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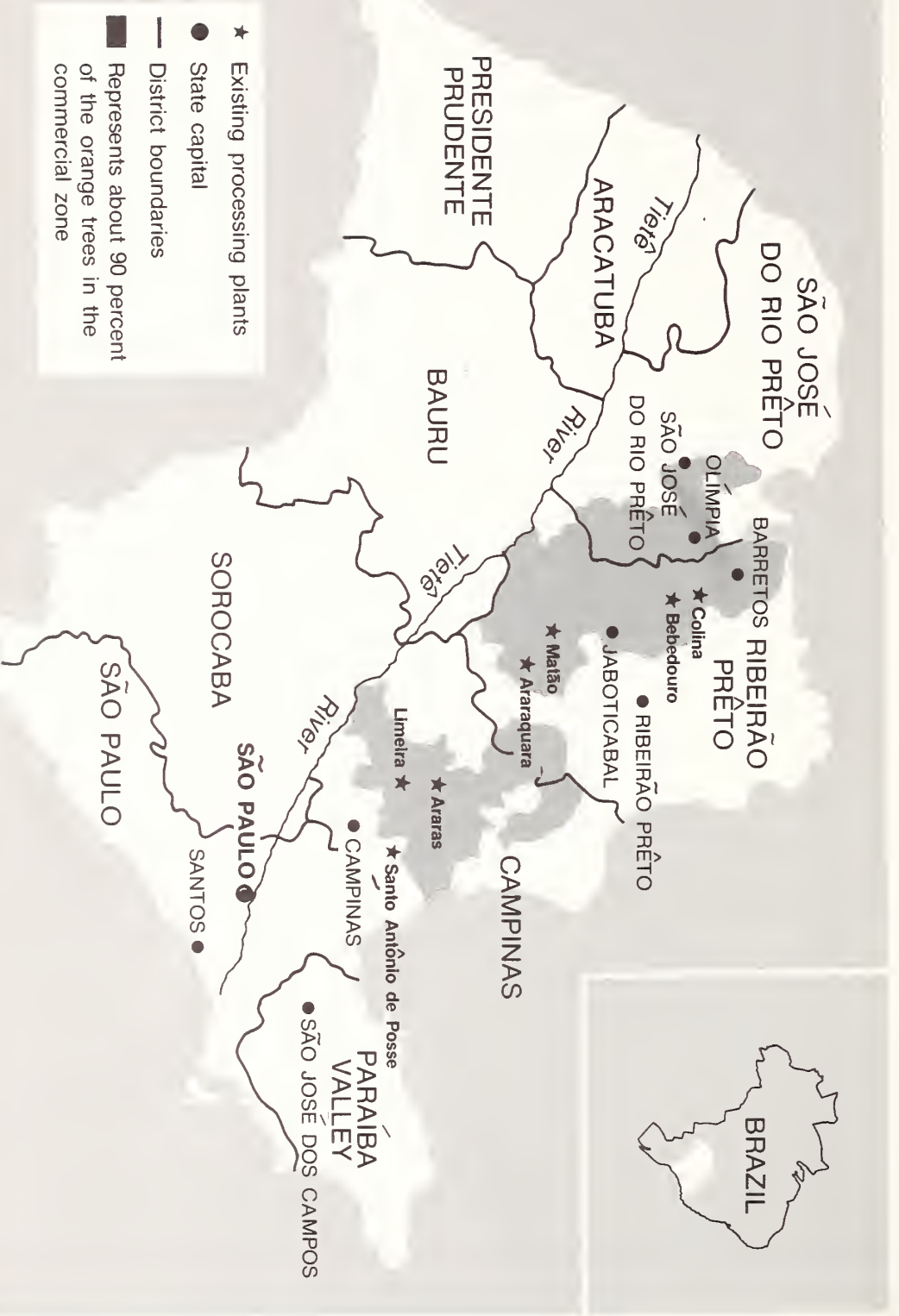
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Brazil's Orange Juice Industry



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Foreign Agricultural Service

Major Commercial Orange Producing Areas In São Paulo State




- ★ Existing processing plants
- State capital
- District boundaries
- Represents about 90 percent of the orange trees in the commercial zone



FOREWORD

Brazil's citrus industry has expanded at a rapid rate ever since it first entered the export market for frozen concentrated orange juice in the early 1960's. Brazil surpassed the United States as the world's No. 1 exporter in 1968, and 10 years later sold more orange juice to the United States than to any other outlet. To capitalize on the strong export demand, Brazilian processors are continuing to expand and modernize their industry, although large carryover stocks this season could give pause to their buoyant hopes for unencumbered growth.

This report covers the development of Brazil's orange-processing industry from the fruit groves through the marketing stage. The author is indebted to Brazilian Government and industry representatives for the information and assistance that they provided. Special appreciation is extended for the invaluable assistance from Edmond Missiaen, former Agricultural Officer in São Paulo, Brazil, and now with the Horticultural and Tropical Products Division, FAS.



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BRAZIL'S ORANGE JUICE INDUSTRY

By John H. Wilson*

INTRODUCTION

Commercial production of citrus (mainly oranges) in Brazil started at the turn of the century. The industry was devoted almost entirely to the local and export markets for fresh citrus until the early 1960's, when it entered the export market for frozen concentrated orange juice (FCOJ).

Brazil's entry into the world market for orange juice closely followed the 1962 freeze in Florida, which drove up prices of U.S. concentrate and created a strong demand for foreign juice. Brazil, whose processing previously had been limited to producing essential oils, soon realized the tremendous marketing opportunities available for FCOJ and began to develop processing capacity and new markets for this product. Abundant supplies of processing fruit and the ability to produce a competitive product enabled Brazil to surpass the United States as the world's leading exporter of FCOJ and eventually go on to capture three-fourths of the world export market.

The favorable prices paid to orange growers resulted in thousands of hectares of new plantings in the 1978 and 1979 seasons (July-June). The juice industry therefore, is assured of an adequate supply of oranges in the future and foresees a continued strong demand for concentrate in world markets. The industry is gearing up for the increase in orange output by expanding and modernizing its processing facilities.

POSITION IN THE WORLD MARKET

Brazil's citrus industry is based almost entirely on the export of FCOJ. These exports—all of 65° brix concentrate, bulk shipped in 52-gallon drums—currently account for about 85 to 90 percent of the combined value of fresh citrus and citrus product exports.¹ FCOJ exports were valued at \$332.6 million in calendar 1978 (see Table 1). Important byproducts of juice processing (mainly

citrus pulp pellets and orange oil) account for most of the remaining value of citrus and citrus product exports (see table 1).

The volume of FCOJ exports has accelerated rapidly since shipments began in the early 1960's. Exports advanced from 5,943 metric tons in calendar 1963 to 27,166 tons in 1968, 120,990 in 1973, and a record high of 335,629 in 1978. Sales in 1978 were 56 times greater than those in 1963. However, exports during calendar 1979 slipped below the 1978 level to about 317,000 tons. This decline followed a dip in domestic production and reduced demand from the United States, which since 1977 has been a major market, as well as competitor with Brazil. That competition began in earnest during the mid-1960's and by 1968 had moved Brazil ahead of the United States as the world's leading exporter of FCOJ.

Although sales of FCOJ have widened to include many markets, Brazil has concentrated on three important ones—Western Europe (mainly West Germany, the Netherlands, and Sweden), the United States, and Canada. Shipments to these areas accounted for 93 percent of Brazil's total exports during 1972-78 (see table 2).

The United States emerged as Brazil's No. 1 buyer of concentrate in 1978, taking 148,000 metric tons of 65° brix concentrate or 44 percent of that country's exports, compared with 22 percent the previous year and 8 per-

BRAZILIAN ACRONYMS

| | |
|--------------|--|
| ABRASUCOS: | Associação Brasileira das Industrias de Suco Citrico |
| ASSOCITRUS: | Associação Paulista dos Citricultores |
| CACEX: | Carteira de Comercio Exterior |
| CANECC: | Campanha Nacional de Eradicacão do Cancro Citrico |
| EMBRAPA: | Empresa Brasileira de Pesquisas Agropecuarias |
| EMBRATER: | Empresa Brasileira de Assistencia Tecnica e Extensão Rural |
| FAESP: | Federacão de Agricultura do Estado de São Paulo |
| FUNDECITRUS: | Fundo Paulista de Defesa de Citricultura |
| IAC: | Instituto Agronomico de Campinas |
| ICM: | Imposto de Circulacão de Mercadorias |
| IEA: | Instituto de Economia Agricola |
| IPI: | Imposto de Produtos Industriais |

¹This study focuses on FCOJ because of its overriding dominance in Brazil's citrus exports. Fresh citrus exports, consisting of 90-95 percent oranges, account for less than 2 percent of the total foreign exchange earned by Brazil's citrus industry, and Brazil's orange exports account for less than 1 percent of the total world exports of this commodity.

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Table 1—Brazil: Exports of Fresh and Processed Citrus, Calendar 1974-78

[Quantity: Metric tons; Value: US\$1,000]

| Commodity | 1974 | | 1975 | | 1976 | | 1977 | | 1978 | |
|--|----------------|---------------|----------------|---------------|----------------|----------------|----------------|----------------|----------------|----------------|
| | Quantity | Value | Quantity | Value | Quantity | Value | Quantity | Value | Quantity | Value |
| Fresh citrus: | | | | | | | | | | |
| Oranges | 39,519 | 5,809 | 73,071 | 11,767 | 36,404 | 5,323 | 35,591 | 5,322 | 45,407 | 6,955 |
| Tangerines | 1,006 | 156 | 1,226 | 198 | 1,825 | 323 | 356 | 49 | 2,584 | 369 |
| Grapefruit | 885 | 119 | 475 | 68 | 852 | 141 | 28 | 9 | 0 | 0 |
| Lemons and limes | 172 | 75 | 409 | 140 | 400 | 162 | 262 | 152 | 569 | 308 |
| Total | 41,582 | 6,159 | 75,181 | 12,173 | 39,481 | 5,949 | 36,237 | 5,532 | 48,560 | 7,632 |
| Citrus juice: | | | | | | | | | | |
| Orange ¹ | 108,460 | 59,170 | 180,897 | 82,202 | 209,841 | 100,882 | 213,524 | 177,026 | 335,629 | 332,621 |
| Tangerine ² | 1,291 | 755 | 3,140 | 1,364 | 2,080 | 1,141 | 240 | 224 | 1,682 | 1,659 |
| Grapefruit ² | 1,381 | 1,201 | 222 | 115 | 553 | 236 | 491 | 291 | 1,009 | 711 |
| Lemon and lime ² | 958 | 446 | 1,571 | 692 | 1,874 | 790 | 204 | 128 | 1,347 | 958 |
| Total | 112,090 | 61,572 | 185,830 | 84,373 | 214,348 | 103,049 | 214,459 | 177,669 | 339,667 | 335,949 |
| Citrus oils: | | | | | | | | | | |
| Orange (peel) | 2,450 | 1,209 | 2,143 | 877 | — | — | 5,282 | 1,994 | 5,491 | 2,765 |
| Tangerine and bergamot | 32 | 167 | 24 | 35 | — | — | 114 | 268 | 102 | 335 |
| Lemon and lime | 44 | 537 | 60 | 505 | — | — | 41 | 459 | 93 | 1,149 |
| Total | 2,450 | 1,209 | 2,143 | 877 | — | — | 5,437 | 2,721 | 5,686 | 4,252 |
| Citrus pulp pellets³ | — | — | — | — | — | — | 279,402 | 23,954 | 415,463 | 38,899 |

—Denotes not available, unknown, or not applicable.

¹ Concentrated. ² Original statistics do not specify whether single strength or concentrated. ³ Data for 1974 through 1977 partially estimated because export statistics did not break out citrus pulp pellets as a separate item.

Source: Bank of Brazil/CACEX.

Table 2—Brazil: Exports of Concentrated Orange Juice, Calendar 1973-78

[In metric tons]

| Country of destination | 1973 | 1974 | 1975 | 1976 | 1977 | 1978 |
|------------------------------------|---------|---------|---------|---------|---------|------------------|
| United States | 10,983 | 23,112 | 20,609 | 16,675 | 46,807 | 147,511 |
| Western Europe: | | | | | | |
| European Community: | | | | | | |
| Belgium-Luxembourg | 1,322 | 1,626 | 2,142 | 4,382 | 2,146 | 1,801 |
| Denmark | 834 | 530 | 1,079 | 4,282 | 5,789 | 4,506 |
| France | 696 | 240 | 200 | 240 | 40 | 401 |
| Germany, Federal Republic of | 55,291 | 33,875 | 44,115 | 43,497 | 31,388 | 29,445 |
| Netherlands | 26,064 | 20,658 | 42,880 | 67,268 | 53,225 | 45,615 |
| United Kingdom | 456 | 592 | 4,218 | 5,408 | 7,713 | 13,406 |
| Total | 84,663 | 57,521 | 94,634 | 125,077 | 100,301 | 95,174 |
| Other Western Europe: | | | | | | |
| Austria | — | — | — | — | 37 | 469 |
| Finland | 1,086 | 929 | 3,050 | 6,090 | 4,961 | 7,978 |
| Norway | 396 | 668 | 1,211 | 1,520 | 1,714 | 2,143 |
| Spain | 450 | 326 | 4,307 | 2,493 | 3,979 | 2,311 |
| Sweden | 10,381 | 15,346 | 16,130 | 18,266 | 19,359 | 19,042 |
| Switzerland | 314 | 202 | 718 | 284 | 413 | 250 |
| Portugal | 1 | — | 2 | — | — | — |
| Total | 12,628 | 17,471 | 25,418 | 28,653 | 30,463 | 31,193 |
| Total Western Europe | 97,291 | 74,992 | 120,052 | 153,730 | 130,764 | 127,367 |
| Eastern Europe: | | | | | | |
| German Democratic Republic | — | — | 100 | 1,410 | 1,200 | 495 |
| Poland | 851 | 750 | 3,849 | 3,573 | 2,649 | 1,235 |
| Yugoslavia | — | — | 100 | — | — | — |
| Total Eastern Europe | 851 | 750 | 4,049 | 4,983 | 3,849 | 1,730 |
| Total Europe | 98,142 | 75,742 | 124,101 | 158,713 | 134,613 | 129,097 |
| Other countries: | | | | | | |
| Australia | — | 212 | 1,590 | 510 | 351 | 6,622 |
| Canada | 8,793 | 7,446 | 21,119 | 15,836 | 20,688 | 33,866 |
| Chile | — | — | — | — | 235 | 485 |
| Israel | 2,671 | 1,100 | 8,914 | 14,505 | 5,642 | 9,312 |
| Japan | 105 | 123 | 296 | 340 | 246 | 912 |
| Paraguay | 130 | — | — | 100 | 1 | — |
| South Africa | 160 | — | — | — | 53 | — |
| Venezuela | — | 725 | 4,247 | 3,162 | 4,888 | 7,448 |
| Other | 6 | — | 21 | — | — | ¹ 376 |
| Total | 11,865 | 9,606 | 36,187 | 34,453 | 32,104 | 59,021 |
| Grand total | 120,990 | 108,460 | 180,897 | 209,841 | 213,524 | 335,629 |

— Denotes not available, unknown, or not applicable.

¹ Includes 156 tons to Lebanon and 130 tons to Argentina.

Source: 1973, 1975, 1977—Official Trade of Brazil; 1974, 1976, 1978—Reports of Agricultural Officer, American Consulate, São Paulo.

NOTE: See table 14 for historical data on Brazil's exports of FCOJ.

cent in 1976. The surge in U.S. imports is the direct result of a freeze in Florida in January 1977, which caused subsequent crops in that State to fall sharply from the 1976/77 outturn of 186.8 million boxes (7.6 million tons) and domestic prices to escalate. The resultant price differential between domestic and imported juice made it attractive

for U.S. importers and processors to buy Brazilian concentrate and still pay the U.S. duty of 35 cents per gallon of natural (single-strength equivalent) juice. This is roughly equivalent to 34 cents per pound (solids) of concentrate, or \$487 per metric ton of 65° brix concentrate.

Exports to Canada have also gained significantly in the past 3 years, going from 15,836 tons in 1976 to 33,866 in 1978. During this same period, Brazil's share of the Canadian market jumped from 35 to 54 percent, largely at the expense of U.S. processors who have traditionally been the dominant suppliers of FCOJ to Canada. The U.S. share of the Canadian market dropped from 61 percent in 1976 to 41 percent in 1978.

The year 1978 marks the first time the Canadians imported more bulk concentrate than concentrate already packaged for retail use. All imports from Brazil are received in 52-gallon steel drums, and prior to sale the juice must be repackaged and/or reconstituted for distribution to the domestic market. On the other hand, about 95 percent of all U.S. exports of FCOJ to Canada are exported in containers of less than 1 gallon.

In contrast to the exports to the United States and Canada, Brazilian shipments to Europe dropped notably in 1977 and 1978. Between 1976 and 1978, Western Europe's share of Brazilian exports fell from 62 percent to 38 percent, and Eastern Europe's share dwindled from 3 percent to 1 percent. The decline is attributed to the overwhelmingly strong demand for FCOJ from the United States and Canada in the past two seasons, especially in 1978.

Other markets gaining in importance include Israel and Venezuela. Despite the surge of shipments to the United States in 1978, exports to these markets have remained strong and increased 65 and 52 percent, respectively, from the 1977 level.

Israel is likely to remain a large outlet for the Brazilian juice as there is a shortage of oranges for processing in that country. Israeli processors blend Brazilian juice with domestic juice and oftentimes market the end product abroad. Most of Israel's juice exports go to the European Community (EC), where they receive a 70-percent duty reduction. Since the establishment of the preferential duty in 1974, Brazil's exports to Israel have skyrocketed from 1,100 tons in 1974 to 8,914 in the following year and 9,312 in 1978.

Venezuela is becoming an important consuming nation of orange juice. It is one of the largest producers of concentrate in Latin America (about 5,000 tons in 1979) and, like Israel, imports Brazilian juice to blend with its domestic output in order to obtain a better quality product.

GROWING OPERATIONS

Producing Areas

The commercial citrus industry of Brazil is centered in São Paulo State² within a 150-by-50 mile belt, extending from the city of Campinas in the south to São José do Rio Preto and Colômbia in the north. The belt has recently begun to expand northward into São Paulo's neighboring State of Minas Gerais, particularly near the town of Frutal.

New plantings are occurring mainly to the west and north of Bebedouro toward the towns of São José do Rio Preto and Frutal. Most plantings in these areas have taken place on land formerly in pasture. Rising land prices have made it uneconomic to keep land in pasture and forced farmers to switch to higher value crops such as citrus.

The presence of citrus canker in certain parts of western São Paulo State has confined the commercial producing zone to areas north to the Tietê River (which divides São Paulo east to west), and east of São José do Rio Preto. Citrus produced on the south side of the Tietê, including that from the neighboring State of Paraná, is

²São Paulo State comprises most of Brazil's commercial production. It accounted for 68 percent of Brazil's total output and 72 percent of Brazil's total area of oranges in 1978. Rio de Janeiro is Brazil's second largest producing State followed by the States of Rio Grande do Sul and Minas Gerais. See table 3.

Table 3—Brazil: Bearing Area and Production of Oranges¹ by State, 1977-79²

| State | 1977 | | | 1978 | | | 1979 | | |
|----------------------------------|-------------------|----------------------|----------------------------|-------------------|----------------------|----------------------------|-------------------|----------------------|----------------------------|
| | Area ³ | Production | | Area ³ | Production | | Area ³ | Production | |
| | Thousand hectares | Thousand metric tons | Million boxes ⁴ | Thousand hectares | Thousand metric tons | Million boxes ⁴ | Thousand hectares | Thousand metric tons | Million boxes ⁴ |
| São Paulo | 278 | 3,754 | 92 | 328 | 6,120 | 150 | 338 | 5,920 | 145 |
| Rio de Janeiro | 36 | 432 | 10 | 26 | 335 | 8 | 33 | 412 | 10 |
| Sergipe and Bahia | 21 | 245 | 6 | 24 | 379 | 9 | 27 | 351 | 9 |
| Rio Grande do Sul | 24 | 290 | 7 | 24 | 281 | 7 | 24 | 290 | 7 |
| Minas Gerais | 22 | 270 | 7 | 22 | 265 | 7 | 25 | 290 | 7 |
| S. Catarina and Paraná | 9 | 175 | 4 | 8 | 139 | 3 | 9 | 147 | 4 |
| Other States | 24 | 354 | 9 | 25 | 335 | 8 | 24 | 343 | 8 |
| Total Brazil | 414 | 5,520 | 135 | 457 | 7,854 | 192 | 480 | 7,753 | 190 |

¹ Probably includes some tangerines. ² Year of harvest. ³ Area of producing trees only. ⁴ One box equals 40.8 kilograms. On average there are about 250 oranges per box and 6,127 oranges per metric ton.

NOTE: See table 16 for a historical series of production data.

Source: Reports of Agricultural Officer, American Consulate, São Paulo.

prohibited from being shipped north of the river, where all of the processing plants are located.

There is still ample room for expansion in areas both inside and outside of the commercial producing zone. However, several factors or barriers, besides citrus canker, hinder growth. Urbanization limits expansion south of Campinas, while the high concentration of sugarcane to the east of the current commercial producing zone hinders new plantings of citrus in these areas. In addition, warm winter temperatures and poor soils are restricting the commercial zone from spreading to areas north of Frutal.

Tree Numbers and Orange Production

The São Paulo Secretariat of Agriculture's Institute of Agricultural Economics (IEA) publishes annual estimates of nonbearing and bearing tree numbers in São Paulo State by administrative regions. Virtually all of the commercial groves and over 95 percent of the nonbearing and bearing tree numbers in São Paulo lie within the districts of Campinas, Ribeirão Preto, and São José do Rio Preto (see table 4). Ribeirão Preto

Table 4—São Paulo State: Tree Numbers and Production of Oranges by Administrative District, 1968 and 1976-78

| Item | Unit | 1968 | 1976 | 1977 | 1978 |
|-----------------------------------|---------------|----------|---------------|---------------|----------------------|
| Campinas: | | | | | |
| Nonbearing trees | 1,000 trees | — | — | — | 5,860 |
| Bearing trees | — do — | 9,534 | 16,700 | 16,170 | 19,850 |
| Total trees | — do — | — | — | — | 25,710 |
| Boxes per tree | Boxes | 1.39 | 1.60 | 1.39 | — |
| Total boxes | — do — | 13,312 | 26,700 | 22,500 | — |
| Ribeirão Preto: | | | | | |
| Nonbearing trees | 1,000 trees | — | — | — | 8,910 |
| Bearing trees | — do — | 10,035 | 26,500 | 30,100 | 36,000 |
| Total trees | — do — | — | — | — | 44,910 |
| Boxes per tree | Boxes | 1.37 | 1.84 | 1.56 | — |
| Total boxes | — do — | 13,724 | 48,800 | 47,000 | — |
| São José do Rio Preto: | | | | | |
| Nonbearing trees | 1,000 trees | — | — | — | 5,520 |
| Bearing trees | — do — | 2,212 | 9,500 | 7,200 | 7,900 |
| Total trees | — do — | — | — | — | 13,420 |
| Boxes per tree | Boxes | 1.39 | 1.61 | 1.80 | — |
| Total boxes | — do — | 3,075 | 15,300 | 13,000 | — |
| Other regions:¹ | | | | | |
| Nonbearing trees | 1,000 trees | — | — | — | 439 |
| Bearing trees | — do — | 3,654 | 4,630 | 4,980 | 5,060 |
| Total trees | — do — | — | — | — | 5,499 |
| Boxes per tree | Boxes | 1.49 | 1.90 | 1.91 | — |
| Total boxes | — do — | 5,449 | 8,800 | 9,500 | — |
| Total regions: | | | | | |
| Nonbearing trees | 1,000 trees | — | 18,616 | 20,821 | 20,729 |
| Bearing trees | — do — | 25,435 | 57,330 | 58,450 | 68,810 |
| Total trees | — do — | — | 75,946 | 79,271 | 89,539 |
| Boxes per tree | Boxes | 1.40 | 1.73 | 1.57 | 2.18 |
| Total boxes | — do — | 35,560 | 99,600 | 92,000 | ² 150,000 |

— Denotes not available, unknown, or not applicable.

¹ Mostly noncommercial. ² Estimate by Agricultural Officer, American Consulate, São Paulo.

NOTE: Trees are usually considered to be bearing during their 4th year. See table 15 for a historical series of tree numbers.

Source: São Paulo State Secretariat of Agriculture Institute of Agricultural Economics (IEA).

Table 5—São Paulo State: Supply and Distribution of Oranges,¹ 1976-79²[In millions of boxes³]

| Item | 1976 | 1977 | 1978 | Preliminary |
|--|------|------|-------|-------------|
| | | | | 1979 |
| Total production | 99.6 | 92.0 | 150.0 | 145.0 |
| Accruals from other states ⁴ | 0 | 1.5 | .4 | 1.0 |
| Less noncommercial production and losses | 7.7 | 5.5 | 6.0 | 5.0 |
| Total commercial availability | 91.9 | 88.0 | 144.4 | 141.0 |
| Fresh consumption | 24.0 | 25.1 | 26.0 | 24.5 |
| Fresh exports | .9 | .9 | 1.4 | 1.5 |
| Processed | 67.0 | 62.0 | 117.0 | 115.0 |
| Total commercial distribution | 91.9 | 88.0 | 144.4 | 141.0 |

¹ Includes a small amount of tangerines. ² Marketing years beginning in May of year indicated. ³ Boxes of 40.8 kg (90 lb). ⁴ Oranges purchased from States of Minas Gerais and Rio de Janeiro for processing in São Paulo. Interstate movement of fruit for fresh consumption is not considered.

Source: Reports of Agricultural Officer, American Consulate, São Paulo.

contained the largest number of trees in 1978—about 44.9 million. However, São José do Rio Preto realized the greatest increase in both nonbearing and bearing tree numbers between 1977 and 1978.

Total production of oranges has increased significantly since Brazil entered the world export market for frozen concentrated orange juice. Output in São Paulo State has risen from 21.6 million boxes in 1963 to 150 million boxes in 1978.³ However, production in 1979 dipped to around 145 million boxes (see table 5).

Despite the decline, new plantings during 1979 are estimated to be as large as those in 1978, and they are expected to continue at a relatively high rate in the first half of 1980. The rate of increase in new plantings in the years ahead will depend to a large extent on prices received by the growers for their fruit.

Farm Characteristics⁴

Industry sources estimate that São Paulo State has about 5,000 commercial farms devoted mainly to citrus. Based on the IEA's estimate of 89.5 million trees in São Paulo State in 1978 (see table 4), the average holding is about 17,000 trees. The size of individual holdings varies considerably—from many farms having only 500 trees to a few with more than 500,000. On the whole, these farms average about 210 trees per hectare. Many of the smaller farms, however, average up to 250 trees per hectare.

Most of the citrus farms are owner operated, with very little land leased for citrus production. Commercial citrus groves operated by tenant farmers are uncommon.

Irrigation

The rainy season in São Paulo State begins in October and lasts until about April. The principal bloom is in August and September, two of the driest months.

³Orange production estimates include small amounts of tangerines. See table 16 for a historical time series of production data (1960-78).

About 98 percent of the citrus groves in Brazil rely entirely on rainfall for moisture needs. Although irrigation enhances yields, irrigation of citrus farms is uncommon in Brazil owing to the high costs of investment and energy.

One farm in the southern part of the commercial citrus zone accounts for almost all of the irrigated citrus in São Paulo.⁴ The farm encompasses about 3,100 hectares and has approximately 500,000 trees. Most of its production is sold to the fresh fruit market, both local and export. About 40 percent of Brazil's fresh citrus exports originate from this farm.

Yields

Because irrigation is not widely practiced in the major citrus regions, yields vary in line with amount and distribution of rainfall. Yields, however, have tended to increase over the past decade, from 1.20 to 1.50 boxes per tree in the late 1960's to between 1.57 and 2.18 boxes during 1976-78 (see table 4). The 1978 average yield of 2.18 boxes per tree was a record high. The best managed groves regularly averaged between 3 and 4 boxes per tree in the late 1970's.

Yields are improving because of better cultural practices in both the nurseries and groves and better selection of rootstock and budwood. Application of fertilizers is universal, and the use of spray material is much more common than in the past. Because of high land values and favorable prices of oranges, farmers are now finding it more economical to take better care of their groves. Trade sources indicate that average yields are likely to improve substantially (especially in groves planted

⁴Most of its irrigation pumps are operated by electrical power rather than diesel fuel. The Government has supported the conversion of diesel pumps to electrical pumps by offering low-interest credit for the purchase of electrically powered irrigation equipment.

Table 6—São Paulo State: Costs of Establishing a Citrus Grove, 1979

[In U.S. dollars per hectare¹]

| Year | Labor | Seedlings | Fertilizer and lime | Spray materials | Machinery operation | Depreciation | Interest | Total |
|--------------------|------------|------------|---------------------|-----------------|---------------------|--------------|-----------|--------------|
| First | 138 | 165 | 45 | 34 | 106 | 32 | 34 | 554 |
| Second | 70 | 23 | 18 | 30 | 52 | 18 | 13 | 224 |
| Third | 81 | — | 49 | 57 | 61 | 21 | 15 | 284 |
| Fourth | 118 | — | 85 | 95 | 72 | 24 | 22 | 416 |
| Total | 407 | 188 | 197 | 216 | 291 | 95 | 84 | 1,478 |

— Denotes not applicable.

¹ Based on exchange rate of December 31, 1978: US\$1.00 = Cr\$19.95. Assumes 200 trees per hectare.

Source: Instituto de Economia Agrícola (IEA), São Paulo, *Informações Econômicas*, July 1978.

after 1975) and that a larger percentage of trees will be yielding as much as 4 boxes in the near future.

Cost of Establishing New Orange Groves

According to a 1978 study by IEA, the per-hectare cost of establishing an orchard is \$554 the first year and \$1,478 in the first 4 years (see table 6). The largest single expense is labor, followed by machinery operation.

The data in the study do not take into consideration the purchase price of land. In 1979, land purchase costs in São Paulo State average approximately \$1,730-\$1,850 per hectare for unimproved prime land. Based on 1977 currency values, land values increased from an index value of 100 in 1969 to 500 in 1978.

Operating Costs

In an August 1978 study, the IEA also estimated production costs of a well-established orange grove for the 1978 and 1979 production years (see table 7). Between these two seasons, production costs were projected to rise by 50 percent, from 8,224 to 12,309 cruzeiros per

hectare. The greatest increase was in disease and insect control.

However, when converted into U.S. dollar equivalents, the costs per hectare would increase from \$533 in 1978 to \$616 in the following year, a rise of only 16 percent. The devaluation of the cruzeiro in relation to the U.S. dollar is the reason for the differences in percentage increases when cruzeiros are converted to dollars.

Grower Prices

The Government indirectly controls prices paid for processing oranges, through a "reference" price based on the weight of the fruit, not on pounds solids. In other words, a grower receives the same price for the fruit regardless of its quality. Also, there is no differential based on the location of the groves.

Enforcement of the pricing scheme is carried out by the Foreign Trade Department of the Bank of Brazil (CACEX), which has the authority to deny export licenses to firms that do not comply with the prescribed price.

The 1979 season's price agreement was decided in late March 1979, and for the first time in 5 years, industry and grower representative agreed upon a price without

Table 7—São Paulo State: Costs of Operating a Well-Established Orange Grove, 1978-79

| Item | 1978 ¹ | 1979 ² | Increase | 1978 ¹ | 1979 ² | Increase |
|--------------------------------|------------------------------|-------------------|----------------|---|-------------------|----------------|
| | <i>Cruzeiros per hectare</i> | | <i>Percent</i> | <i>U.S. dollars per hectare³</i> | | <i>Percent</i> |
| Labor | 2,093 | 2,730 | 30 | 136 | 137 | 1 |
| Fertilizer and lime | 1,631 | 2,297 | 41 | 106 | 115 | 8 |
| Disease and insect control ... | 1,672 | 3,418 | 104 | 108 | 171 | 58 |
| Machinery | 1,216 | 1,674 | 38 | 79 | 84 | 6 |
| Others | 385 | 621 | 61 | 25 | 31 | 24 |
| Depreciation | 1,226 | 1,596 | 30 | 79 | 80 | 1 |
| Total | 8,224 | 12,309 | 50 | 533 | 616 | 16 |

¹ For harvest in calendar 1978. Assumes yield of 340 boxes per hectare. ² Forecast for harvest in calendar 1979. Assumes yield of 400 boxes per hectare. ³ Exchange rate as of December 31, 1977: US\$1.00 = Cr\$15.44; December 31, 1978: US\$1.00 = Cr\$19.95.

Source: Instituto de Economia Agrícola (IEA), São Paulo, *Prognóstico, 1978/79*, August 1978.

**Table 8—São Paulo State: On-Tree Prices
For Oranges Processed, 1970-79**

| Season ¹ | Price per box | |
|---------------------|------------------|----------------------------------|
| | <i>Cruzeiros</i> | <i>U.S. dollars</i> ² |
| 1970 | 4.00 | 0.88 |
| 1971 | 5.30 | 1.03 |
| 1972 | 6.50 | 1.12 |
| 1973 | 9.00 | 1.49 |
| 1974 | 6.80 | 1.04 |
| 1975 | 8.00 | 1.01 |
| 1976 | 10.00 | .95 |
| 1977 | 30.00 | 2.26 |
| 1978 | 36.00 | 2.04 |
| 1979 | 51.00 | 2.00 |

¹ Crop year beginning May 1 of indicated year. ² Based on exchange rate as of June 30 of each year.

Source: Reports of Agricultural Officer, American Consulate, São Paulo, and the IEA.

intervention from the Government. The 42-percent increase in the 1979 price over the previous year's was roughly equivalent to the rate of inflation in Brazil.

In 1978, most orange juice companies paid producers with a 90-day promissory note carrying a 22-percent annual interest rate, discounted from the grower's return. In 1979, however, the payment was different. Early in the season, the growers and industry representatives estimated the number of boxes a grove would produce throughout the entire processing season. Based on this estimate, the industry advanced the growers 11 cruzeiros per box in March or April and another 12 cruzeiros per box by August 31. Subsequent payments were made on

the 10th day of each month beginning in September, based on the number of additional boxes received by the plant during the month.

PROCESSING OPERATIONS

Number and Size of Plants

With the exception of a small plant in the northeastern State of Sergipe and three small plants in the southern States of Santa Catarina and Rio Grande do Sul, Brazil's citrus processing industry is located entirely in São Paulo State. There is a possibility, however, that a small plant may be built in São Paulo's neighboring state of Minas Gerais near the town of Frutal in 2 or 3 years because of the recent plantings of about 2 million trees in that area. Currently, about 75 to 80 percent of São Paulo's commercial orange production is processed into frozen concentrated orange juice, and almost all of it is exported.

Brazil started processing orange juice for export on a small scale in 1962 with the construction and completion of a small plant at Bebedouro. The following year a modern plant was built at Araraquara, about 170 miles northwest of São Paulo City. Presently there are 11 processing plants in São Paulo State, and there are plans (some definite, others less so) to build four more plants to begin operation by the 1981 or 1982 seasons (see table 9). If built as planned, the four new plants would have a combined total of 40 extractors and the

Table 9—São Paulo State: Location and Capacity of Citrus Processing Plants, 1979-80

| Plant location | Ownership | 1979 | | 1980 | |
|------------------------------|------------------|-------------------------|------------------------|-------------------------|------------------------|
| | | Extractors ¹ | Evaporation capacity | Extractors ¹ | Evaporation capacity |
| | | <i>Number</i> | <i>Pounds per hour</i> | <i>Number</i> | <i>Pounds per hour</i> |
| North: | | | | | |
| Bebedouro | C | 60 | 210,000 | 80 | 310,000 |
| Do | D | 48 | 170,000 | 72 | 270,000 |
| Colina | A | 48 | 170,000 | 96 | 400,000 |
| Central: | | | | | |
| Araraquara | A | 84 | 335,000 | 84 | 335,000 |
| Matão | B | 83 | 400,000 | 83 | 400,000 |
| Do | E | 12 | 30,000 | 24 | 30,000 |
| Do | F | 4 | 10,000 | 8 | 20,000 |
| South: | | | | | |
| Araras | ² A/B | 28 | 52,000 | 28 | 52,000 |
| Limeira | B | 44 | 83,000 | 44 | 183,000 |
| Do | ² A/B | 24 | 45,000 | 24 | 45,000 |
| Santo Antonio de Posse | ² A/B | 12 | 30,000 | 12 | 30,000 |
| Total | | 447 | 1,535,000 | 555 | 2,075,000 |

¹ Most of the extractors operate at a speed of 75 rpm and are capable of crushing about 2 to 3 boxes of fruit per minute. Some of Brazil's newer extractors operate at 100 rpm. ² Plants are owned jointly and equally by firms A and B.

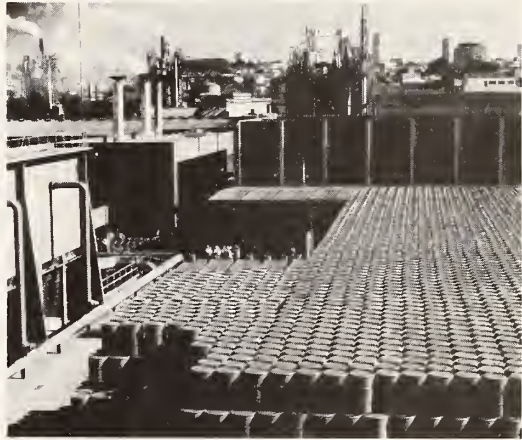
Sources: Industry and trade sources, São Paulo.



1



2



3



4



5

1. A large irrigated and high-yielding citrus grove in Brazil's São Paulo State. This farm alone accounts for around 40 percent of Brazil's exports of fresh citrus.

2. Edmond Missiaen, former U.S. Agricultural Officer, São Paulo, and a Brazilian grower examine young citrus trees.

3. Drums that will be used for exporting frozen concentrated orange juice are stockpiled outside of a processing plant at Araraquara.

4. The exterior of a small citrus processing plant at Matão. This plant has one evaporator capable of removing 10,000 pounds of water vapor per hour.

5. Niklos Naday, a Brazilian grower, inspects young trees ready for transplanting into a grove.

Plant Equipment and Material

capacity to evaporate 130,000 pounds of water per hour. The plants are to be located in the cities of Bebedouro, São José do Rio Preto, Olímpia and São Paulo City.

To meet the expected increase in orange production and maintain their share of the market, 6 of the 11 processing plants are expanding their processing capacity by installing new juice extractors and evaporators. With the expansion of the existing plants, the number of juice extractors in Brazil is expected to increase to 555 by the middle of the 1980 season. The evaporators will be able to remove a total of 2,075,000 pounds of water per hour.

In an effort to be more cost efficient and produce a better quality product, Brazilian processors are beginning to install tank farms for concentrate storage. One of the largest firms, located in Araraquara, installed a tank farm consisting of twenty to thirty 100,000-gallon capacity (498 tons net weight equivalent of concentrate⁵) cold-storage tanks so as to reduce handling costs, obtain consistent blends, and facilitate the transfer of juice in bulk. Such tank farms have been in existence in Florida since 1972, but never before in Brazil.

With the exception of one or two of the smaller plants, all of Brazil's processing plants have the necessary equipment to produce not only concentrated juice but a number of byproducts.

The machinery (including juice extractors evaporators, dryers, centrifuges, waste heat evaporators) is fully automated and is as modern as that in the United States.

The bulk of Brazil's juice extractors are leased from an American-owned firm. In addition, the evaporators and several other pieces of machinery are purchased from and installed by U.S. firms. In 1979, one plant in Matão, installed the world's largest single evaporator, which has the capacity to remove 180,000 pounds of water vapor per hour.

The 52-gallon (259 kg net-weight) drums utilized to store and ship concentrate are all manufactured in Brazil. At least one major processing firm owns its own drum manufacturing plant.

Ownership

As indicated in table 9, firms A and B account for most of the processing capacity in São Paulo State by having 323 extractors out of 445 in 1979. Furthermore, these two companies control 7 of the existing 11 processing plants.

The industry has undergone extensive reorganization in the past few years. Firms A and B (the larger firms) formed a holding company in 1977 and bought out three small, independently owned plants located in Araras, Limeira, and Santo Antônio de Posse in the same year. Furthermore, a U.S.-based firm purchased a Brazilian-owned firm in late 1976, and a growers' cooperative brought a plant from the São Paulo Government in March 1979.

All of the firms except two are owned and operated by Brazilian companies. Firm B is 50 percent German and 50 percent Brazilian, and Firm D is owned by a U.S. company.

Only one of the plants is owned and operated by a growers' cooperative. The cooperative purchased the plant in March 1979 from the São Paulo State Government, which appropriated it in 1974 after the original European owners declared bankruptcy. About 650 of the cooperative's 3,000 members have capital investments in the plant.

Another growers' cooperative has expressed interest in building a small juice plant in São José do Rio Preto by the 1980/81 or 1981/82 processing season. Founded in 1978, the cooperative has about 300 members but expects membership to reach two to three times that level by the end of the 1980's.

Labor Costs

Wages for unskilled laborers working in citrus processing plants run fairly close to the official minimum wage. As of May 1, 1979, the official minimum wage in São Paulo State was Cr\$9.45 per hour or Cr\$2,268 per month. Based on the June 30, 1979, exchange rate, these figures are equivalent to US\$0.37 per hour or \$88.87 per month. The official wage rate is adjusted for inflation every 6 months.⁶

Semiskilled or skilled workers are paid slightly to moderately more than unskilled workers depending on their specialty. Labor costs to the employer are actually higher than the actual wages paid to the worker because of the added costs of fringe benefits, such as health care, retirement, and bonuses. Both men and women work in Brazil's processing plants. During the peak season, plants operate 24 hours per day.

Orange Varieties for Processing

The principal orange varieties for processing are the Hamlin, Pera, Natal, and Valencia. The Hamlin is the predominant variety crushed during the first part of the processing season. Compared to other orange varieties, it is low in solids and poor in color. Juice from the Cravo tangerine often is blended with that from the Hamlin to improve the color.

The Pera orange accounts for about 70 percent of all oranges and tangerines processed and is harvested mainly from July to mid-November (see table 10 and chart). The Pera produces a high-quality juice and is well suited for the climate in São Paulo State.

⁵One ton of concentrate (65° brix) equals 200.838 gallons (65° brix.)

⁶Before 1979, wages were adjusted annually.

Table 10—Principal Varieties of Oranges and Tangerines Processed In Brazil

| Item | Principal harvesting periods | Share of total processed |
|--------------------|------------------------------|--------------------------|
| | | <i>Percent</i> |
| Oranges: | | |
| Hamlin | April-mid-July | 8 |
| Pera | July-mid-November | 70 |
| Natal | mid-August-December | 10 |
| Valencia | mid-August-December | 7 |
| Tangerines: | | |
| Cravo | March-May | 2 |
| Dancy | May-July | 1 |
| Murcott | mid-July-mid-October | 2 |

Source: Agricultural Economics Institute, Campinas, São Paulo. Percentages obtained from interviews with various trade and Government officials.

The Natal and the Valencia are both late maturing oranges, harvested principally from mid-August through December. Because of Natal's high brix-acid ratio, planting trends are being directed toward it and away from the Valencia.

For purposes of obtaining a high-quality blend, Brazil's orange juice output consists of about one part tangerine juice to about 20 parts orange juice. Important

tangerine varieties, other than the Cravo, include the Murcott and Dancy.

Citrus Byproducts

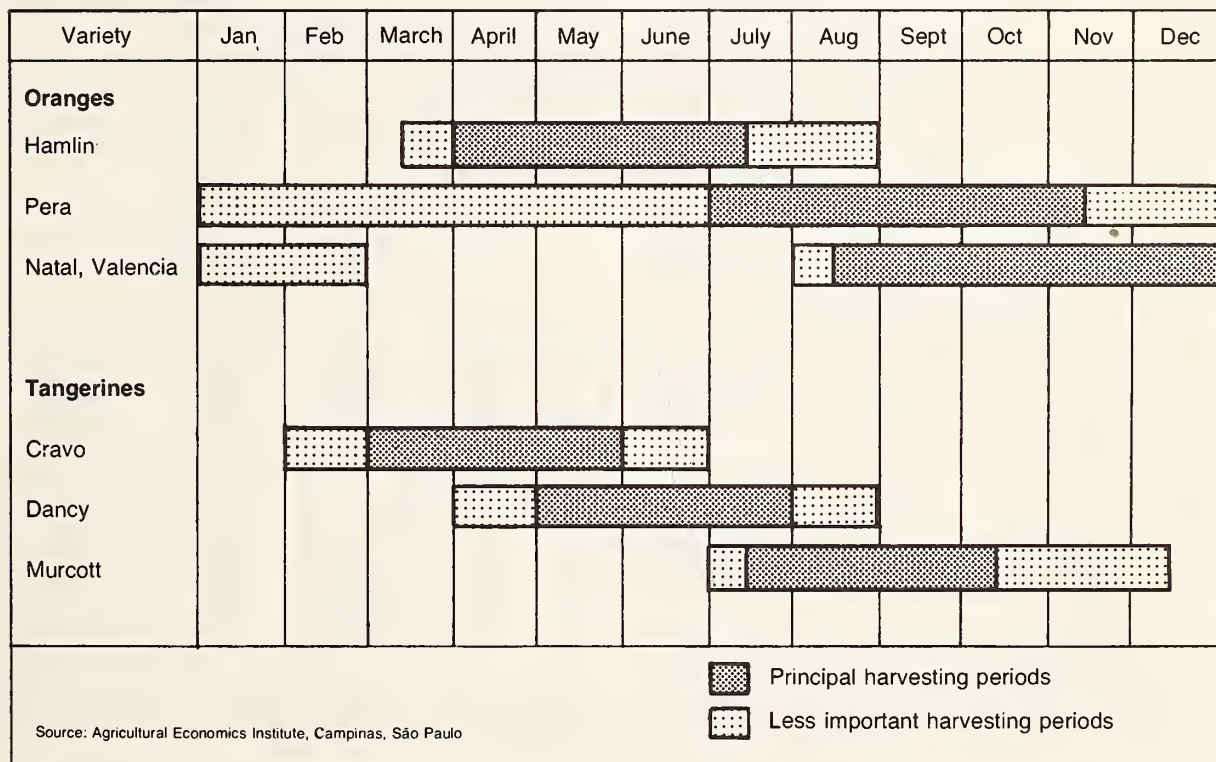
Although the Brazilian citrus processing industry is based on the production of frozen concentrated orange juice, modern equipment enables almost every plant to utilize the orange in its entirety. The most important by-products of the Brazilian juice industry are citrus pulp pellets, essential oils, essence oils, and D-limonene.

Citrus pulp pellets (CPP) are made from the peel, internal membranes, juice vesicles, and seed residue that are ejected by the fruit extractors. Brazil makes a so-called "sweetened pulp" as citrus molasses (made from press liquor) is added to the curing peel residue. All CPP is used for cattle feed, and the addition of molasses makes the feed more palatable. Over 95 percent of the CPP output is exported to Western Europe, principally to West Germany and the Netherlands.

Essential oils are obtained from the peel of the citrus fruit, and essence oils, from the water vapor during the evaporation process or concentration of citrus juices. D-limonene, or stripper oil, is obtained as a byproduct from the manufacture of citrus molasses.

These "oils" have wide and varied applications. They are used as flavorings in foods, beverages, and con-

São Paulo State: Harvesting Periods of Principal Orange and Tangerine Varieties



fectionaries and as solvents in soaps and perfumes. They also have wide applications in the manufacture of products such as rubber, plastics, and textiles.

Supply and Distribution of Orange Juice and Pulp Pellets

There are no official data on the quantity of frozen concentrated orange juice and citrus pulp pellets produced. However, an indication of the total output of these products can be obtained by examining export and consumption data and assuming that the carryover of pipeline stocks from one season to the next remains unchanged (see table 11)⁷.

About 398,000 tons of FCOJ⁸ and 470,000 tons of CPP were produced from the record 117 million boxes (4.8 million tons) of oranges processed in São Paulo State during 1978. In the same year, yields of FCOJ and CPP per box of oranges processed were 3.4 and 4.2 kilograms, respectively.

Output of FCOJ in 1979 is forecast at 391,000 tons, slightly below the 1978 level. However, production of CPP rose about 13,000 tons from the 470,000 tons of 1978. The greater output of CPP is attributed to the fact that almost all of the pulp in 1979 was processed into pellets, whereas in the previous year only 95 percent of the pulp was processed for market use.

⁷Supply and distribution data for 1979 are forecasts.

⁸All orange juice concentrate output is 65° brix, one metric ton of which is equivalent to 200.84 U.S. gallons of 65° brix concentrate.

Exports of FCOJ during the 1979/80 marketing year (July 1- June 30) are expected to drop significantly from those in 1978/79. The projected decline is attributed mainly to a rebound in Florida's 1979/80 orange crop to 200 million boxes (a record high) from the reduced levels of 1977/78 and 1978/79. Those short crops drove up U.S. prices of concentrate, creating an enormous demand for imported juice and making the United States Brazil's leading buyer of concentrate last year. However, U.S. demand for imported juice has since fallen sharply.

Those reduced 1979/80 exports will leave Brazil with carryover stocks of FCOJ for the first time. Based on an estimated consumption level of 18,000 tons and exports of 283,000 tons, stocks are forecast to reach 90,000 tons by the end of 1979/80.

MARKETING

Currently, all the frozen juice concentrate for export is packaged in 52-gallon steel drums. The drums are double-lined with polyethylene bags, filled with chilled concentrate juice, and then placed in cold (frozen) storage warehouses. The drums are transported by truck to the port of Santos, from where practically all of Brazil's concentrate is exported. A typical truck can haul about 80 drums, and the trip to the port of Santos takes 8 to 10 hours from most processing plants in São Paulo State. The trucks are covered with double-insulated tarpaulin, which generally results in a temperature loss of 2 to 3 degrees centigrade during the trip to Santos. At Santos, there is cold storage space for about 160,000 drums (41,462 tons, net weight).

Table 11—São Paulo State: Production and Distribution of Frozen Concentrated Orange Juice and Citrus Pulp Pellets, 1976-79¹

| Item | Unit | 1976 | 1977 | 1978 | Forecast 1979 |
|------------------------------------|------------------------------|------|------|------|---------------|
| Oranges: | | | | | |
| Production | 1 million boxes ² | 100 | 92 | 150 | 145 |
| Processed | — do — | 67 | 62 | 117 | 115 |
| Percent processed | percent | 67 | 67 | 78 | 79 |
| FCOJ: | | | | | |
| Beginning stocks | 1,000 metric tons | 0 | 0 | 0 | 0 |
| Yield per box of oranges | kilograms | 3.15 | 3.70 | 3.40 | 3.40 |
| Production ² | 1,000 metric tons | 211 | 229 | 398 | 391 |
| Exports | — do — | 196 | 220 | 390 | 283 |
| Apparent consumption | — do — | 15 | 9 | 10 | 18 |
| Ending stocks | — do — | 9 | 0 | 0 | 90 |
| CPP: | | | | | |
| Beginning stocks | 1,000 metric tons | 0 | 0 | 0 | 0 |
| Yield per box of oranges | kilograms | 4.2 | 4.2 | 4.2 | 4.2 |
| Production ² | 1,000 metric tons | 281 | 260 | 470 | 483 |
| Exports | — do — | 275 | 253 | 463 | 473 |
| Apparent consumption | — do — | 6 | 7 | 7 | 10 |
| Ending stocks | — do — | 0 | 0 | 0 | 0 |

¹ Years beginning May 1 for production and processing and years beginning July 1 for exports. ² One box = 40.8 kilograms or 90 pounds. In 1978, only about 95 percent of the citrus pulp was processed into pellets for market use.

Source: Reports from Agricultural Officer, American Consulate, São Paulo.

The method of transporting juice, however, is currently undergoing rapid change. In the near future, one major firm will ship a portion of its output in bulk to Europe, as opposed to shipping in the 52-gallon drums. The frozen slush juice will be transported by truck from the processing plant to Santos at temperatures well below freezing in stainless steel containers insulated with fiberglass, holding 20 to 22 tons each. The juice will be pumped from the trucks and stored at Santos in 100,000-gallon cold-storage tanks and later discharge directly into a vessel especially adapted for bulk transport of concentrated juice. When the ship reaches its destination, the concentrated juice will be discharged into other storage tanks and then transported by truck to various bottlers.

Company officials indicate that this project is economical and furthermore is a prototype for future shipment of almost all Brazilian juice. They expect to save \$80 to \$100 per metric ton of concentrate, or about 8 to 10 percent of the f.o.b. Santos price when the bulk transportation system is fully operational. The savings will be mainly from not having to bear the high cost of drums (about US\$14 each) and the double-polyethylene liners (about US\$1.50 per drum). Officials also anticipate lower fuel costs and have indicated that bulk transportation will ensure a better quality product because of reduced contamination and heat loss.

Most sales are made on a c.i.f. basis and are handled individually by each company through its own sales and distribution offices and through wholesalers. There are no national or quasi-State organizations involved in the marketing of citrus products. Since practically all the Brazilian juice loses its national identity once it reaches the marketplace, no advertising is currently undertaken, and none is planned.

Since 1976, there have been no Government-decreed minimum export prices for orange juice. The extensive reorganization of the industry over the past couple of years, however, resulted in the juice firms' agreeing on a common export price. The industry has learned that

price wars and price undercutting is dangerous and can prove disastrous. The financial failure of the smaller processing firms in the mid-1970's was brought on, in part, by vicious price competition among processors.

Trade sources view the domestic market as untapped, as only 3 to 6 percent of the total juice output goes to this sector. The domestic market has proven difficult to develop because of the ample supplies of fresh oranges and other fruit throughout the year, competition from other beverages, and a lack of cold storage facilities. Currently, practically all the juice consumed in Brazil is squeezed from fresh oranges.

One large processor has formed a joint venture with a large multinational beverage company to produce and distribute a new orange juice product for the domestic market. The new product, which came on the market in late 1979, does not require refrigeration and is marketed in quarter-liter cartons of concentrate and one-liter cartons of reconstituted juice.

GOVERNMENT ASSISTANCE AND CONTROLS

Assistance to Growers

The Federal and State Governments have extended a number of benefits to facilitate the development of citrus. Among the more important ones are the availability of subsidized credit, assistance in establishing grower prices for oranges, and the establishment of several research and extension programs.

Subsidized credit for the financing of production expenses (such as fertilizer, pesticides, labor, and machinery operation) is one of the Government's principal contributions to the grower sector. Loans for the purchases of fertilizer are interest free, and interest rates for the financing of other production expenses range from 15 to 18 percent. In real terms, adjusted for inflation, these interest rates are indeed favorable alongside an inflation rate of 41 percent in calendar 1978 and 77 percent in 1979.

In view of the high rate of inflation, the availability of low-interest credit is limited, and most of the loans cover less than 80 percent of a grower's total annual variable costs of production. Investment credit for the financing of new groves has not been available for several years.

Citrus is not one of the agricultural commodities included in the Government's minimum price program.⁹ However, the State and Federal Governments work with growers and processors to establish mutually acceptable "on tree" prices for oranges bought by the processing

Table 12—Brazil: Average F.O.B. Price (Santos) of Frozen Concentrated Orange Juice

[In dollars per metric ton]

| Month | 1975 | 1976 | 1977 | 1978 | 1979 |
|---------------------|------|------|-------|-------|-------|
| January | — | 483 | 488 | 1,061 | 1,020 |
| February | — | 478 | 488 | 1,048 | 783 |
| March | — | 481 | 514 | 1,009 | 980 |
| April | — | 480 | 515 | 1,047 | 962 |
| May | — | 475 | 520 | 1,041 | 967 |
| June | — | 481 | 847 | 1,031 | 937 |
| July | 432 | 473 | 809 | 977 | 967 |
| August | 427 | 480 | 923 | 973 | 966 |
| September | 461 | 489 | 1,011 | 976 | 958 |
| October | 467 | 479 | 1,019 | 979 | 955 |
| November | 472 | 494 | 1,041 | 977 | 955 |
| December | 476 | 482 | 1,035 | 973 | 955 |

—Indicates data not available.

Source: Bank of Brazil/CACEX.

⁹The minimum price program includes about 45 agricultural commodities and is controlled and administered by the Production Financing Commission (CFP) within the Ministry of Agriculture.

industry. This reference or grower price (discussed on page 7) was set at 51 cruzeiros per box of oranges for the 1979 season. The purpose of the reference price is to ensure growers a fair return for their fruit.

The Federal and São Paulo State Governments, convinced that only better and more intensive research can lead to higher agricultural productivity, have initiated programs aimed at improving citrus cultivation and fruit quality. The Brazilian Agricultural Research Enterprise (EMBRAPA), a Federally funded program, operates 15 major regional and crop research centers throughout Brazil and finances graduate-level education for hundreds of researchers, both at home and abroad. EMBRAPA's citrus research staff is centered at the National Fruit and Manioc Research Center in Cruz das Almas in the State of Bahia. However, citrus research at this center has only recently gotten underway.

The São Paulo State Government also plays a major role in helping to improve citrus production techniques—via its research centers, universities, and extension services. Two noted State research institutions actively involved with citrus are the Campinas Agronomic Institute (IAC) and the Biological Institute. Research at the IAC, which operates the Citrus Experimental Station near Limeira, is aimed at improving plant genetics and cultivation techniques. Research at the Biological Institute is geared toward disease and pest control. Both institutes are part of the State Secretariat of Agriculture.

At present, the São Paulo State University system is not heavily involved with citrus research, mainly because of a lack of grants in this area. However, more money for citrus research is expected to be made available in the future. ASSOCITRUS, a growers organization, has made firm plans to fund two university professors (at the campus in Jaboticabal) to conduct applied research in the area of citrus cultivation.

São Paulo State also operates agricultural extension centers in each of its municipalities. This State is the only one in Brazil that is not associated with EMBRATER, the national agricultural technical assistance and extension system. São Paulo's own system is closely integrated with its agricultural research programs.

Assistance to growers has also been extended through the National Campaign for the Eradication of Citrus Canker (CANECC), a Federal- and State-supported program that was established in 1957. During the 23 years of the program's operations, about 1.7 million trees have been uprooted in São Paulo State on about 79,000 properties. Most of the removals occurred in the southwestern part of the State.

The total expenses of CANECC in 1978 in São Paulo were \$44.7 million cruzeiros (US\$25.4 million).¹⁰ Of the total outlay, the Federal and São Paulo State Governments contributed Cr\$5.2 and Cr\$30.0 million, respectively, and a grower and processor organization, FUNDECITRUS, contributed the remainder (about Cr\$9.5 million).

FUNDECITRUS was formed in 1977 with the objective of reinforcing the eradication efforts of CANECC. The organization is funded by both the growers and processors in São Paulo State via a check-off system on boxes of citrus processed. For every box destined for a processing plant in the 1979 season, the growers contributed 8 centavos (about 0.31 U.S. cent)¹¹ and the processors contributed 25 centavos (about 1.0 U.S. cent) to the program.

To date, CANECC has been successful in preventing the spread of citrus canker to the commercial production centers, and presently the disease is not a problem, *per se*. However, it poses a serious threat to the citrus industry because it could spread to the commercial zone. Citrus canker is still prevalent in some areas, particularly in the States of Parana' and Mato Grosso do Sul,¹² and needs to be monitored constantly.

Assistance to Processors

Federal and State assistance to processors includes duty-free imports of factory equipment, attractive credit terms, and various tax incentives and subsidies conducive to increased production and exports of frozen concentrated orange juice.

The Brazilian Government allows duty-free entry of all factory parts and equipment for citrus processing plants where there is no domestically produced substitute. The exemption greatly benefits citrus processors because much of their machinery and parts are not available locally.

The Government also provides subsidized credit to processors to finance investment in new factory equipment. Processors can borrow up to 70 percent of the cost of the equipment at below-market interest rates. In 1979, the interest rate was 22 percent per annum for a 5- or 6-year term loan. The credit is additionally attractive because of an 18- to 24-month grace period before repayment of principal begins. However, not all processors use subsidized credit for factory investment; some prefer to reinvest their own earnings in plant expansion.

In addition, subsidized financing of production for export is available to processors under terms of the Central Bank Resolution 515 of February 2, 1979. This resolution permits processors to borrow up to 30 percent of the value of their exports in the previous year. The average repayment period is 276 days. Six months after the initial loan, and depending on the availability of Federal funds, processors can obtain an additional loan equal to 20 percent of the increase in exports during the past 6 months over those in the corresponding period of the previous year. The interest rate on Resolution 515 financing is 8 percent per annum discounted at the time

¹¹Based on June 30 exchange rate: US\$1.00=Cr\$25.52.

¹²The Federal Government contributed an additional Cr\$18.4 million in 1978 to CANECC to combat citrus canker in the States of Parana' and Mato Grosso do Sul.

¹⁰Based on June 30 exchange rate: US\$1.00=Cr\$17.60.

of the loan. Commercial interest rates in mid-1979 were running around 50 percent.

The basic tax structure in Brazil contains features that greatly benefit producers and exporters of FCOJ. Oranges processed in São Paulo State for export are not subject to the 14-percent ICM tax, (a State-levied value-added tax), and exporters of FCOJ are not subject to the 8-percent IPI tax (a federally levied value-added tax). Profits made from export sales of FCOJ are also exempted from the corporate income tax. For products not exempted, the tax is 30 percent of the gross profits.

An important subsidy available to exporters of FCOJ is gradually being phased out. Before 1979, exporters received a tax credit equal to 20 percent of the f.o.b. value of export sales. This was reduced in January 1979 to 18 percent and in April 1979 to 17 percent. The tax credit is to drop 1 percent per calendar quarter until it is completely eliminated in 1983.

Controls

One of the most important measures of control relates to the issuance of export licenses. No shipments of FCOJ can leave Brazil without a license issued by the Foreign Trade Department of the Bank of Brazil (CACEX). This regulation gives the Government a means of enforcing standards, such as the payment of the agreed-upon reference price for oranges.

At present, the Federal and State Governments exercise little control elsewhere over the citrus industry. A firm may construct a new plant or expand existing facilities with little interference, and there are no identity or minimum-quality requirements on citrus products. However, the Government indirectly controls many facets of the industry by having the power to withdraw the financial and other assistance extended to both growers and processors.

Grower and Processor Organizations

The two principal grower organizations are the São Paulo Federation of Farmers (FAESP) and the São Paulo Citrus Producers Association (ASSOCITRUS). Their purpose is to represent the interests of the growers with the Federal and State Governments.

FAESP was established several years before ASSOCITRUS and represents growers of all crops (including citrus) in São Paulo State. As the citrus industry grew in size and importance, however, growers felt the need to establish an organization solely for citrus farmers—in an effort to strengthen their position and power. The resultant organization, ASSOCITRUS, was founded in 1974 and currently has about 2,500 members. It is funded by a check-off on each box of citrus processed. In 1979, the per-box check-off was 10

centavos, with 8 going to FUNDECITRUS¹³ and 2 to cover operating costs.

The Brazilian Association of Citrus Juice Producers (ABRASUCOS), founded in 1974, is the only processors' organization of any significance. Its purpose is to represent the interests of traders of FCOJ, four of which are currently represented.

PRODUCTION OUTLOOK

By the mid-1980's, Brazil's FCOJ industry is likely to have the potential to export between 545,000 and 625,000 tons of concentrate. These levels are up substantially from the record 390,000 tons exported in the 1978/79 season (July-June) and double the average level of exports in the 1976 and 1977 seasons.

Supply and distribution potentials of FCOJ and CPP in São Paulo State can be derived for 1985, given the following assumptions:

- Orange output in São Paulo State will range between 220 and 240 million boxes by 1985.
- Domestic consumption of fresh oranges will increase at an annual rate of 3 percent from the average level obtained during 1976-78.¹⁴
- Yields of FCOJ and CPP will remain constant at the 1976-78 average level.
- Domestic consumption of concentrates will total 50,000 tons.¹⁵
- The percent of the total output of CPP exported in 1985 will remain constant at the 1976-78 average level.

The projections are summarized in table 13. Output of FCOJ is expected to amount to 595,000 tons in 1985, if São Paulo's crop totals 220 million boxes, and 673,000 tons if the crop reaches 240 million boxes. Production of CCP would, in turn, range between 748,000 and 832,000 tons.

The data in table 13 also show that a greater proportion of the total orange crop is expected to be processed in 1985 than during the 1970's and a greater share of FCOJ may be consumed domestically. Industry and trade sources in Brazil have indicated that this will be the case. The processing capacity in Brazil is rapidly increasing, and Brazilian sources are projecting a gradual upward trend in domestic consumption as new consumer products come on the market.

MARKETING PROSPECTS

Brazil is the world's dominant supplier of FCOJ, controlling 80-85 percent of annual exports of this product. An anticipated production growth of 45 to 60 per-

¹³FUNDECITRUS is discussed in more detail on page 14.

¹⁴The annual growth rate of 3 percent is slightly greater than Brazil's population growth rate of about 2.5 percent per annum.

¹⁵Based on interviews with industry and trade sources.

Table 13—São Paulo State: Production and Distribution Forecasts of Frozen Concentrated Orange Juice and Citrus Pulp Pellets, 1985

| Item | Unit | Average 1976-78 | 1985 forecast ¹ | |
|--|------------------------------|--------------------|----------------------------|----------------|
| | | | Lower limit | Upper limit |
| Oranges: | | | | |
| Production | 1 million boxes ² | 114 | 220 | 240 |
| Processed ² | — do — | 82 | 178 | 198 |
| Share processed | percent | 72 | 81 | 82 |
| Frozen concentrated orange juice: | | | | |
| Beginning stocks | 1,000 metric tons | 0 | 0 | 0 |
| Yield per box of oranges | kilograms | 3.4 | 3.4 | 3.4 |
| Production | 1,000 metric tons | 279 | 605 | 673 |
| Export potential | — do — | 268 | 555 | 623 |
| Share exported | percent | 96 | 92 | 93 |
| Apparent consumption | 1,000 metric tons | 11 | 50 | 50 |
| Ending stocks | — do — | 0 | 0 | 0 |
| Citrus pulp pellets: | | | | |
| Beginning stocks | 1,000 metric tons | 0 | 0 | 0 |
| Yield per box of oranges | kilograms | 4.2 | 4.2 | 4.2 |
| Production | 1,000 metric tons | 337 | 748 | 832 |
| Exports | — do — | 330 | 733 | 815 |
| Share exported | percent | 98 | 98 | 98 |
| Apparent consumption | 1,000 metric tons | 7 | 15 | 17 |
| Ending stocks | — do — | 0 | 0 | 0 |

¹ Forecasts of the supply and distribution of FCOJ and CPP for 1985 are based on two orange production forecasts; a lower bound of 220 million boxes (8.98 million tons) and an upper bound of 240 million boxes (9.78 million tons). The estimates are further based on the assumption that domestic consumption of fresh oranges (noncommercial production and losses plus fresh commercial consumption) will increase at an annual rate of 3 percent from the average level obtained in 1976-78 and that the yields of FCOJ and CPP remain constant. ² One box = 40.8 kilograms or 90 pounds.

cent by 1985 points to further gains in the export market. The extent to which exports increase, of course, depends heavily on the demand.

Through 1978, demand for Brazilian juice was strong enough to move all Brazil's exportable output. The situation changed in 1979, however. Because of a record high orange crop in Florida, U.S. demand for Brazilian FCOJ fell sharply below that of 1978. As a result, Brazil may not be able to sell all of its concentrate in the 1979/80 marketing year, so that Brazil's FCOJ stocks could reach 90,000 tons by July 1980.

Despite this slowdown, all indications are that U.S. demand for Brazilian concentrate will regain its strength and continue at relatively high levels in the foreseeable future. Prices of domestic concentrate are not expected to subside to any considerable degree, and the trend toward increased consumption of orange juice, coupled with population growth, will help maintain sales in the United States. The U.S. Bureau of Census reports that U.S. population is likely to grow by 10 percent over the next 20 years.

Trade prospects also are promising in Western Europe and Canada, at least until the mid-1980's. The Brazilians see per capita consumption increasing in both of these areas because of a trend in consumer preference away from fresh oranges to juice. Orange juice consumption

in Canada, for example, rose 84 percent between 1971 and 1977.¹⁶

The current situation has made the Brazilians even more aware, however, of the danger of relying completely on traditional markets such as the United States, Canada, and Western Europe. Consequently, the industry is looking more seriously to Japan, Eastern Europe, and other nontraditional markets, as well as to its domestic market.

In a move to develop the domestic market, a major U.S. firm and a Brazilian firm have launched a joint venture to produce and distribute consumer-size packages of juice for local consumption. The consumer-size tetra-packs of concentrate and single-strength juice are currently being marketed in major population centers and appear to be selling well.

An abundant supply of citrus, coupled with high capital investments in processing equipment, suggests that Brazil will continue to be in the forefront as a producer of frozen concentrated orange juice for several years. The future of the industry is contingent on many factors, including marketing patterns abroad and developments within the local market.

¹⁶Tilley, Daniel S. Import and Retail Demand for Orange Juice in Canada. *Economic Research Department, Florida Department of Citrus, July 1979.*

Table 14—Brazil: Exports and Average F.O.B. Price of Frozen Concentrated Orange Juice, Calendar 1963-78¹

| Year | Exports | | Average F.O.B. price |
|----------|--------------------|------------------|-------------------------|
| | Total | To United States | |
| | <i>Metric tons</i> | | <i>U.S. dol. per MT</i> |
| 1963 ... | 5,313 | 735 | 408 |
| 1964 ... | 3,825 | 1,880 | 376 |
| 1965 ... | 5,760 | 1,318 | 327 |
| 1966 ... | 13,929 | 2,040 | 340 |
| 1967 ... | 18,647 | 3,403 | 359 |
| 1968 ... | 30,096 | 12,239 | 386 |
| 1969 ... | 23,245 | 2,824 | 469 |
| 1970 ... | 33,468 | 1,005 | 440 |
| 1971 ... | 77,334 | 23,395 | 464 |
| 1972 ... | 87,156 | 17,655 | 476 |
| 1973 ... | 120,990 | 10,983 | 526 |
| 1974 ... | 108,460 | 23,112 | 546 |
| 1975 ... | 180,897 | 20,609 | 454 |
| 1976 ... | 209,841 | 16,675 | 481 |
| 1977 ... | 213,524 | 46,807 | 829 |
| 1978 ... | 335,629 | 147,511 | 991 |

¹ Since 1969, all exports have been of 65° brix concentrate. Before 1969, one company exported 58° brix concentrate, and the others exported 65° brix.

Source: Bank of Brazil/CACEX, and reports of Agricultural Officer, American Consulate General, São Paulo.

Table 15—United States and Brazil: Exchange Rates, as of June 30, 1963-79

| Year | Cruzeiros to U.S. dollar |
|------------|--------------------------|
| 1963 | 0.60 |
| 1964 | 1.16 |
| 1965 | 1.83 |
| 1966 | 2.20 |
| 1967 | 2.70 |
| 1968 | 3.63 |
| 1969 | 4.02 |
| 1970 | 4.53 |
| 1971 | 5.16 |
| 1972 | 5.81 |
| 1973 | 6.06 |
| 1974 | 6.52 |
| 1975 | 7.92 |
| 1976 | 10.50 |
| 1977 | 13.30 |
| 1978 | 17.60 |
| 1979 | 25.52 |

Source: Department of Treasury, Special Reportings Branch.

Table 16—State of São Paulo, Oranges: Tree Numbers, Production, Processing, and Prices, 1960-78¹

| Year | Tree numbers ² | | | Production ³ | Processed ³ | Production of FCOJ ⁴ | Grower price ⁵ | | |
|------------|---------------------------|------------------|------------------|--------------------------------|--------------------------|---------------------------------|---------------------------|--------------------------------|--------------------------------------|
| | Bearing ² | Nonbearing | Total | | | | Cruzeiros per box | U.S. dol. per box ⁷ | |
| | <i>Thousands</i> | <i>Thousands</i> | <i>Thousands</i> | <i>1,000 boxes⁶</i> | <i>1,000 metric tons</i> | <i>1,000 boxes⁶</i> | <i>1,000 metric tons</i> | <i>Cruzeiros per box</i> | <i>U.S. dol. per box⁷</i> |
| 1960 | 13,594 | NA | NA | 14,400 | 588 | — | — | — | — |
| 1961 | 16,026 | NA | NA | 18,726 | 764 | — | — | — | — |
| 1962 | 17,012 | NA | NA | 19,200 | 784 | — | — | — | — |
| 1963 | 17,912 | NA | NA | 21,600 | 882 | 2,100 | 6 | 0.41 | 0.68 |
| 1964 | 19,050 | NA | NA | 16,160 | 660 | 1,600 | 5 | 1.38 | 1.19 |
| 1965 | 19,815 | NA | NA | 23,936 | 977 | 2,500 | 8 | 1.30 | .71 |
| 1966 | 21,550 | NA | NA | 29,856 | 1,219 | 4,200 | 14 | 1.50 | .68 |
| 1967 | 23,433 | NA | NA | 34,400 | 1,404 | 7,000 | 22 | 1.70 | .63 |
| 1968 | 25,435 | NA | NA | 35,560 | 1,451 | 10,000 | 33 | 2.40 | .66 |
| 1969 | 26,130 | 6,700 | 32,830 | 34,830 | 1,422 | 9,000 | 29 | 5.00 | 1.24 |
| 1970 | 28,500 | 10,500 | 39,000 | 44,350 | 1,810 | 15,000 | 48 | 3.80 | .83 |
| 1971 | 30,800 | 13,200 | 44,000 | 46,000 | 1,878 | 23,000 | 80 | 5.50 | 1.07 |
| 1972 | 34,700 | 15,500 | 50,200 | 60,700 | 2,478 | 34,000 | 107 | 7.00 | 1.20 |
| 1973 | 40,000 | 16,500 | 56,500 | 62,400 | 2,547 | 35,000 | 121 | 10.00 | 1.65 |
| 1974 | 44,000 | 26,020 | 70,020 | 82,000 | 3,347 | 49,000 | 170 | 7.00 | 1.07 |
| 1975 | 55,600 | 18,680 | 74,280 | 84,700 | 3,457 | 53,000 | 189 | 7.80 | .98 |
| 1976 | 57,330 | 18,616 | 75,946 | 99,600 | 4,065 | 67,000 | 211 | 11.75 | 1.12 |
| 1977 | 58,450 | 20,821 | 79,271 | 92,000 | 3,755 | 62,000 | 229 | 28.00 | 2.10 |
| 1978 | 68,810 | 20,729 | 89,539 | 150,000 | 6,122 | 117,000 | 400 | 36.00 | 2.05 |

NA — Not available.

— Zero or insignificant.

¹ Orange marketing year begins in April. ² Plantings are thought to average 210 trees per hectare. Trees are usually considered to be bearing in the 4th year after planting. ³ May include some tangerines. ⁴ Frozen concentrate orange juice, 65° brix. ⁵ Oranges for processing. ⁶ Boxes of 40.8 kg. (90 lbs.). ⁷ Using June 30 exchange rate.

Source: São Paulo Secretariat of Agriculture—Institute of Agricultural Economics (IEA); Reports of Agricultural Officer, American Consulate General, São Paulo, Trade.

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