total depreciation by hours of total service life. Interest, taxes, housing, and insurance are charged at an annual rate of 6 percent of new cost, as suggested in [1, p.328].

4/ Variable costs include charges for repairs and maintenance fuel, and lubrication. Estimates are based on [1, pp. 328-333]. Fuel charged at 50 cents per gallon.

## Baja Cost Estimates

The table below shows the labor used in Baja tomato production and is followed by the Baja tomato budget. Specification of physical quantities of inputs used was based on personal interviews with producers supplemented by visits to vegetable fields and packinghouses to observe production activities. Current data on input prices were obtained from input suppliers.

The costs of machinery services were based on custom rates for preplant operations. The costs of machine services following planting were based on discussions with growers in Baja about costs on their farms. Pesticide costs, too, were based on discussions with producers about the costs in their operations.

Appendix table 11--Estimated labor required per hectare to perform each operation for growing staked tomatoes in Baja California, Mexico, 1978

Operation	: Tractor : driver <u>1/</u>	: Truck : driver	: Pesticide : application	: Irrigation : labor	: Other : labor
<u>Man-days</u>					
Planting	: N.A.	N.A.	N.A.	N.A.	21.0
Cultivating	: 1.5	N.A.	N.A.	N.A.	N.A.
Scaring birds	: N.A.	N.A.	N.A.	N.A.	21.0
Applying fertilizer	: 4.0	N.A.	N.A.	N.A.	N.A.
Applying pesticide	: N.A.	N.A.	2.0	N.A.	N.A.
Irrigating	: N.A.	N.A.	N.A.	7.7	N.A.
Pruning and tying plants	: N.A.	N.A.	N.A.	N.A.	60.0
Installing stakes	: N.A.	N.A.	N.A.	N.A.	13.6
Installing cord and wire	: N.A.	N.A.	N.A.	N.A.	18.0
Removing stakes and cord	: N.A.	N.A.	N.A.	N.A.	12.8
Repairing stakes	: N.A.	N.A.	N.A.	N.A.	8.5
Transporting materials	: N.A.	3.0	N.A.	N.A.	N.A.
<b>Total</b>	: 5.5	3.0	2.0	7.7	154.9

N.A. = Not applicable.

1/ Does not include tractor driver labor for preplant operation. Cost for tractor labor used in preplant soil preparation is included in the custom rate charge for those operation.



Appendix table 12--Costs for producing and marketing vine-ripe tomatoes in Baja California, Mexico, 1978

Item	Description	Cost	
		Pesos/ hectare	Dollars/ acre
Preharvest:			
Land rent		10,000	177.26
Ground preparation	:Custom hire rates	4,978	88.20
Seed	:0.4 pound per hectare	4,000	70.87
Machine service	:Ownership and operation	9,877	175.00
Fertilizer	:400 kg nitrogen, 400 kg phosphorus, : 300 kg potassium	8,500	150.61
Pesticide	:Diverse formulations	10,000	177.19
Stakes	:667 large at 5 pesos each :5,000 small at 1.5 pesos each	10,833	191.94
Cord and wire	:Henequen cord	5,000	88.59
Labor	:5.5 days tractor labor at \$175 per day	962	17.05
	:3 days truck driver at \$145 per day	435	7.71
	:2 days pesticide application at \$127 per : day	254	4.50
	:7.7 days irrigation labor at \$130 per day	1,000	17.72
	:154.9 days other labor at \$117 per day	18,123	321.12
Administrative costs	:4.5 percent of costs excluding interest	3,778	66.94
Interest on operating capital	:12 percent of operating capital for 5 : months	4,387	77.73
Total preharvest		92,127	1,632.43
Export yield per acre	:1,134 2-layer flats		<u>Dollars/ 2-layer flat</u>
Harvest:			
Picking		24,067	0.38
Hauling		2,533	.04
Total harvest		26,600	.42
Packing and marketing:			
Labor		10,872	.17
Building and equipment		15,350	.24
Cartons		39,011	.61
Miscellaneous		8,956	.14
Administrative		8,314	.13
Sales commission		38,385	.60
Crossing costs		5,116	.08
Tariff		26,869	.42
Transport to Tijuana		19,825	.31
Total packing and marketing		172,698	2.70

UNITED STATES DEPARTMENT OF AGRICULTURE  
WASHINGTON, D.C. 20250



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