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A GEOGRAPHICAL ANALYSIS OF THE CITRUS
INDUSTRY OF SÃO PAULO, BRAZIL

A Dissertation
Presented to
the Graduate Council of
The University of Tennessee

In Partial Fulfillment
of the Requirements for the Degree
Doctor of Philosophy

by
Robert George Pierson

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ABSTRACT

The purpose of this study is to analyze geographically the citrus industry of São Paulo, Brazil. The state of São Paulo is the nation's largest and most efficient citrus producer and is the country's only significant exporter of citrus fruit. Since the establishment of the São Paulo processing industry in 1962, Brazil has become one of the world's most important exporters of frozen concentrated orange juice. Research for the study included field trips to the citrus producing regions of São Paulo and work in numerous libraries in Brazil and the United States. Invaluable assistance was rendered by government officials and private growers.

Commercial citrus production in São Paulo began in 1869. The industry grew slowly until 1925, when the commencement of exports to Europe stimulated a period of rapid development. During the 1930's citrus production and exports increased significantly, but in 1940 expansion and prosperity were terminated by the Second World War and by tristeza, a tree-killing virus disease. After a decade of research the disease was brought under control and the industry entered another period of growth and prosperity which has continued to the present.

The physical environment of São Paulo is almost ideal for the production of citrus. Large portions of the state have level to undulating terrain. Precipitation exceeds 1,000 mm in all parts of the

state and temperatures in the main producing areas rarely fall below freezing. Occasional drought is the only climatic hazard. Soils in São Paulo generally lack humus and soluble minerals, but drainage in the producing regions is good.

Significant spatial changes have occurred in the state's citrus industry during the last four decades. Production originally developed in the southeastern part of the state. A number of factors such as urbanization, rising land values, and climatic advantages have caused the industry to move northwards. Bebedouro is the state's main center for the production of export and processing fruit and Limeira is the most important producing area for the domestic market.

Citricultural methods and practices in São Paulo vary considerably. Some growers utilize the best techniques and equipment available, while others provide little care for their groves. Generally, the large commercial farms are well managed and compare favorably with groves in Florida or other parts of the world.

Government assistance to the citrus industry has been limited primarily to the prevention and control of disease. Several minor forms of assistance have been the publication of useful information for citrus growers, the collection of statistical data and the promotion of legislation designed to aid the industry. Government help in organizing the industry and in promoting the sale of fruit overseas has been lacking.

The manufacturing of frozen concentrated orange juice began in 1962 when adverse climatic conditions reduced citrus production in Florida, the world's only major juice exporting region at that

time. In March, 1970, there were five processing plants in operation in São Paulo. The major product of these plants is frozen orange juice which is exported primarily to Europe and North America.

The marketing of fresh fruit for export is handled by several private companies that operate packing houses in the citrus producing regions. All export fruit is graded and packaged carefully. On the other hand, fruit that is sold on the domestic market generally receives little attention. The main consumers of citrus exports from São Paulo are the countries of western Europe, Canada and Argentina. Most of the citrus produced for the domestic market is consumed in the large urban centers such as São Paulo where the buying power of the people is highest.

The prospects of the São Paulo citrus industry appear to be good. Nurseries are producing several million seedlings annually. The area devoted to citrus production is increasing by an average of 7,540 hectares per year and the value of the state's orange crop has more than tripled since 1960. It must be realized, however, that the present level of prosperity is based in part on overseas sales of fruit and orange juice--about 44 per cent of the commercial citrus crop is exported. Until the domestic market is able to consume a larger proportion of the state's output of fresh fruit and frozen orange juice, the industry will continue to be influenced by fluctuations in the international market.

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CHAPTER I

INTRODUCTION

During the last half of the nineteenth century the state of São Paulo began to experience far-reaching changes which have made it Brazil's most prosperous state. The influx of several million European immigrants and the rapid growth of the coffee industry were the primary factors in São Paulo's rise to economic supremacy. For many years Brazil has been the world's chief supplier of coffee, and during much of this time São Paulo has been the largest producing state. Unfortunately, however, the state overreached itself and at times production greatly exceeded demand. By means of government intervention and control, a period of relative prosperity was maintained until 1929 after which the state's economic structure began to collapse. No longer could the entire state rely primarily on the fortunes of a single commodity.

Following the decline of the coffee industry, a number of changes have taken place. Both government and private investors have placed greater emphasis on the development of manufacturing than upon agricultural and pastoral activities. Agriculturists have paid more attention to crops other than coffee, while forestry, fishing, and mining have become increasingly important in the state's over-all economy. Within this atmosphere of economic diversification and

change, the state's citrus industry began to take on new economic significance.

In the early 1920's the production of citrus fruit in São Paulo gradually expanded. Within a few years small amounts of citrus fruit were being sold to Argentina and several countries of Europe. By 1930 the volume of fruit produced and exported had risen sharply, and the industry had assumed international proportions. However, abnormal trade conditions during the Second World War and tristeza, a serious tree-killing disease, brought this period of prosperity to an end in 1940. For many years São Paulo's citrus experts struggled to combat the effects of this disease. Success was finally achieved, and by 1955 both production and exports showed a strong upward trend. Since then the citrus industry not only has recovered, but has surpassed its former position. Today, São Paulo probably has a larger area devoted to citrus production than all other Brazilian states combined,¹ and Paulista² citrus fruit and frozen orange juice constitute two of the country's major food exports.³ On the international scene, Brazil

¹Table I on page 3 lists the area in citrus production for each state and territory in 1968. These figures were published by the Instituto Brasileiro de Estatística, a federal agency, and the indicated Paulista area differs significantly from that reported by the Secretaria da Agricultura de São Paulo. According to the latter's calculations, there were 121,100 hectares occupied by producing citrus trees in 1968. This is considerably more than the 75,430 hectare estimate of the federal government. No other part of Brazil has been experiencing such rapid expansion in citrus production as São Paulo. In 1969 a total of 156,300 hectares in producing citrus fruit, was reported by the Secretaria da Agricultura. These statistics indicate that São Paulo has a larger area in producing citrus trees than all the other Brazilian states combined.

²The term, Paulista, is the adjectival form for the name São Paulo. When used as a noun it refers to a person from São Paulo.

³Shackford Pitcher, "Brazil Expands Its Citrus Processing." Foreign Agriculture, Vol. VI, (Dec. 23, 1968), p. 9.

TABLE I
AREA IN PRODUCING CITRUS TREES IN BRAZIL
BY STATES AND TERRITORIES, 1968

State or Territory	Hectares
São Paulo	75,430
Minas Gerais	19,969
Rio Grande do Sul	16,562
Rio de Janeiro	16,295
Guanabara	7,360
Paraná	6,168
Sergipe	4,935
Bahia	4,724
Espírito Santo	4,040
Pernambuco	3,453
Goiás	2,955
Santa Catarina	2,656
Ceará	1,924
Maranhão	1,186
Mato Grosso	1,128
Paraíba	1,097
Pará	836
Alagoas	799
Piauí	711
Rio Grande do Norte	382
Amazonas	280
Acre	129
Distrito Federal	55
Rondônia	37
Amapá	34
Roraima	25
	173,170

Source: Anuário Estatístico do Brasil, 1967, Instituto Brasileiro de Estatística.

has become the world's second largest citrus producer, and the eighth largest citrus exporter (Tables II and III).⁴

The Problem.--The rise of the Paulista citrus industry to its present place of prominence is a significant development in the economic geography of the state. Major changes have occurred in the spatial arrangement and location of the industry. Scientific and technological advances have resulted in outstanding production gains. An entirely new dimension has been added by the recent establishment of a juice processing industry. The economy of the state has been strengthened by the export of citrus fruits and products to other sections of Brazil as well as to approximately 25 foreign countries. These developments reveal the growing importance of the citrus industry in the over-all economy of the state.

The purpose of this study is to describe the development of commercial citrus production in the state of São Paulo and to analyze the recent trends in the industry, particularly as they relate to prospects for continued expansion and growth. More specifically, answers to the following questions will be sought:

1. What characteristics of the physical environment have been significant in the development of the state's citrus industry? On the other hand, what are the detrimental aspects of the physical milieu?
2. In what ways has the cultural environment influenced the growth and prosperity of the industry?

⁴Table XXVI in the appendix shows the world's seven leading orange and tangerine producing nations as ranked by the U.S.D.A.

TABLE II
AVERAGE ANNUAL CITRUS PRODUCTION, 1963-1967

Countries	Metric Tons
1. United States	7,696,600
2. Brazil	2,489,600
3. Spain	2,103,000
4. Italy	1,877,600
5. Japan	1,669,000
6. India	1,238,200
7. Mexico	1,049,400
8. Israel	888,000
9. Argentina	842,400
10. South Africa	587,000
11. China (People's Republic)	580,000
12. Morocco	577,400
13. Egypt	545,800
14. Greece	502,400
15. Turkey	430,800
16. Algeria	417,600
17. Pakistan	406,800
18. Australia	249,400
19. Lebanon	236,600
20. Paraguay	226,200
21. Peru	225,400
22. Ecuador	204,000
23. Portugal	152,200
24. Venezuela	148,400
25. Bolivia	148,000
26. Cuba	127,200
27. China (Nationalist)	116,800
28. Jamaica	108,200
29. Cyprus	103,400
30. Others	1,376,800
Total	27,324,200

Source: Production Yearbook, 1968, Food and Agriculture Organization of the United Nations.

TABLE III

AVERAGE ANNUAL CITRUS EXPORTS, 1963-1967

Country	Metric Tons
1. Spain	1,169,400
2. Israel	552,100
3. Italy	492,000
4. Morocco	444,200
5. United States	426,300
6. South Africa	320,600
7. Algeria	205,600
8. Brazil	117,600
9. Greece	111,800
10. Lebanon	111,000
11. Cyprus	86,000
12. Mexico	58,400
13. China (People's Republic)	48,200
14. Tunisia	42,800
15. Turkey	31,900
16. Australia	23,200
17. Japan	16,600

Source: Trade Yearbook, 1969, Food and Agriculture Organization of the United Nations.

3. What is the historical background of the Paulista citrus industry?

4. What current methods and practices are employed by Paulista citriculturists and what basic problems confront them?

5. To what extent have federal and state governments assisted the citriculturists in meeting their problems?

6. In what parts of the state has commercial citriculture prospered the most and what is the locational significance behind the development of these regions?

7. To what extent is transportation a problem within the industry?

8. How is the industry succeeding in meeting its marketing problems? What relations exist between marketing and production? What are the implications of the processing industry, both at home and abroad?

9. What are the prospects for Paulista citriculturists and processors?

Sources of Data.--In order to analyze the Paulista citrus industry, and to answer the questions posed in the preceding section, it was necessary to collect data from a variety of sources both in Brazil and in the United States. Libraries, including the library of the Campinas Institute of Agronomy,⁵ and the libraries of the University

⁵The library of the Instituto Agronômico de Campinas is a major agricultural library in Latin America.

of Tennessee, the University of Florida, and Michigan State University were very helpful. Libraries belonging to various governmental agencies in the cities of São Paulo, Rio de Janeiro and Washington, D.C., also proved useful.

The most valuable sources of information were knowledgeable persons such as fazendeiros,⁶ government agricultural agents, citrus specialists in the São Paulo Department of Agriculture, the Campinas Agronomic Institute, the Limeira Experiment Station and the United States Consulate in the city of São Paulo.

Two trips were made to Brazil for field study. The first trip occurred in 1969 during the months of July, August and September when the São Paulo citrus industry was at the height of its harvesting, processing and exporting season. The second trip was made early in 1970 during the warmer months of February and March when the citrus industry was engaged in maintenance and preparatory activities. Field research in São Paulo included examining citrus groves and visiting numerous packing houses and processing plants. Visual and statistical comparisons were also made between Paulista citricultural areas and those of the states of Minas Gerais, Rio de Janeiro, Guanabara, and Rio Grande do Sul.

⁶A fazendeiro is the proprietor of a large farm or ranch.

CHAPTER II

THE HISTORICAL BACKGROUND OF THE SÃO PAULO CITRUS INDUSTRY

The growing of citrus fruits has been important in some parts of the world for several thousand years. Scattered references indicate that the Chinese were acquainted with at least two species of citrus four thousand years ago.¹ Citricultural historians are uncertain as to the exact place of origin for each citrus variety; however, they do agree that the original habitats were located within the southern and southeastern margins of Asia.² The spread of citrus trees from the Orient to the Mediterranean area was an important step in the history of citriculture, particularly since it occurred prior to the great era of European exploration. It is also significant that Portugal had become one of Europe's most important citrus producing countries not long before the discovery of Brazil.³

Arrival and Spread of Citrus Trees in Brazil.--The arrival of citrus trees in Brazil occurred shortly after its discovery by

¹H. J. Webber and L. D. Batchelor, The Citrus Industry (Berkeley and Los Angeles: University of California Press, 1943), p. 2.

²Samuel Tolkowsky, Hesperides: A History of the Culture and Use of Citrus Fruits (London: John Bale, Sons and Burnow, Ltd., 1938), p. 323.

³Webber and Batchelor, op. cit., p. 14.

Pedro Alvares Cabral in 1500. The Brazilian author Edmundo Navarro de Andrade in his book Citricultura points out that although the exact date for the arrival of citrus in Brazil is not definitely known, the orange tree is believed to have accompanied the first settlers.⁴

One of the earliest known European settlements along the Brazilian coastline appears to have been Cananéia (approximately 200 kilometers southwest of Santos) where a small group of castaways from the 1516 La Plata expedition of Juan Díaz de Solís set up house-keeping with some of the local Indian women.⁵ According to a Spanish document written by an anonymous author in 1540, many citrus trees had been observed in the vicinity of this settlement.⁶ Although there is insufficient evidence to prove that the castaways were actually responsible for planting the citrus trees, it is significant that only twenty-four years later there should be a report indicating the presence of many trees in the area.

According to J. Henry Burke, a prominent writer on citriculture, oranges were first brought to Brazil by the Portuguese

⁴Edmundo Navarro de Andrade, Citricultura (São Paulo: Brasil de Rothschild and Cia., 1929), p. 141.

⁵Richard M. Morse, The Bandeirantes (New York: Alfred A. Knopf, 1967), p. 7.

⁶Francisco Adolpho de Varnhagem, Historia Geral do Brasil Antes da sua Separação e Independência de Portugal (São Paulo: Companhia Melhoramentos de São Paulo, 1933), p. 117.

about 1530.⁷ This coincides closely with the date for the establishment of São Vicente (1532), Portugal's first settlement in Brazil.⁸

Even though historians are silent concerning the early presence of citrus plants at this settlement, it would seem highly probable that the Portuguese would have brought with them a wide variety of food bearing plants, including at least some species of citrus trees. This assumption seems plausible, not only because of the historical evidence given by Navarro de Andrade and Henry Burke, but because citriculture had attained a prominent place in Portuguese agriculture a short time before the discovery of Brazil.⁹

The earliest definite reference to citrus trees in Brazil was made by the Brazilian historian, Gabriel Soares de Sousa. De Sousa arrived in Bahia in 1567 and remained in the area for seventeen years. His description of the orange trees in the vicinity of Bahia not only suggests a plentiful supply of delicious fruit, but also indicates the early presence of a citrus-based perfume industry.

The orange trees that are planted by seed, do so well in the soil, that in three years they grow into trees taller than a man, and in this third year bear fruit that is larger and

⁷J. Henry Burke, Citrus Industry of Brazil. Foreign Agricultural Report No. 109 (Foreign Agricultural Service U.S.D.A., 1958), p. 3.

⁸Hubert Herring, A History of Latin America (New York: Alfred A. Knopf, 1968), p. 215.

⁹From the 17th century onwards citrus fruits were valued by explorers, not only as food, but because they helped to prevent scurvy. The benefits derived from these fruits in avoiding scurvy were recognized as early as 1601 by the British East India Company, but prior to that date there were many deaths at sea due to this vitamin deficiency disease. It was not until 1753 that J. Lind of the British navy published his Treatise on the Scurvy. As a result of Lind's investigations limes became a part of naval rations--resulting in the term "Limey". Daniel Monroe, "Scurvy," Encyclopedia International, v. 16 (New York: Grolier Incorporated, 1966), p. 314.

more delightful than any in the world; and the oranges have a very pleasant flavor that is very, very sweet, and the white jacket with which the sections are clothed is also sweet. The orange trees become very large and beautiful, and produce many blossoms from which a very fine perfume is made which has a more fragrant aroma than that from Portugal.¹⁰

Since the early colonists in Brazil were confined primarily to the littoral region, citriculture was limited to this area also; however, as time went on the population spread inland and so did the cultivation of citrus trees. During the colonial period Brazil's vast interior was explored by bands of adventurers from São Paulo looking mainly for Indians, gold and precious stones. These people, called bandeirantes, traveled much of the drainage basin of the Rio Paraná in their search for wealth and Indian slaves. At the present time large numbers of wild citrus trees can be found growing in forested areas along the banks of the Paraná, and residents within the region describe the existence of forests of sour orange trees.¹¹ The manner in which these trees were spread to their present location is uncertain, but it is possible that some of the early explorers or bandeirantes were responsible for their distribution.

Another manner of distribution was by natural means.

Tolkowsky points out that river currents, wild animals, and birds augmented the spread of citrus trees in Brazil.¹²

¹⁰Gabriel Soares de Sousa, Tratado Descritivo do Brasil, 3rd ed., (Rio de Janeiro: Companhia Editora Nacional, 1938), p. 180.

¹¹Visit with Paulo Marquart, former resident of western Paraná, Sept. 1969.

¹²Tolkowsky, op. cit., pp. 1, 2.

The discovery of gold (during the 1690's) and precious stones (1729) in the interior also aided the spread of citrus trees, for large numbers of people were drawn from the coast and dispersed over much of the country. According to Portuguese law, a fifth of the gold had to be paid to the Crown, causing some prospectors to scatter across the country to avoid the government tax collectors. In the following quotation, Benjamin H. Hunnicutt describes how these prospectors helped to spread citrus trees throughout much of Brazil.

They struck out through the trackless woods, avoiding the established highways, which were policed. They carried with them citrus fruits to prevent scurvy, and thus more citrus seeds were distributed. They were the Johnny Appleseeds of Brazil. It is no surprise to scientists to find citrus growing wild in every tropical and subtropical region of the country.¹³

The evidence indicates that the main period for the spread of citrus trees in Brazil occurred during the 17th and 18th centuries when the search for gold attracted a large number of people to the interior. The fact that Hunnicutt mentions scurvy prevention as a reason the prospectors took citrus with them is significant, since the benefits derived from eating citrus were only beginning to be widely known. It is also important to note that the spread of citrus throughout Brazil took place before a commercial citrus industry had developed within the country.

Development and Growth of the Paulista Citrus Industry.--

São Paulo was not the first Brazilian state to develop a commercial

¹³Benjamin H. Hunnicutt, Brazil, World Frontier (New York: D. Van Nostrand Company, Inc., 1949), pp. 152, 153.

citrus industry. During the colonial era the demand for citrus in Rio de Janeiro resulted in the development of a commercial citrus industry in the vicinity of the city. By 1886 citrus exports from this area were made to Argentina and Uruguay. Two years later this trade was temporarily terminated by the importing governments and the citrus producers then turned to São Paulo as a market for their surplus fruit.¹⁴

The second citrus area to develop was located near Salvador, the capital of the state of Bahia. By 1860 the countryside surrounding Salvador had become a minor citrus region that was known for the famous Bahiana orange,¹⁵ a seedless, navel variety.¹⁶ Exports from Bahia to the La Plata Republics also took place for a short period, but the increase of local production within Argentina brought this to an end.¹⁷

In the state of São Paulo the commercial citrus industry began during the 19th century. According to Luis Amaral, a writer on the

¹⁴Luis Amaral, Historia Geral da Agricultura Brasileira (São Paulo: Companhia Editora Nacional, 1940), II, p. 425.

¹⁵It would appear that the Bahiana orange originated from a mutation which occurred somewhere in the vicinity of the capital city of Bahia. Early in the 1870's some of these unique plants were shipped by F. J. C. Schneider, A Presbyterian Missionary, to the United States Department of Agriculture in Washington, D.C., where they were propagated by William Saunders, the Superintendent of Grounds. In 1873 Mrs. Eliza Tibbetts of Riverside, California, procured some of the plants for her ranch. Because they came from Washington, she called them the Washington Navel orange, a name which still applies today. (Information from Hunnicutt, op. cit., pp. 153, 154).

¹⁶Amaral, op. cit., p. 425.

¹⁷Hunnicutt, op. cit., p. 153.

agricultural history of Brazil, the first commercial grove was established in 1869 by Flaminio Ferreira de Camargo in the município of Limeira. Before long other groves were established in the area and Limeira became known as a prominent center of citrus production. Even at a fairly early date the selling of oranges to rail passengers became a common sight as their trains halted briefly at the Limeira railway station.¹⁸

Commercial citrus groves also began to develop in other parts of the state. At an early date the towns of Sorocaba, Taubaté and Atibaia became known as citrus producing centers.¹⁹ Near the town of Guaratinguetá in the Paraíba Valley, a grove of some 400 orange trees was planted on the Moreira fazenda in the year 1915.²⁰

In 1925 the state of São Paulo made experimental shipments of oranges to Argentina, but the fruit was sold without any system of standardization or packaging.²¹ The following year the state began exporting citrus to Europe. The first shipment of oranges is said to have been made by João Dierberger Jr., a citriculturist in the município of Limeira. The Dierberger farm, generally known as the "Fazenda Citra," was the first to cultivate the Bahiana orange in São Paulo. The two original plants were brought from Bahia on the back of a donkey in 1908, and within a few years became an important

¹⁸Amaral, op. cit., p. 426.

¹⁹Ibid.

²⁰Sylvio Moreira, "Historia da Citricultura em São Paulo," São Paulo Agrícola, Ano. I, No. 8 (August, 1959), p. 79.

²¹Ibid.

variety in the area. During the first few years of Paulista citrus export, the Bahiana orange was one of the principal varieties sold on the European market.²²

It is sometimes claimed that the Paulista citrus industry rose to importance as a result of the coffee disaster of 1929. However, this is not substantiated by existing data. The export of more than 200,000 boxes in 1929 is sufficient evidence to prove the presence of a citrus industry prior to the collapse of the coffee market.²³ On the other hand, citrus trees frequently replaced coffee plants as the latter spread westward across the state, and the decline of coffee undoubtedly encouraged diversification. By 1930 the Paulista citrus industry was well established.

²²Interview with João Dierberger Jr. and members of his staff, Limeira, SP, July 30, 1969.

²³A. E. Junior, A Evolução da Economia Paulista e Suas Causas (São Paulo: Companhia Editôra Nacional, 1937), p. 476.

CHAPTER III

THE PHYSICAL CHARACTERISTICS OF SÃO PAULO'S CITRUS PRODUCING REGIONS

The state of São Paulo possesses a significant variety of physical characteristics, some of which are very favorable for the cultivation of citrus. Only a few portions of the state possess environmental conditions that do not permit the growing of citrus trees. Spatial variation within the physical environment has helped to produce the present distribution of commercial citriculture. An analysis of the state's physical characteristics is therefore of basic concern to this study.

Surface Configuration.--The map on page 18 portrays the four major physiographic regions of São Paulo. The Atlantic Littoral consists primarily of a low-lying coastal plain. It is very narrow in the north but gradually becomes broader towards the south. It is generally characterized by level terrain, alluvial soils, lagoons, beaches, barrier islands and hot humid conditions. In some areas small hills rise above the plain and in the north the lower flanks of the Serra do Mar¹ occasionally descend directly into the Atlantic Ocean.

¹The Serra do Mar is the name given to the Great Escarpment in southeastern Brazil.

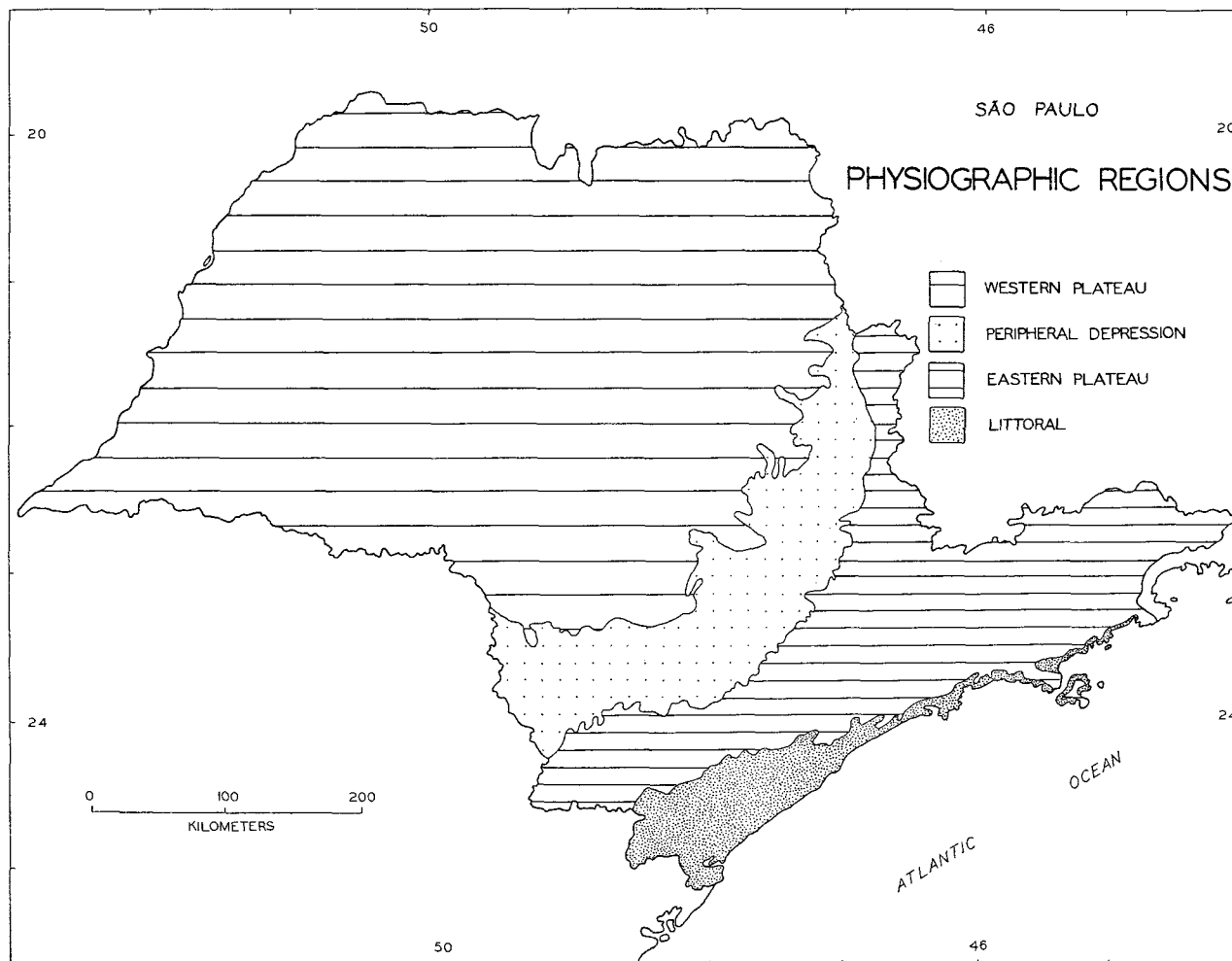


Figure 1. Physiographic Regions.

Source: Atlas Climático e Ecológico do Estado de São Paulo.

The Eastern Plateau is an elevated region directly inland from the Atlantic Littoral. Its eastern margin, a block-faulted zone known as the Great Escarpment, is one of the state's most conspicuous physical features. In some areas the escarpment drops abruptly to the coastal plain or to the ocean forming a formidable barrier between the littoral and the interior. The surface configuration of the Eastern Plateau is characterized by broad rounded hills and wide valleys. The relatively level São Paulo Basin and the Paraíba Valley are important sub-regions of the Eastern Plateau.

The Peripheral Depression lies inland from the Eastern Plateau and is characterized by level to undulating terrain. Its surface configuration is more uniform than any of the other physiographic regions.

The Western Plateau occupies the northern and western part of the state. It is the largest region (almost two-thirds of the state) and possesses an undulating terrain with wide river valleys and prominent interfluves that slope gently to the northwest. The Western Plateau is separated from the Peripheral Depression by a low escarpment which faces south and east.

Most of the state of São Paulo consists of a moderately elevated plateau (Figure 2). Approximately 85 per cent of the state has an elevation of between 300 and 900 meters. Only 8 per cent of the area lies below 300 meters, whereas about 7 per cent rises above 900 meters.² The cultivation of citrus is possible at all

²Geografia do Brasil: Grande Região Sul, Vol. IV, Tome 1, (Rio de Janeiro: Instituto Brasileiro de Geografia e Estatística, 1963), p. 14.

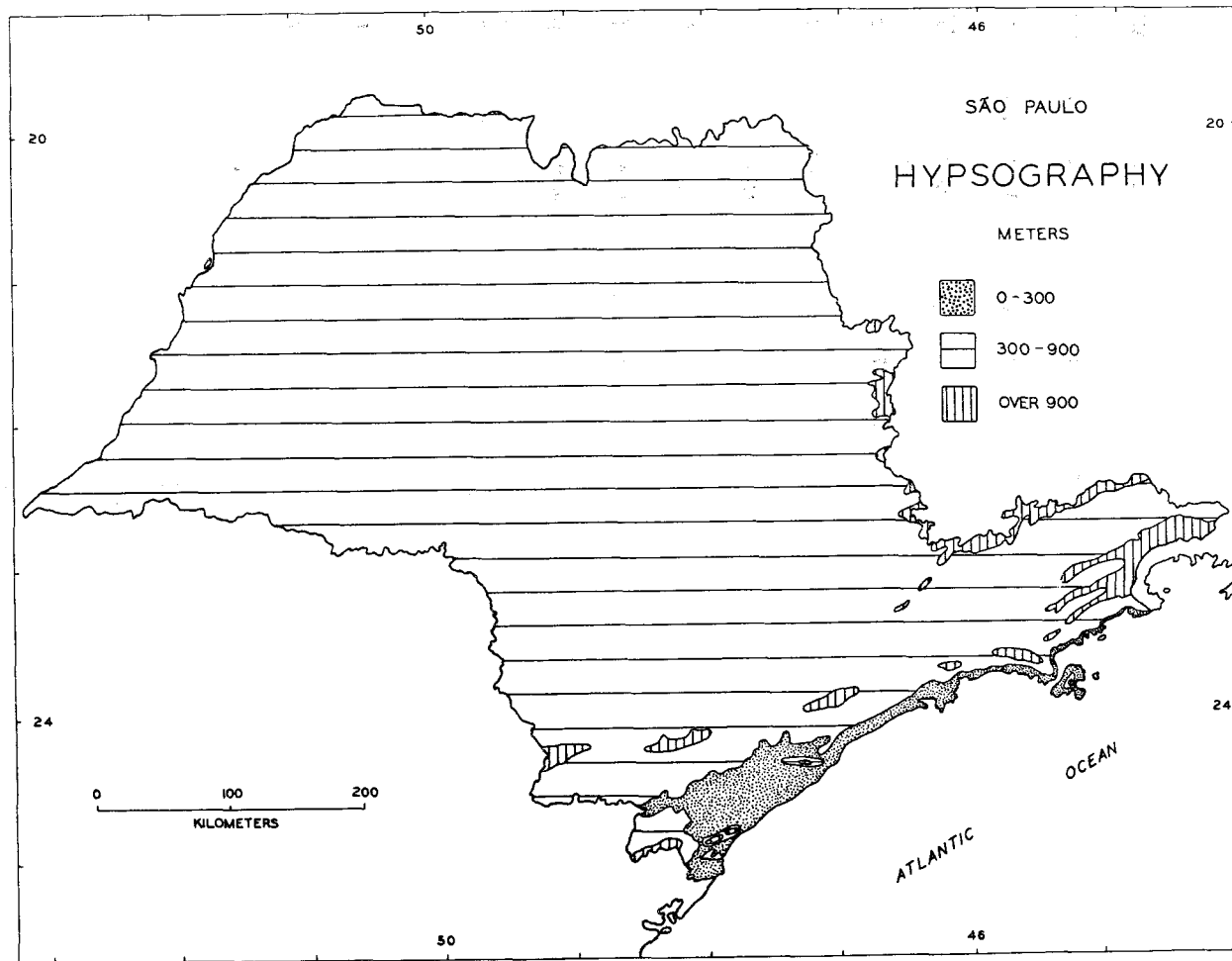


Figure 2. Hypsography.

Source: Guia Rodoviário e Turístico do Estado de São Paulo. Folhas Topographicas do Estado de São Paulo, Brasil (1:250,000).

elevations except the highest ones where severe frosts occur. The combination of high humidity and excessively warm temperatures encountered on the coastal plain are also inferior for citriculture.³

Climate.--Climatic conditions are of particular importance to the production of citrus fruit. Climate places definite limitations on both the feasibility and distribution of citriculture. It also strongly influences the quantity and quality of the fruit produced. The following analysis provides a general description of the state's climate and points out factors that are of special concern to the citriculturist.

Climatic conditions in the state of São Paulo are varied. Because the state extends 608 kilometers from north to south⁴ and is located at the outer margin of the tropics, average temperatures decrease towards the south. Augmenting this latitudinal decrease in temperature is the gradual southerly increase in altitude, except for the abrupt escarpment and the narrow coastal plain. As a result, latitude and altitude combine to produce a more temperate climate in the southern portion of the state than in the north. The warmer climate of the narrow coastal plain is caused by reduced elevation and propinquity to a warm body of water.

³The influence of climate on citriculture is discussed in greater detail on pages 47 and 48.

⁴Anuário Estatística do Brasil - 1968, Vol. 29 (Rio de Janeiro: Instituto Brasileiro de Estatística, 1968), p. 15.

Atmospheric conditions within the state of São Paulo are governed largely by the interaction of three different air masses: the Tropical Atlantic, the Polar Atlantic, and the Equatorial Continental. The degree of influence exerted by each air mass varies with the time of year and the climatic characteristics of its place of origin. In the winter when the state's weather conditions are frequently controlled by the Polar Atlantic air mass, temperatures drop significantly. During the summer the Equatorial Continental air mass is important because it brings rain to the interior of the state. If this air mass is weak, drought conditions will generally prevail. The Tropical Atlantic air mass affects São Paulo at various times throughout the year, but its influence is limited primarily to the eastern part of the state. The Tropical Atlantic air mass is responsible for the high levels of precipitation recorded along the windward slopes of the Serra do Mar.⁵

Most of the citrus in São Paulo is grown in (Cwa type of climate) areas with warm, moist summers and cool, dry winters (Figure 3). Almost one half of the state has this type of climate. A comparison between the climatic map on page 23 and the hypso-graphic map on page 20 reveals the importance of altitude and surface configuration in the state's overall climatic pattern.

In general the state of São Paulo has a mild climate; extremes of temperature during either winter or summer are rare. The absence

⁵Geografia do Brasil: Grande Região Sul, Vol. IV, Part I (Rio de Janeiro: Instituto Brasileiro do Geografia, 1968), pp. 120-124.

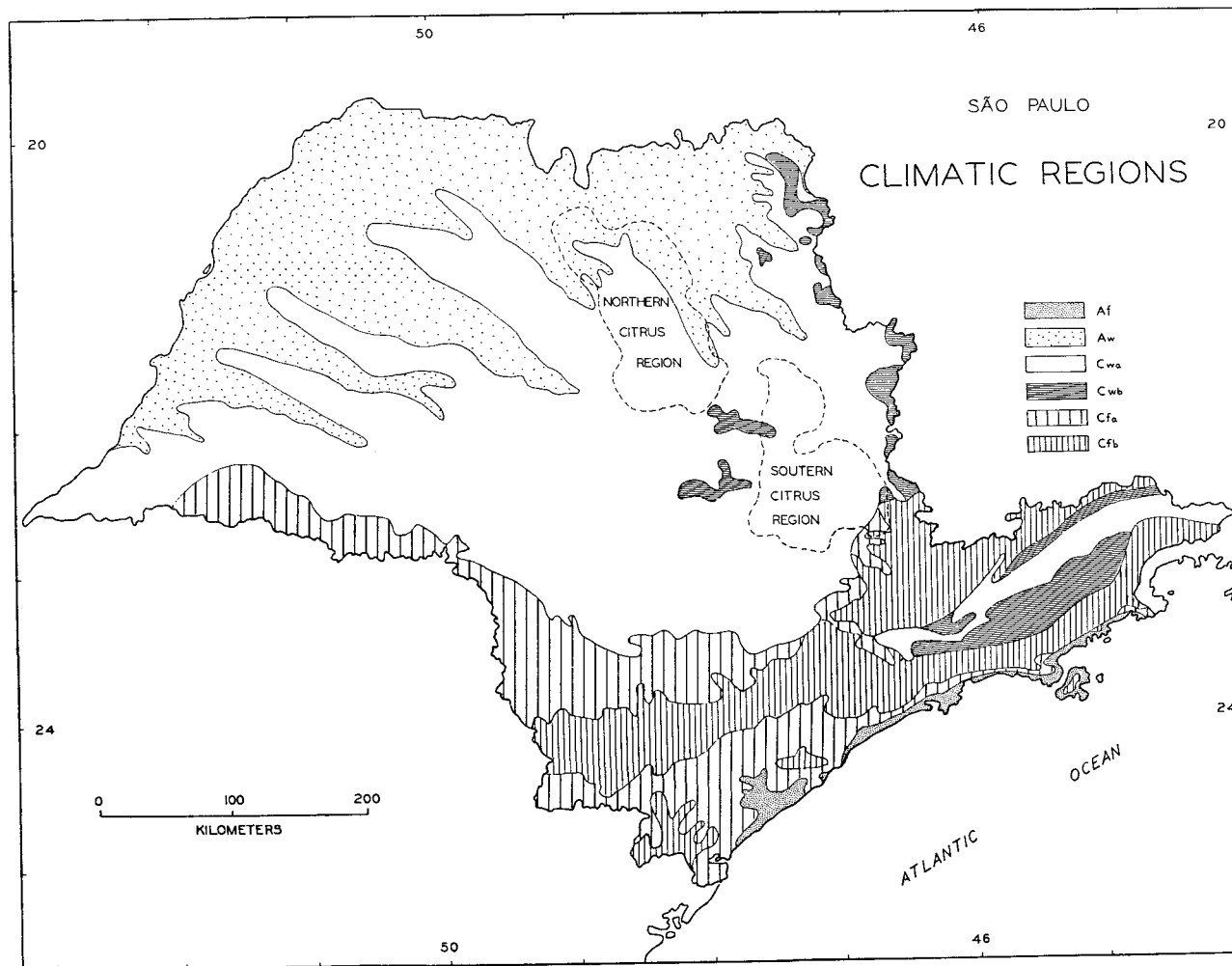


Figure 3. Climatic Regions.

Source: Atlas Climático e Ecológico do Estado de São Paulo.

of damaging frosts in some parts of the state is a distinct advantage to the citrus grower. However, since a sizeable portion of the state experiences freezing conditions, a map depicting the number of days with frost per year has been included on page 25. It can be noted from the map that the number of days with frost is greatest in the mountainous areas of the state. The southern portion of the Peripheral Depression is also subject to occasional frosts.

Freezes occur during June, July and August, or the low sun period. Normally, temperatures drop below zero (centigrade) for short periods only and are the result of nocturnal radiation in the drier parts of the state. Invasions of polar air also bring freezing temperatures, but these are of short duration and generally are restricted to the southern part of the state.⁶ The northern regions are free from the type of frost that damages or kills citrus trees. Since the quality of the citrus fruit is superior in areas where temperatures occasionally approach the freezing mark, the cool winters of the Peripheral Depression have at least one advantage. For this reason it is claimed that the oranges produced in the more southern parts of the state are of a better quality than those grown further north.⁷

⁶During the winter of 1969, freezing temperatures occurred on the Eastern Plateau and in the Peripheral Depression when climatic conditions were controlled by a polar air mass. Light snowfalls were experienced at higher elevations in the states of Santa Catarina and Rio Grande do Sul.

⁷Interview with the citriculturist, George Pompeu, Jr., Limeira Citrus Experiment Station, July 29, 1969.

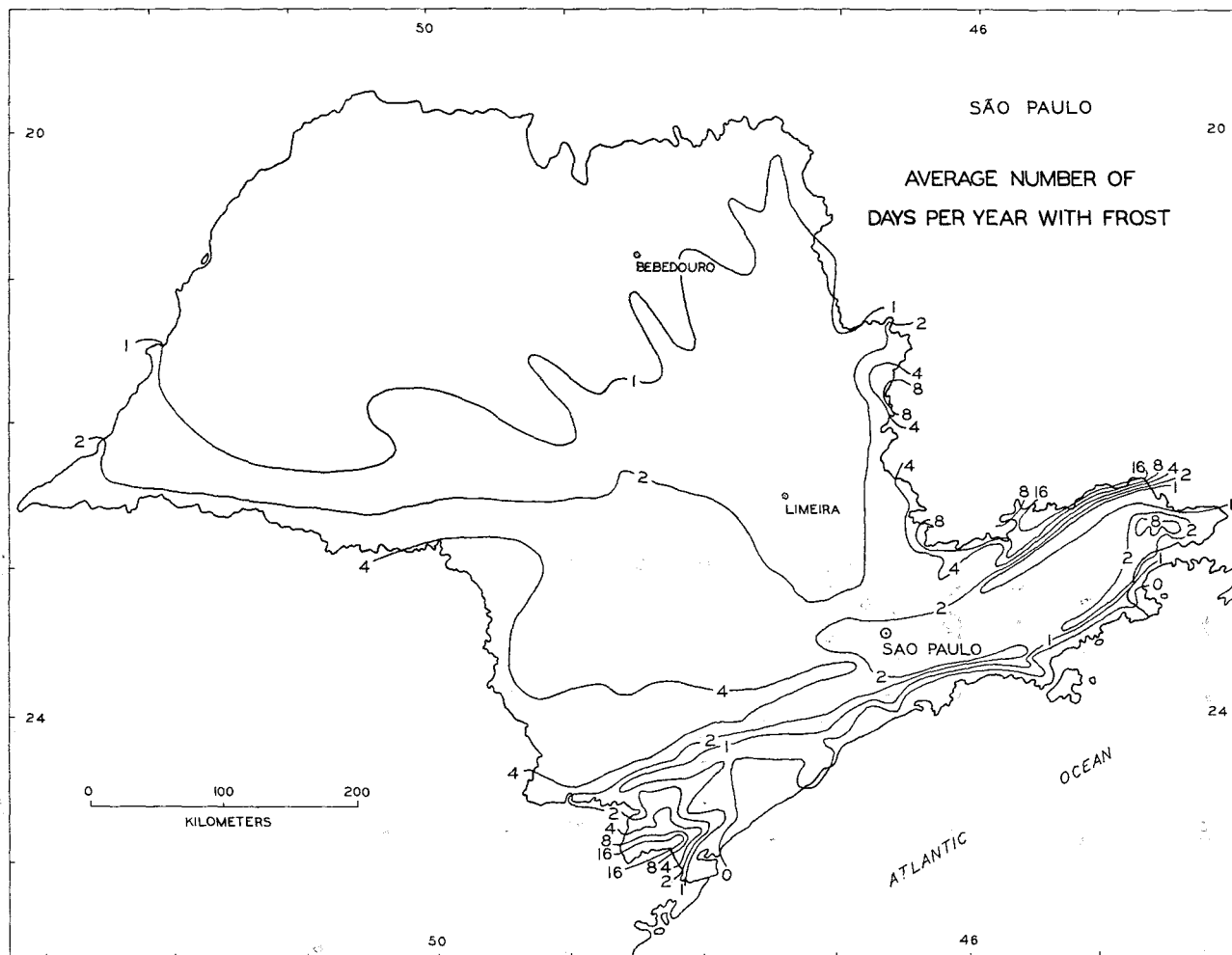


Figure 4. Average Number of Days per Year with Frost.

Source: Atlas Climático e Ecológico do Estado de São Paulo.

Precipitation is another climatic factor that is vital to the citrus grower. The entire state of São Paulo receives more than an average of 1,000 mm of precipitation per year. However, the regional distribution varies considerably, and seasonal and annual contrasts are pronounced.

Rainfall is greatest along the Atlantic Littoral and in the mountainous parts of the state (Figure 5). In these areas 1,500 to 2,000 mm generally are received each year. At Itapanhaú on the windward slopes of the Serra do Mar, more than 4,500 mm of rainfall per year have been recorded.⁸ Fortunately, most parts of the state only receive from 1,000 to 1,250 mm of precipitation annually, a quantity that is more ideal for citriculture than the heavy amounts experienced along the littoral or in the mountains.

The only parts of the state that receive rainfall throughout the year are the Atlantic Littoral and the Serra do Mar. All other areas have a dry season which becomes more pronounced towards the northwest.⁹ To citriculturists, the dry period not only provides better conditions for harvesting the fruit, but also improves the quality by reducing the relative water content.

The quantity of precipitation received during the rainy season varies considerably from year to year. To those who can not afford

⁸Celso Antunes, Geografia de São Paulo (São Paulo: Editora do Brasil, S.A., n.d.), p. 92.

⁹H. G. Blanco and H. Godoy, Cartas das Chuvas do Estado de São Paulo (Campinas: Seção de Climatologia Agrícola, Instituto Agrônômico de Campinas, 1967), Series of monthly rainfall maps.

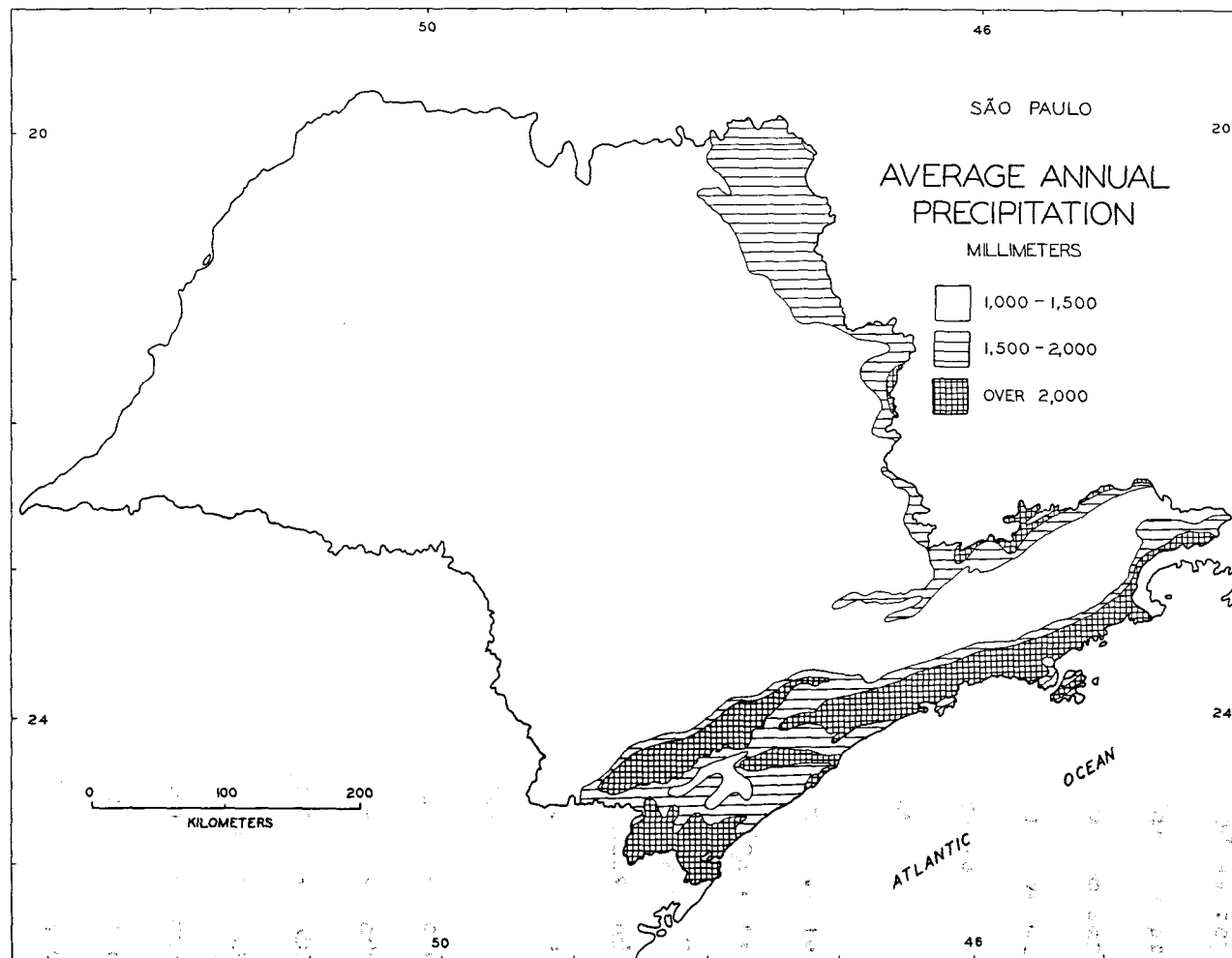


Figure 5. Average Annual Precipitation.

Source: Atlas Climático e Ecológico do Estado de São Paulo.

irrigation a serious drought can mean disaster. Table IV on page 29 gives the total annual precipitation received at Limeira between 1934 and 1969. Limeira is an important center for citrus growing, and the reliability of its rainfall can be considered as representative of much of the interior. Table IV shows that the Limeira precipitation totals fluctuate greatly from year to year. The maximum amount received in a given year was 1927.7 mm in 1958, while the minimum was 888.8 mm in 1968. Annual fluctuations are considerable and relatively dry years are part of the normal sequence.

Soils.--The state of São Paulo possesses a wide variety of soils. Some of the soils are well suited to commercial citrus production and others are not. Since the distribution and productivity of the citrus groves are directly related to the quality and type of soil, a brief analysis of the edaphic factor is necessary in order to understand spatial variation within the citrus industry.

São Paulo's soils have developed under the influence of a warm, humid climate. In general, they can be characterized as pedalferic or iron-aluminum accumulating soils with low humus and soluble mineral contents. Despite the lack of striking climatic contrasts, the state's soils do possess marked variations. This is largely the result of differing parent materials, vegetation cover, and drainage patterns. Since the soils of São Paulo are closely related to the

TABLE IV
TOTAL ANNUAL PRECIPITATION, LIMEIRA, SÃO PAULO
1934 - 1969

Year	Millimeters	Year	Millimeters
1934	1219.5	1952	1374.9
1935	1628.0	1953	1276.1
1936	1439.0	1954	1349.0
1937	1493.0	1955	1326.9
1938	1389.1	1956	1287.9
1939	1618.6	1957	1459.5
1940	1131.7	1958	1927.7
1941	1154.7	1959	1284.0
1942	1302.4	1960	1642.3
1943	1569.2	1961	1081.1
1944	1169.6	1962	1327.8
1945	1421.1	1963	900.6
1946	1287.0	1964	1239.5
1947	1839.8	1965	1759.9
1948	1347.9	1966	1509.6
1949	1386.0	1967	1423.8
1950	1436.2	1968	888.8
1951	1304.2	1969	965.2

Source: Files of the Instituto Agronômico de Campinas.

underlying rock formations, a system of classification that is basically lithological in nature has been selected.¹⁰

Nine major soil types are shown in Table V on page 31.¹¹ This particular classification emphasizes the main soil types without incorporating excessive pedological detail. A map depicting the distribution of the soil types is found on page 32.

Even though citrus trees can be grown on all of São Paulo's main types of soils, they are not all suited to commercial citriculture. The best soils for this purpose are the Botucatú and the Baurú sandstone soils, the glacial¹² soils, and to a lesser degree the terra roxa and alluvial soils. The map on page 32 reveals that these soil types are found mainly in the Peripheral Depression and on the Western Plateau, and that they cover a large portion of the state.

The Botucatú and the Baurú sandstone soils and the glacial soils are of great importance to the citrus industry. They are generally sandy to loamy in texture and possess good aeration and drainage characteristics, factors of utmost importance to successful citrus production. Unfortunately, the soils in the main citrus areas are not exceptionally rich in minerals and humus; however, the

¹⁰Preston James, Latin America, 4th ed. (New York: The Odyssey Press, 1969), p. 777.

¹¹J. E. de Paiva Neto and Associates, "Observações Gerais Sobre os Grandes Tipos de Solo do Estado de São Paulo." Bragantia Vol. XI, Nos. 7-9 (Campinas: Instituto Agrônômico de Campinas, July-Sept. 1951), pp. 227-253. The following soil analysis is based primarily on the findings of J. E. de Paiva Neto and Associates.

¹²The glacial soils are derived from Permo-Carboniferous varves and tillite (Martin Schwarzbach; J. E. de Paiva Neto). The term glacial is used primarily as a name in this context.

TABLE V
SOIL TYPES OF SÃO PAULO

Soil Type	Percent of Total Area	Square Kilometers	Hectares	Geographical Location
Devonian	0.4	1,000	100,000	Peripheral Depression
Glacial	8.1	20,000	2,000,000	Peripheral Depression
Arenito de Corumbataí	2.8	7,000	700,000	Peripheral Depression
Arenito de Botucatú	29.1	72,000	7,200,000	Western Plateau
Terra Roxa	7.3	18,000	1,800,000	Scattered
Arenito de Baurú	25.1	62,000	6,200,000	Western Plateau
Tertiary	1.4	3,500	350,000	São Paulo & Paraíba Basins
Alluvial	1.8	4,500	450,000	Littoral & Fluvial Areas
Salmourão & Massapé	24.0	59,000	5,900,000	Eastern Plateau & Littoral

Source: J. E. de Paiva Neto and Associates, "Observações Gerais Sobre os Grandes Tipos de Solo do Estado de São Paulo." Bragantia, Vol. XI, Nos. 7-9 (Campinas: Instituto Agrônômico de Campinas, July-Sept. 1951), pp. 227-253.

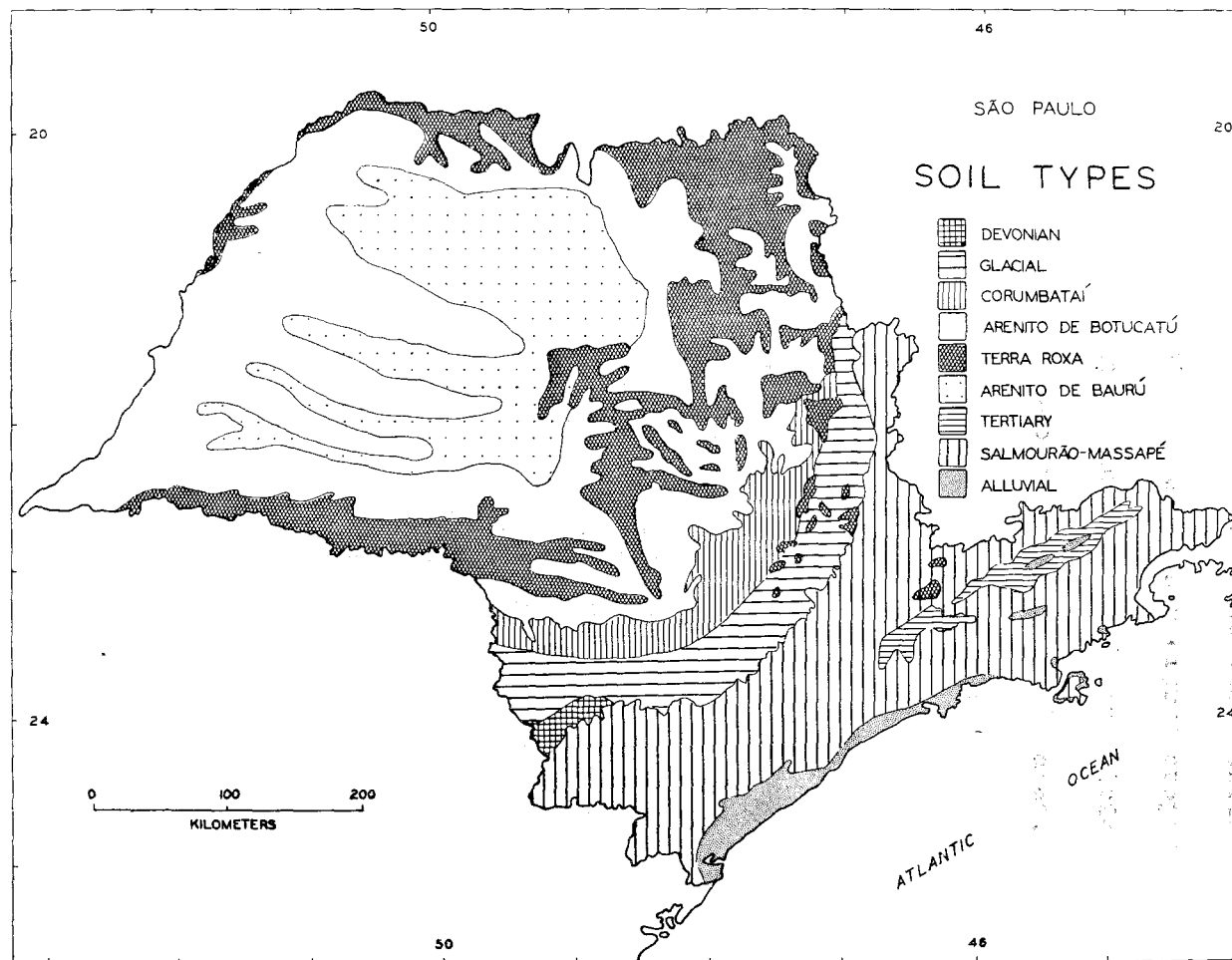


Figure 6. Soil Types.

Source: J. E. de Paiva Neto and Associates, Bragantia, Vol. XI, Nos. 7-9 (July-September), 1951.

former can be added in the form of commercial fertilizers. Terra roxa soils are generally richer in minerals and humus than the sandstone and glacial soils, but due to drainage problems which develop after constant usage, they are less desirable to citriculturists.¹³ Some alluvial soils also produce good citrus crops in the Paraíba Valley, but increasing urbanization and competition from other crops has reduced the importance of citrus in this area.

¹³Levantamento de Reconhecimento dos Solos do Estado de São Paulo, no. 12 (Rio de Janeiro: Ministério da Agricultura, Centro Nacional de Ensino e Pesquisas Agronômicas, no. 12, 1960), p. 623.

CHAPTER IV

SPATIAL VARIATION IN PAULISTA CITRICULTURE

FROM 1931 TO 1970

By 1930 the commercial citrus industry of the state of São Paulo had developed into a significant economic activity. The following year its importance was underlined by the appearance of citrus data in both federal and state publications. Since that time a great deal of statistical material has been published. Federal records include information on the production, value and number of hectares in oranges at both state and município levels; in the early years these data were more standard and complete than state records. Since 1944, however, statistics reported by the state have become increasingly detailed and provide a large quantity of information by município on several varieties of citrus. Unfortunately, most statistics are estimates rather than actual counts.¹

¹Statistics from the Secretaria da Agricultura de São Paulo have been used whenever possible. They are generally more reliable than those published by the federal government because state enumeration techniques are usually superior (they include sample field counts) and because the network of reporters is larger. Statistical data are published regularly by the Departamento de Estatística de São Paulo; however, since their agricultural data are obtained from the Secretaria da Agricultura, the original sources have been used whenever possible. Federal records have been used whenever state statistics were not complete (sizeable differences frequently exist between the two). The former are usually regarded with suspicion by Paulista authorities.

The following analysis covers the 39 year period 1931 to 1970 and examines the causative factors underlying spatial variation in São Paulo's citrus industry. It is based in part on the tables, graphs, and maps found on pages 36, 37 and 38.

Orange Production, 1931-1965.--Even though commercial citrus production in the states of Rio de Janeiro and Bahia preceded that of São Paulo, the statistics for 1931 reveal that the latter had already become the nation's major producing region. Paulista orange production (366,800 tons) amounted to 46 per cent of the nation's total. A larger area was devoted to citriculture in São Paulo than in any other state. In value the Paulista orange crop was worth \$6,660,000 or approximately one half of the country's total. By any of the measurements cited, São Paulo was Brazil's leading orange producing state. The next most important producer was Rio de Janeiro, which harvested approximately one third of the nation's orange crop.

Commercial orange production in São Paulo began in the vicinity of Limeira and in the Paraíba Valley, but by 1931 it had spread to the São Paulo Basin and to the município of Sorocaba in the southern portion of the Peripheral Depression. A map showing the distribution of the main producing areas in 1931 is found on page 38. Although the southeastern portion of the state is the only area that possessed production densities great enough to show on the map, this does not mean that most of the state was without citrus trees. Almost all of São Paulo's 260 municípios produced at least small amounts of citrus, even in the sparsely settled areas of the northwest. The

TABLE VI
ORANGE PRODUCTION IN SÃO PAULO, 1931-1969

Year	Hectares in Production	Tons of Fruit Produced	Value of Crop (U.S. Dollars)*
1931	24,300	366,800	6,660,000
1932	35,500	528,100	9,615,000
1933	41,274	570,000	13,464,000
1934	41,950	615,900	12,578,000
1935	37,830	574,400	10,316,000
1936	38,000	432,100	9,264,000
1937	36,170	422,600	7,544,000
1938	34,010	442,200	6,910,000
1939	40,000	480,000	3,122,000
1940	40,500	480,000	3,636,000
1941	41,935	520,000	4,285,000
1942	40,967	508,000	4,235,000
1943	40,939	488,000	4,315,000
1944	23,252	291,100	2,123,000
1945	22,505	290,600	3,488,000
1946	22,228	269,900	3,693,000
1947	19,685	237,200	4,148,000
1948	13,800	146,800	2,744,658
1949	11,900	104,200	2,226,495
1950	11,200	138,300	4,048,611
1951	16,400	114,600	4,438,034
1952	16,400	89,500	6,114,316
1953	20,900	156,800	3,735,457
1954	26,100	198,700	4,250,080
1955	33,000	252,400	6,685,749
1956	38,400	314,100	8,784,073
1957	45,800	391,600	9,926,027
1958	60,000	501,000	8,763,416
1959	67,000	590,700	8,685,102
1960	80,900	721,900	9,315,429
1961	95,400	936,300	10,755,456
1962	101,300	960,000	15,289,869
1963	111,400	1,080,000	19,258,000
1964	113,400	814,800	28,688,000
1965	123,500	1,167,800	39,926,000
1966	102,600	1,160,500	39,226,000
1967	111,600	1,376,000	21,773,000
1968	121,100	1,422,400	29,821,000
1969	156,300	1,393,200	32,170,000

*Dollar values were calculated from Cruzeiros by using the average annual rates of exchange found in Table XXVII on page 169.

Source: Statistics for the period 1931-1947 were taken from *Anuário Estatística do Brasil*. Statistics for the period 1948-1969 came from the files of the Secretaria da Agricultura de São Paulo.

ORANGE PRODUCTION IN SÃO PAULO, 1931-1969

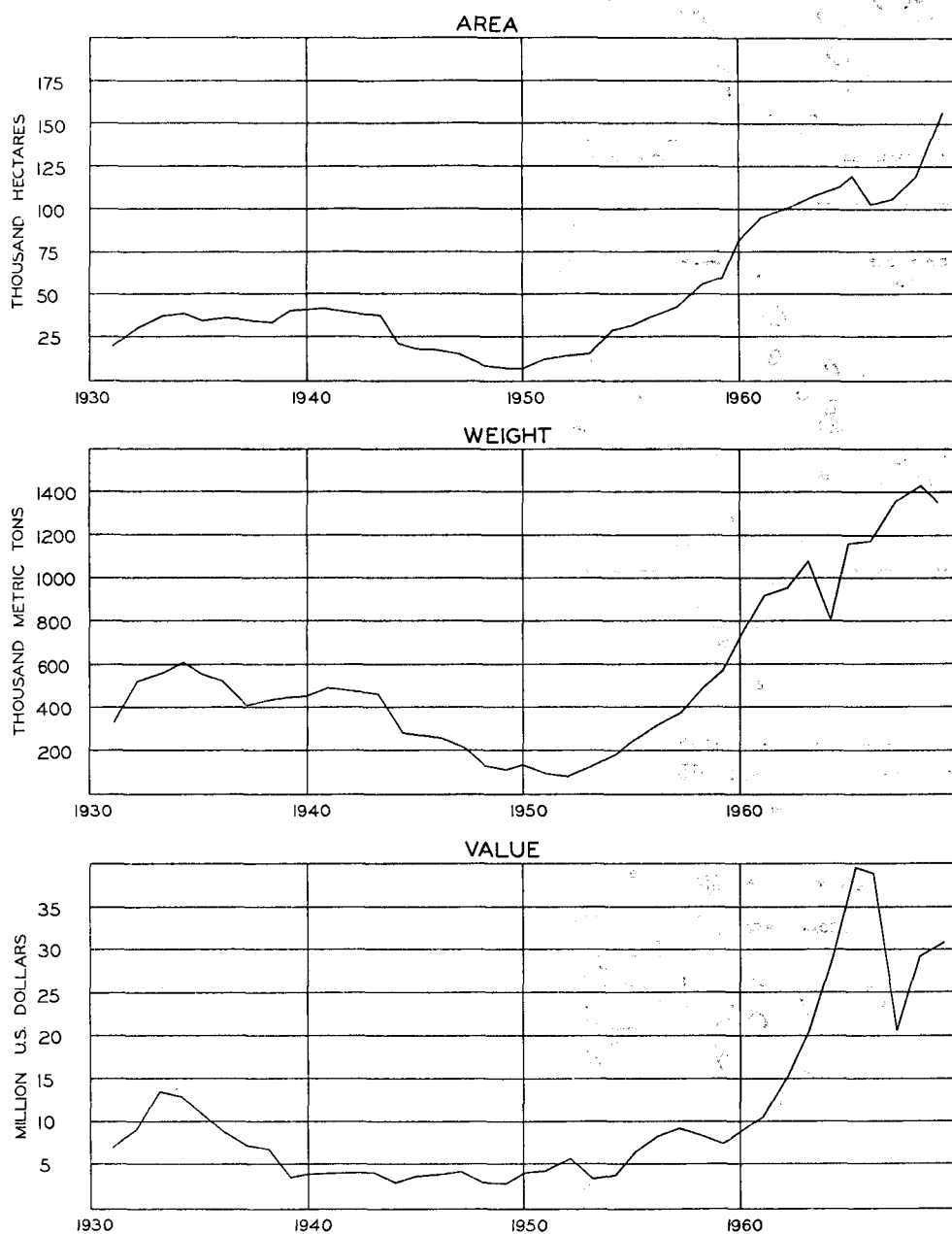


Figure 7. Orange Production in São Paulo by Area, Weight and Value, 1931-1969.

Source: Anuário Estatística do Brasil (1931-1947). São Paulo Department of Agriculture (1948-1969).

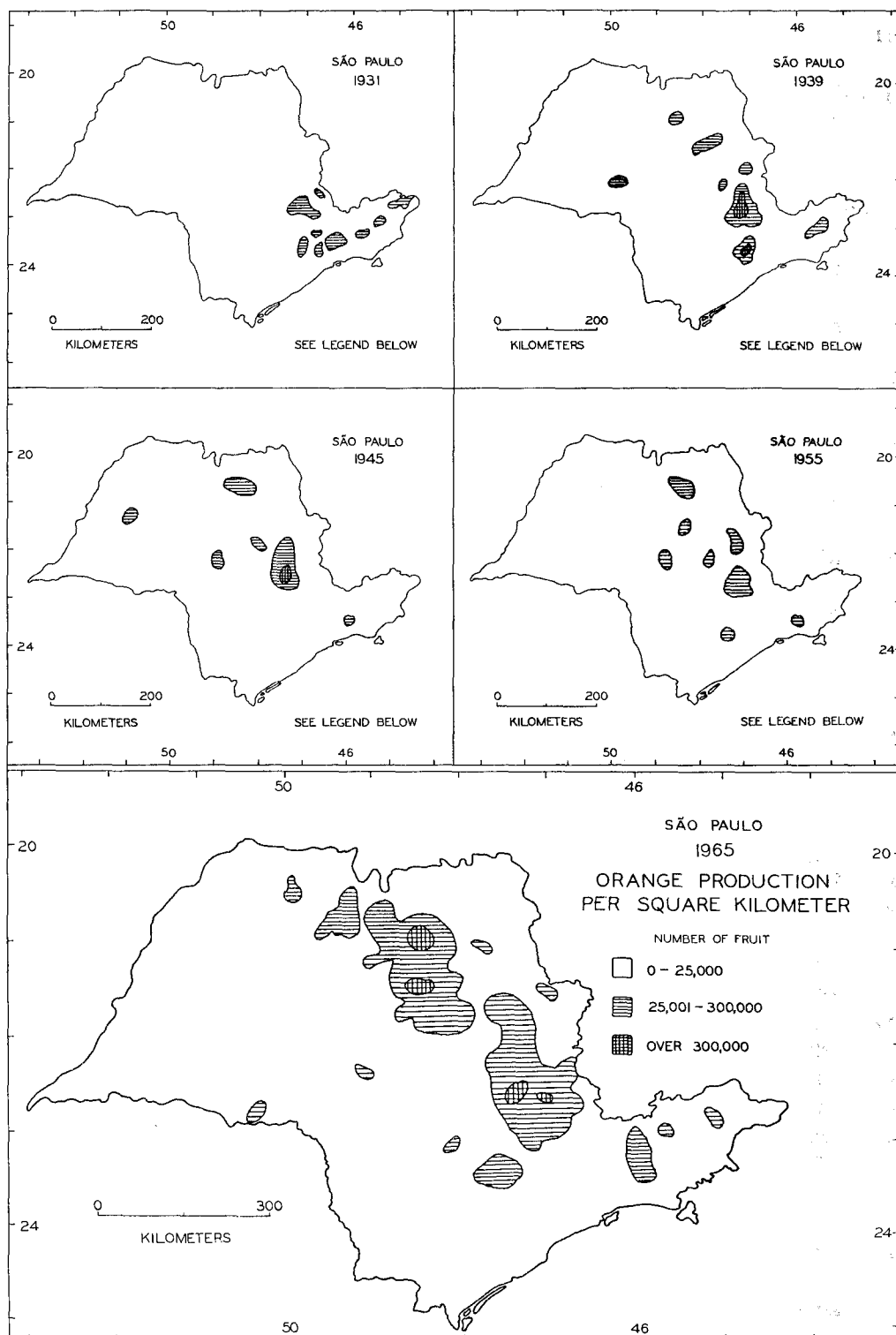


Figure 8. Orange Production per Square Kilometer, 1931, 1939, 1945, 1955, 1965.

Source: Estatística Agrícola e Zootécnica, 1930/31; Recenseamento Geral do Brasil, 1940; Files of the São Paulo Department of Agriculture, 1945, 1955 and 1965.

state's three most important municipios in the quantity of citrus harvested were Limeira (12.25 per cent), Sorocaba (11.53 per cent) and São Paulo (7.78 per cent).

The reasons for greater densities in the southeast can be attributed to several important factors. Commercial production first began in this region. A large proportion of the state's people lived in this area, and all of the principal urban centers were located here. The burgeoning export industry was an incentive for growth, particularly in areas easily accessible to the port of Santos. Another reason for expanding citrus production in the southeast was the need for agricultural diversification following the spread of coffee production further inland. Fred A. Motz, formerly of the United States Department of Agriculture, described this development as follows:

A large part of the orange plantings in the state have been made on land that was cleared and prepared for the growing of coffee, sugarcane, mandioca, cotton, and other crops common to Brazil. While most of these crops are still produced, the coffee industry has shifted to other regions. Coffee planters having depleted the fertility of the soil as a result of years of continuous cropping or learning that areas farther inland were better suited for coffee growing, sold their holdings and shifted the industry farther into the interior. This left vast tracts of land to be turned into pasture, planted to other cultivated crops, or allowed to revert back to forests. Along with sugarcane, mandioca, cotton, and other crops came the commercial production of citrus.²

Between 1932 and 1938 the Paulista citrus industry experienced an era of prosperity and expansion. Exports to foreign markets

²Fred A. Motz, The Fruit Industry of Brazil, Foreign Agricultural Report No. 2 (Washington: U.S. Government Printing Office, 1942), p. 10.

increased, and in general, orange production was high. However, the sudden arrival of the tristeza disease in 1937 and the involvement of most of Europe in the Second World War resulted in a period of rapid decline. Because the industry's last year of prosperity before the decline was 1939, a more detailed consideration of its position for that year is useful.

São Paulo was still the nation's leading orange producing state in 1939. Production had increased by 24 per cent and the area devoted to citriculture was up 39 per cent since 1931. Though still ranking as the nation's number one citrus producer, São Paulo's portion of the country's orange crop had declined 11 per cent, and its share in the total number of hectares had dropped by 8 per cent. In 1939 São Paulo and Rio de Janeiro each produced approximately one third of the nation's oranges. The improved position of the Fluminense³ orange industry lay in the fact that it had concentrated on the production of the Pêra variety, while São Paulo had emphasized the naval orange. The demand for the former had increased at a rapid rate in foreign markets, while that of the latter had grown more slowly. In 1939 São Paulo's exports were far behind those of Rio de Janeiro.⁴

Between 1931 and 1939 the distributional pattern of São Paulo's orange industry underwent important changes. The combined output of

³The word Fluminense refers to a person from the state of Rio de Janeiro, and may also be used as an adjective. It will be used occasionally in this paper to reduce the possibility of confusing the state with the city of Rio de Janeiro.

⁴Motz, loc. cit.

the municípios of Limeira (20 per cent) and Sorocaba (17 per cent) increased by about two-thirds, amounting to 37 per cent of the state's entire citrus crop. The third most important município was Araras (8 per cent), a northern neighbor of Limeira. It can be noted from the production map for 1939 on page 38 that much of the expansion had taken place in the southern portion of the Peripheral Depression not far from the state capital. Several minor producing areas on the Western Plateau had also developed. Other noticeable changes were the decline of citrus in the vicinity of the city of São Paulo and the shift of production up the Paraíba Valley to the municípios of Taubaté, Tremembé and Jacareí.

Expanding market conditions at home and abroad were primarily responsible for the spatial changes described above. Between 1920 and 1940⁵ the city of São Paulo increased from 579,033 to 1,326,261 inhabitants.⁶ Much of the urban growth occurred along the railway lines within a few miles of the central business district on land that had formerly supplied the city with vegetables and fruit. The prices of land in the rural part of the município⁷ rose tremendously making it difficult for many types of agriculture to survive.⁸ Between 1931 and

⁵No official census was taken between 1920 and 1940, hence the wide gap in time.

⁶Taken from the files of the Departamento de Estatística de São Paulo.

⁷The term município refers to a rural-urban political subdivision somewhat comparable to the U.S. county.

⁸Richard M. Morse, From Community to Metropolis (Gainesville, Fla.: The University of Florida Press, 1958), pp. 271-289.

1939 the number of orange trees in the município of São Paulo dropped from 396,353 to only 40,067.⁹

Thus the município of São Paulo, with approximately 18 per cent of the state's population (1940), had become an important market for citrus fruit instead of one of the state's leading producers. It is also significant that the major areas of citrus expansion during this period were along railway lines close to the city of São Paulo, namely the Paraíba Valley and the southern portion of the Peripheral Depression. The development of several minor citrus producing areas on the Western Plateau were probably related to population increases and the need for agricultural diversification on land formerly devoted to coffee.

Export statistics for 1939 show a marked increase in the sale of Paulista citrus overseas. Even though São Paulo ranked second to the state of Rio de Janeiro in citrus exports, shipments from the port of Santos had climbed from 834,802 boxes in 1931 to 2,790,653 boxes in 1939.¹⁰ Thus it can be seen that both domestic and foreign markets stimulated significant growth within the industry.

The five year span, 1940 through 1944, was a period of rapid decline in citrus output. During the Second World War exports dropped sharply. Unpicked fruit matured and fell to the

⁹The 1931 total was taken from the Estatístico Agrícola e Zootécnica, 1930-1931. The 1939 total comes from the 1940 National Census, Recenseamento Geral do Brasil.

¹⁰Export statistics are listed on page 128.

ground. Even more devastating to the Paulista citrus industry was the spread of tristeza, a deadly virus disease. Between 1937 and 1959, some ten million citrus trees within the state were rendered unproductive or were killed.¹¹ By 1944 both exports and production had fallen drastically and many citrus farms had been abandoned.

Statistics for 1945 show the magnitude of the decline that had occurred since 1940. The quantity of fruit had dropped to 290,600 tons, 29 per cent less than the 1931 total. Since 1939 some 17,495 hectares of orange trees had either become unproductive or had been removed to make way for other crops. In 1945 São Paulo's portion of the country's orange crop amounted to only 25 per cent compared to 46 per cent in 1931.

The map on page 38 reveals some significant changes in the location of citrus production between 1939 and 1945. Limeira was the only important citrus producing region. Production in the Sorocaba area and the Paraíba Valley had declined. The only noticeable increase occurred in the interior, where minor producing areas had developed. The reason for the rapid decline has been stated above; however, it should be pointed out that tristeza did not affect all parts of the state with equal intensity. The southern regions were infected by a more virulent strain than those further north. This explains why Sorocaba and the Paraíba Valley suffered more rapid

¹¹Sylvio Moreira, "Historia da Citricultura em São Paulo," São Paulo Agrícola, Ano I, No. 8 (August, 1959), p. 80.

declines than Limeira and some of the areas in the interior.¹² In 1945 the state's three leading orange producing municípios were Limeira (23 per cent), Araras (10 per cent) and Valparaíso (7 per cent).

Between 1946 and 1954 the Paulista citrus industry went through a period of fluctuating low level production. However, due to persistent research at the Limeira Experiment Station, tristeza was brought under control and production gradually began to rise. By 1955 this upward trend was accompanied by a noticeable increase in exports, and again the industry entered a period of prosperity.

The most important indication of renewed confidence among citrus growers in 1955 was a steady increase (21,800 hectares since 1950) in the number of hectares occupied by producing orange trees. Output was still below the 1945 level, but this can be accounted for by the fact that many of the trees were young. During the period 1947-1957, Paulista orange production lagged behind that of Rio de Janeiro. Together they produced approximately 40 per cent of Brazil's total orange crop.

Between 1945 and 1955 citrus production in São Paulo underwent a significant shift northwards (Figure 8, page 38). Limeira was still the state's foremost producing region, but tree densities within the area had declined considerably. Tristeza had taken its toll in this area also. The second most important region was located

¹²Interview with J. P. Junior, chief citriculturist at the Estação Experimental de Limeira, Cordeiropolis, SP., July 29, 1969.

in the vicinity of Bebedouro. Expansion in this area began during the 1940's, and by 1955 it had almost equaled Limeira as a citricultural center. This development was particularly significant as Bebedouro has since become the state's major producing region.¹³

Between 1956 and 1964 the Paulista citrus industry experienced rapid growth. Orange production multiplied in many parts of the state. Exports climbed steadily. Packing house facilities expanded. Processing plants improved the stability of the industry by increasing the size and reliability of the market. Nurseries were kept busy supplying the demand for young trees. But the industry was not without its problems. Drought and disease plagued citrus growers in some parts of the state during this period.

Citrus canker was identified in the far western portion of São Paulo near the town of Presidente Prudente in 1957. It was a virulent strain and resulted in the destruction of over a million trees. Only after nine years of strict supervision by the state government was the problem brought under control. Fortunately the infection never crossed the Tietê River northward into the major citrus producing parts of the state.¹⁴

Another problem during this period was the severe drought of 1964, which caused a sharp decline in production (Figure 7, page 37). The decrease amounted to 265,200 tons of fruit, a significant drop for one year.

¹³The reasons for this northward expansion will be discussed on pages 47 and 48.

¹⁴Shackford Pitcher and Robert B. Tisch, Citrus Processing in Brazil (Foreign Agricultural Service, U.S.D.A., Washington, D.C.: 1970), p. 3.

In 1965 São Paulo's orange crop amounted to 1,167,800 tons (252,400 tons in 1955) or 39 per cent of the nation's total. The area in producing orange trees had risen sharply to 123,500 hectares, an increase of 90,500 hectares since 1955. São Paulo had regained its former position as the nation's chief citrus producing state. For 11 years (1947-1957) citrus production in Rio de Janeiro had surpassed that of São Paulo; however, during the middle of the 1950's the former's crop declined both relatively and absolutely because of increasing urbanization and disease.¹⁵ In 1965 the Fluminense portion of the country's orange crop amounted to only 10 per cent or approximately a quarter of São Paulo's total.

During the period 1955-1965 orange production tended to concentrate in two main regions, both located to the northeast of the Tietê River (Figure 8, page 38). Three minor areas developed in the vicinity of Sorocaba, Santa Branca, and São José do Rio Preto. The five leading orange producing municípios in 1965 were Bebedouro (18 per cent), Limeira (9 per cent), Taquaritinga (9 per cent), Araraquara (6 per cent) and Araras (3 per cent), all located within the two major producing areas. For purposes of identification the two regions will be referred to as the Northern and Southern Citrus Regions. The former will be considered first.

The rise of the Northern Citrus Region to its present level (1972) of importance is a relatively recent development. Several important physical and economic factors were responsible for its

¹⁵Ibid.

ascendancy. Climatic conditions in the Northern Region¹⁶ are almost ideal for the cultivation of citrus trees. Temperatures are mild throughout the low sun period with virtually no frost hazard. Precipitation is generally adequate to produce a satisfactory citrus crop; however, some years are excessively dry and irrigation is necessary. The dry season experienced during much of the harvest period is beneficial for the quality of the fruit.¹⁷

Another factor that led to the development of the Northern Region was the availability of relatively inexpensive land. To the south in the more heavily populated and highly developed parts of the state, land prices had become prohibitive for many prospective citrus growers. Farmers looking for land frequently chose the cheaper areas further north.¹⁸

Still another factor responsible for the growth of the Northern Region is the presence of soils that are well suited to the production of citrus. Large parts of the Western Plateau are covered with loamy to sandy soils which generally have excellent drainage. Satisfactory crops can be produced in some areas without fertilizers, but their use normally results in increased yields.¹⁹

¹⁶Whenever brevity is desired the word citrus will be deleted from the names Northern Citrus Region and Southern Citrus Region.

¹⁷L. W. Ziegler and H. S. Wolfe, Citrus Growing in Florida (Gainesville: University of Florida Press, 1961), p. 94.

¹⁸Interview with Otto H. Mahle, Bebedouro citrus grower, March 12, 1970.

¹⁹Ibid.

Lastly, the development of the Northern Citrus Region was influenced by the need to produce fruit as early as possible so that Paulista oranges could reach the European market before the arrival of competing South African citrus. Because of this marketing advantage, exporters are able to benefit from a brief period of higher prices and less competition in Europe.²⁰

Most of the Southern Citrus Region is located in the northeastern part of the Peripheral Depression, but small areas extend onto the adjacent plateaus. The terrain is undulating to hilly, with steeper gradients in the marginal areas. The Southern Region was the state's first important citrus area, and despite the rise of a newer region to the north, still possesses at least two important advantages for citriculture.

The Southern Region is closer to the port of Santos and to the major markets of the state. This is an important economic advantage since transportation costs constitute a sizeable portion of the selling price of the fruit. Nearness to the state capital is also convenient for fazendeiros preferring the advantages of a residence in the city.

Also, the cooler temperatures during the low sun period tend to produce fruit that has superior color and flavor.²¹ For this reason fruit from the Southern Region is shipped to the processing plants further north to improve the quality of the northern juices.²²

²⁰Junior, loc. cit.

²¹Ziegler and Wolfe, op. cit., p. 94.

²²Junior, loc. cit.

Recent Trends in Orange Production.--Since 1965 the Paulista citrus industry has continued to expand. Preliminary statistics for 1970 reveal the presence of 27.7 million producing orange trees within the state, an increase of 7.9 million since 1965.²³ This represents an average increase of approximately 1.6 million trees per year. Despite this over-all growth, problems have been encountered. In 1966 a noticeable decrease in the number of hectares in orange trees occurred as a result of drought and the effects of citrus canker. Dry conditions in 1968 and 1969 resulted in serious declines.²⁴ The loss of fruit in 1969 was particularly large since supplies of ground water had been reduced by two successive years of drought.

The distribution of the orange crop in 1969 was approximately the same as in 1965. The map on page 50 reveals two major concentrations in the northeastern portion of the state (the Northern and Southern Citrus Regions). The boundaries for the two regions were drawn to include municípios in which more than one per cent of the total area was occupied by producing orange trees.²⁵ In the core areas as much as 28.5 per cent of the land is occupied by producing orange trees. A few municípios with slightly less than one per cent of

²³Antonio A. Amaro, "Laranja com sinal amarelo," Correio Agro-Pecuário, X (February, 1970), p. 17.

²⁴See Table VI on page 36.

²⁵The writer endeavored to obtain ratios between the area in orange production per município and the total area in crops per município for 1969. The most recent published data were for 1960. To obtain these data from the files of the Secretaria da Agricultura de São Paulo would have been financially prohibitive.

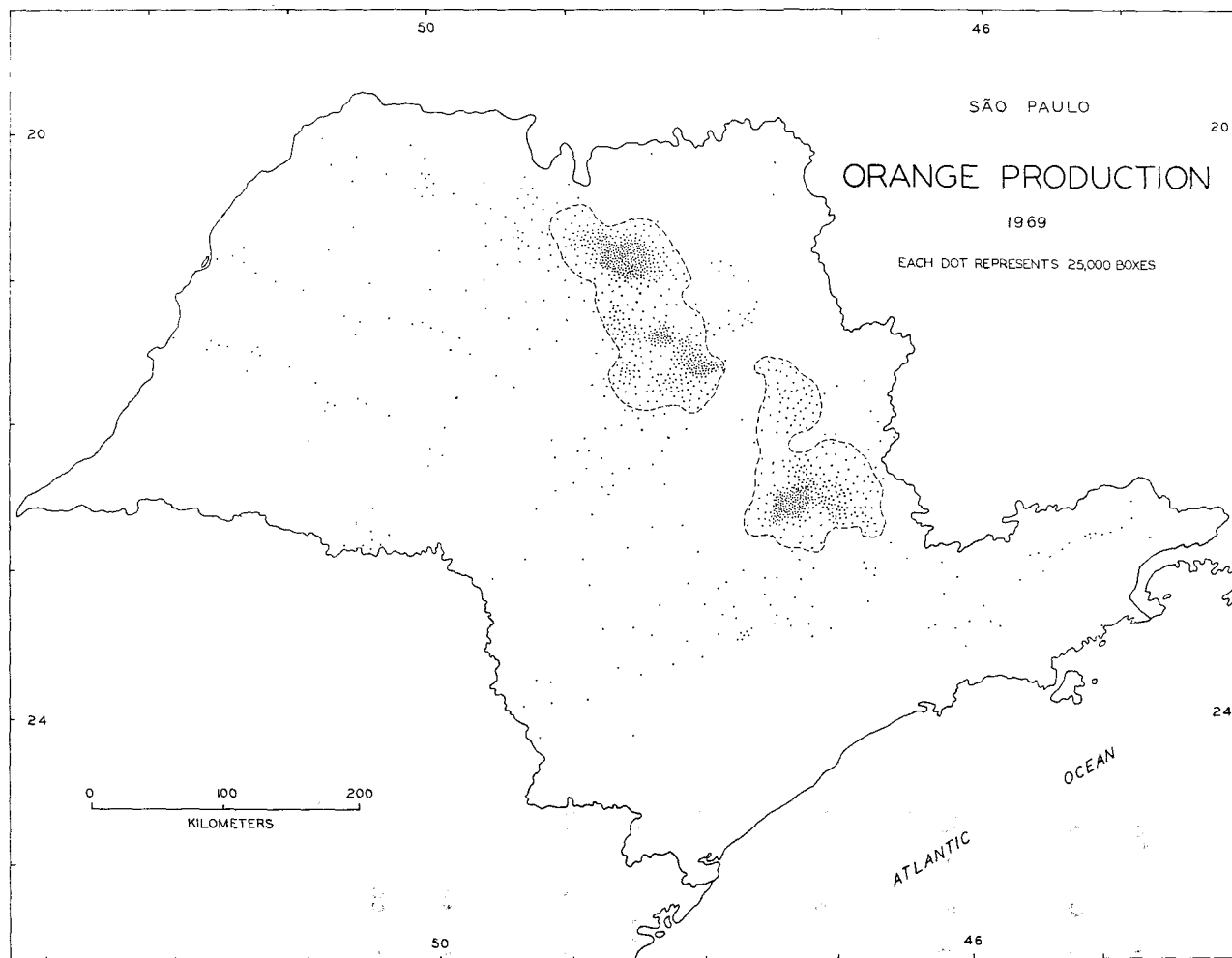


Figure 9. Orange Production, 1969.

Source: Files of the São Paulo Department of Agriculture.

their total area in citrus trees were included within the two main regions because their locations were near the center of the regions.

The importance of the two citrus regions is indicated by the following facts:

1. The two main regions include all or part of the 30 leading orange producing municípios in São Paulo with the exception of Cravinhos, a município close to the Northern Citrus Region.²⁶

2. They include all of the municípios producing oranges for export.²⁷

3. All of the state's juice processing plants have located within these two regions.²⁸

4. No município with less than one per cent of its total area in citrus trees was among the top 40 orange producing municípios in 1969 except three: Cândido Mota (0.7 per cent), Paraguaçu Paulista (0.04 per cent), and Tabapuã (0.8 per cent), all large municípios.²⁹

5. The only municípios with more than one per cent of their total areas in citrus trees outside of the two main regions were Diadema (24 square kilometers), Jardinópolis, an outlier of the

²⁶See Table XXVIII in the Appendix.

²⁷See Table XXI on page 141.

²⁸See the map on page 91.

²⁹All of these municípios are above average in size: Cândido Mota (580 square kilometers), Paraguaçu Paulista (1043 square kilometers), and Tabapuã (474 square kilometers). Part of Tabapuã is in the Northern Citrus Region. In 1969 these municípios ranked 35, 36 and 38 in orange production respectively.

Northern Citrus Region, and three small municipios in isolated parts of the Western Plateau.³⁰

6. The smallness of Paulista municipios has permitted relatively accurate location of boundaries for the state's citrus regions (Figure 9, page 50). The average sized municipio is only 427 square kilometers, and the majority of the municipios in the citrus regions are smaller than average.³¹

No mention has been made of areas that lack citrus production. Two areas in particular stand out as nonproductive regions, the Atlantic Littoral and the western corner of the state (Figure 9, page 50). Both of these areas were formerly minor orange producing regions. However, the Atlantic Littoral declined during the 1930's when large quantities of superior fruit from the interior became available, and production in the western corner of the state decreased when all trees infected with citrus canker were destroyed.

A Survey of Some of the Minor Citrus Fruits.--Statistics for the other citrus fruits are not nearly so complete as for oranges. Production totals indicate their relative unimportance. However, other fruits are becoming more common throughout the state and small amounts are exported from time to time.

³⁰These municipios were Macatuba (237 square kilometers), Sarutaiá (138 square kilometers), and Santa Fé do Sul (170 square kilometers).

³¹The average size of the Tennessee county is about 1153 square kilometers.

Data for lemons and tangerines are incomplete until 1952. Continuous records for the sweet lime (Persian Lime) began in 1957. Only recently have statistics for several varieties of mandarin oranges become available. Grapefruit and kumquats are not important in Brazil and, therefore, are not included in the agricultural census.

Lemon Production.--Lemon trees grow in most parts of the state of São Paulo, but only a small crop is produced annually. Statistics for lemon production have been published by the State Department of Statistics and are available for the 14 year period, 1952 to 1965. Table VII on page 54 shows that the state's lemon output more than tripled during this period. Between 1952 and 1965 the state experienced a 62 per cent increase in population. In comparison the increase in lemons for the same period amounted to 253 per cent.

The distribution of lemon production for 1969 is shown in Figure 10, page 55. Although total production was much smaller than that of oranges, the pattern of distribution was somewhat similar. Concentration of production was not as heavy, and tended to be located near urban centers such as São Paulo, Sorocaba, Campinas and Riberão Preto. Occasionally, lemons have been exported to overseas markets.

Tangerine Production.--Tangerine production is growing rapidly in the state of São Paulo. Between 1952 and 1965 the increase amounted to 392 per cent (Table VIII). Lemons were more important than tangerines in 1952, but the reverse is the case today. If the present trend

TABLE VII
LEMON PRODUCTION IN SÃO PAULO, 1952 to 1965

Year	Hectares in Production	Number of Fruit Produced (000)	Value of Crop (U.S. Dollars)
1952	770*	96,951	7,532.05
1953	802*	91,750	3,450.13
1954	894*	89,000	3,240.75
1955	1,244	121,000	4,851.50
1956	1,162	129,700	6,602.25
1957	1,285	140,800	8,373.59
1958	1,411	150,500	5,720.59
1959	1,675	199,200	7,077.64
1960	1,927	238,500	7,303.73
1961	2,019	250,900	7,517.52
1962	2,403	267,300	6,596.48
1963	2,553	334,706	9,220.96
1964	2,579	299,917	9,595.16
1965	2,735	342,545	9,587.21

Source: Departamento de Estatística de São Paulo, except entries marked with an asterisk which are taken from the Anuário Estatística do Brasil, 1955.

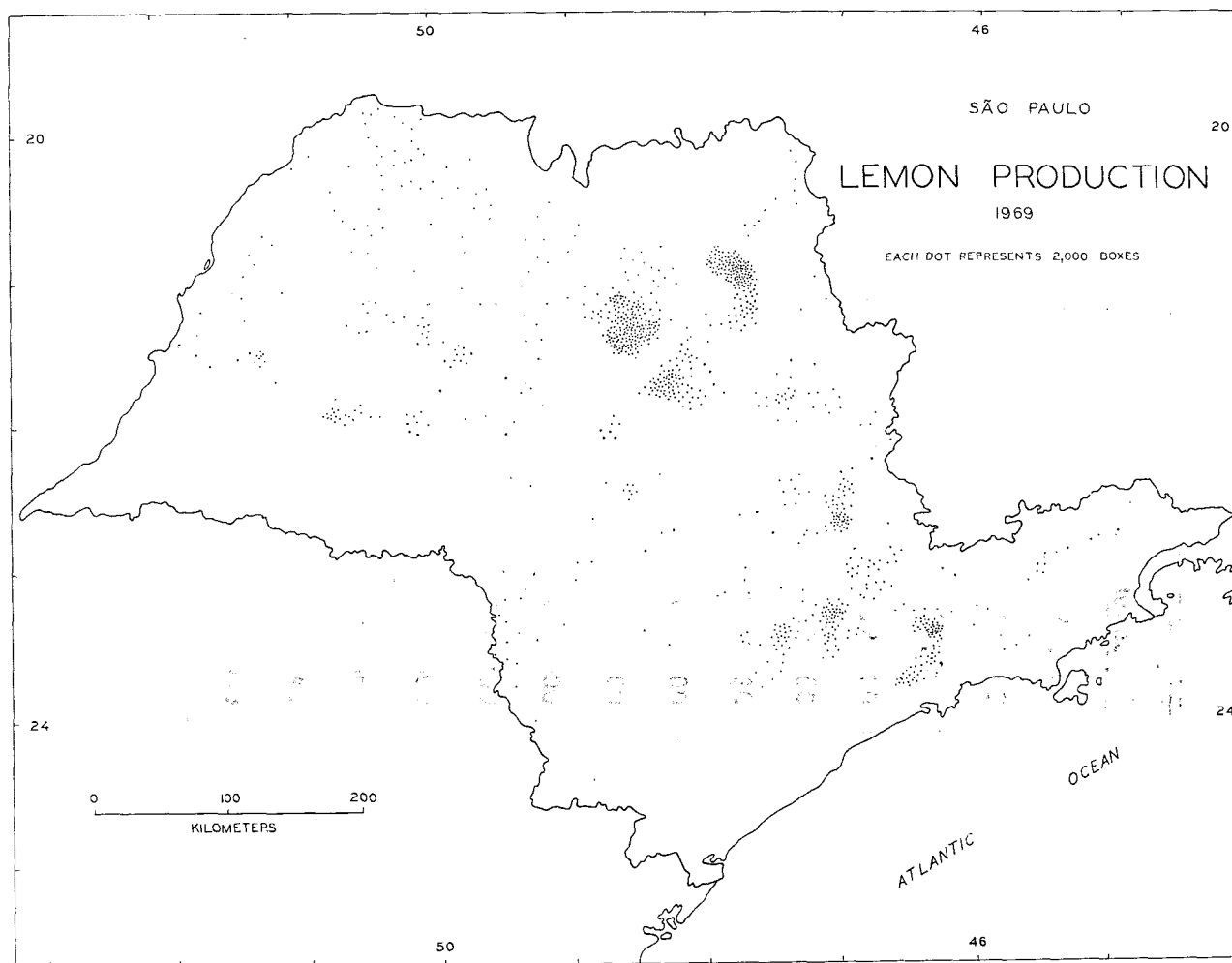


Figure 10. Lemon Production, 1969.

Source: Files of the São Paulo Department of Agriculture.

TABLE VIII

TANGERINE PRODUCTION IN SÃO PAULO, 1952 to 1965

Year	Hectares in Production	Number of Fruit Produced (000)	Value of Crop (U.S. Dollars)
1952	702*	71,731	5,924.67
1953	801*	96,493	3,055.40
1954	1,131*	98,161	5,013.02
1955	NA ^x	112,000	4,027.06
1956	1,840	140,100	10,495.99
1957	2,325	184,200	12,043.47
1958	2,432	163,100	8,142.54
1959	3,054	216,300	10,189.32
1960	3,418	234,500	8,452.81
1961	3,513	246,200	6,273.97
1962	3,858	270,600	8,291.25
1963	4,052	292,364	9,434.64
1964	4,227	273,443	11,033.01
1965	4,963	353,033	12,375.38

^xNot Available.

Source: Departamento de Estatística de São Paulo, except entries marked with an asterisk which are taken from the Anuário Estatística do Brasil, 1955.

continues, the gap between the two will widen. Tangerines have become increasingly important on local urban markets, and some of the processing plants are beginning to increase their output of tangerine juice.

Tangerine production is scattered throughout much of the state (Figure 11). The only major center is the município of Limeira where 309,000 boxes were harvested in 1969.³² Several small producing regions are located near São Paulo, Campinas and Sorocaba. The northern and western parts of the state and the município of Pariquera-Açu in the southern portion of the Atlantic Littoral are also minor tangerine producing areas.

Sweet Lime Production.--The sweet lime (Persian Lime) is a relatively unimportant citrus variety. Production statistics have only been available since 1957 and the quantity of fruit sold is small. However, limes have become increasingly popular in the urban centers of Brazil. Sweet lime production has increased rapidly since 1957, more than tripling in only nine years (Table IX).

Sweet lime production is limited primarily to several municípios near the state capital. The map on page 60 shows that only a small number of sweet limes were produced elsewhere in the state.

Miscellaneous Citrus Varieties.--In Brazil the grapefruit is little more than a curiosity and has been grown commercially only

³²Taken from the files of the Secretaria da Agricultura, São Paulo, SP.

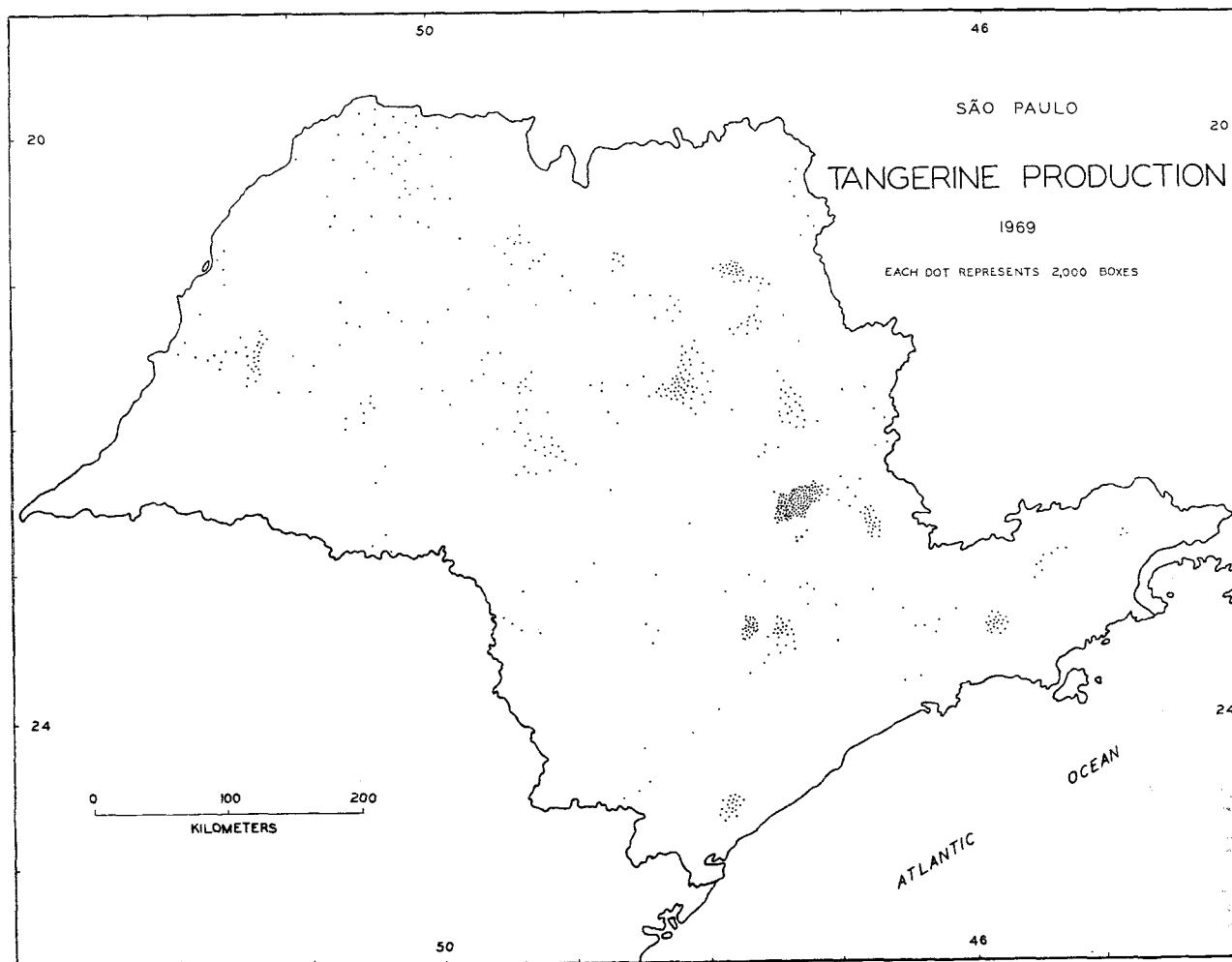


Figure 11. Tangerine Production, 1969.

Source: Files of the São Paulo Department of Agriculture.

TABLE IX
SWEET LIME PRODUCTION IN SÃO PAULO, 1957 to 1965

Year	Hectares in Production	Number of Fruit Produced (000)	Value of Crop (U.S. Dollars)
1957	44	4,157	190.16
1958	46	4,792	130.63
1959	53	4,685	104.73
1960	57	5,754	128.64
1961	104	8,863	190.66
1962	109	9,741	244.54
1963	113	9,049	262.73
1964	164	14,724	456.23
1965	146	14,890	326.78

Source: Departamento de Estatística de São Paulo.

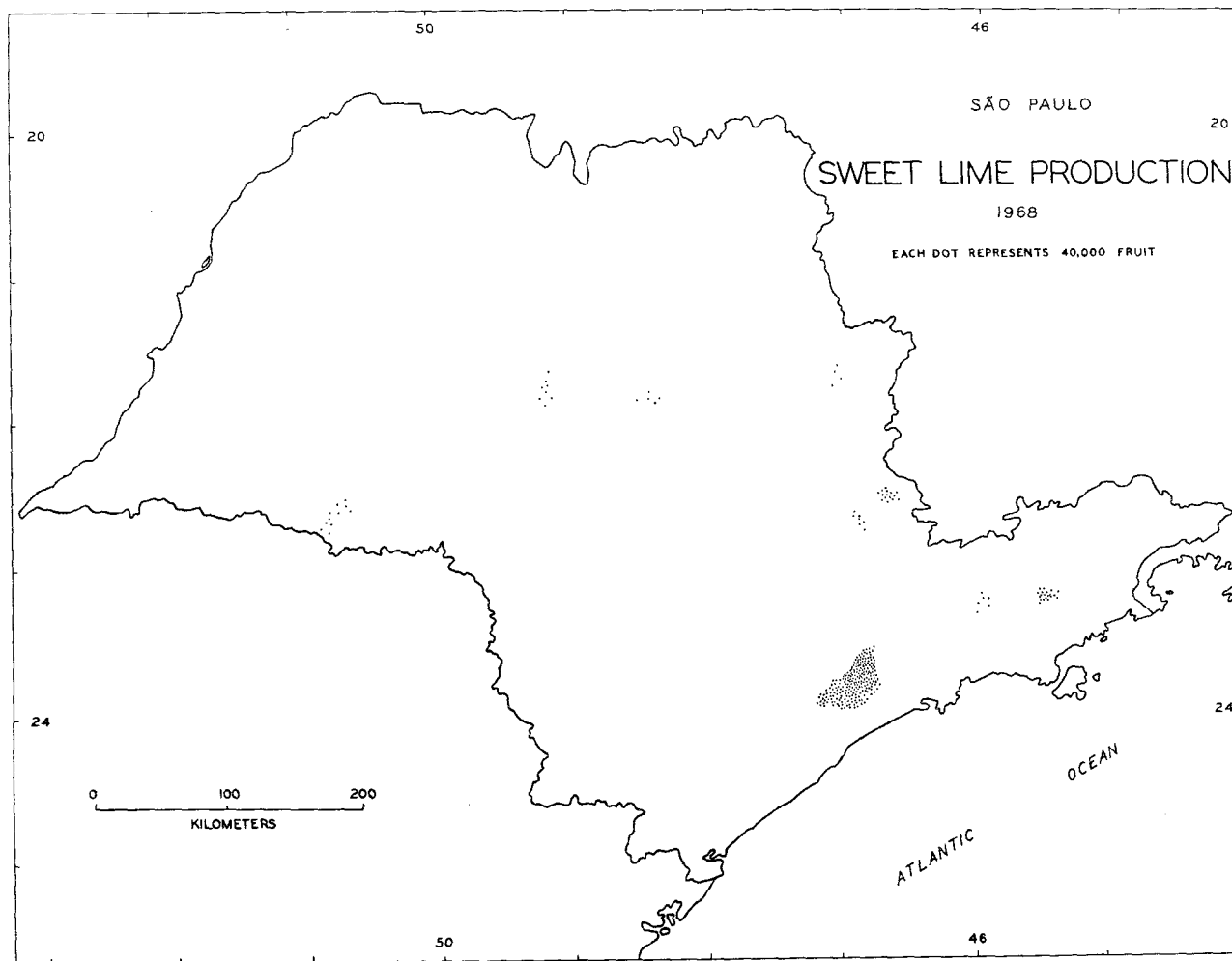


Figure 12. Sweet Lime Production, 1968.

Source: Files of the São Paulo Department of Statistics.

by some of the major citrus exporting companies such as Anglo-Frigorífico. The unimportance of the grapefruit is emphasized by the complete absence of statistical data in the federal and state records.

Other citrus varieties, such as the kumquat and various types of citrus hybrids, are sometimes sold by nurserymen but are generally grown only in residential gardens. In 1969 certain mandarin orange varieties such as the Cravo Orange, the Ponkan, and the Mexerica were given separate treatment in the agricultural census of the São Paulo Department of Agriculture. This is an indication of the increasing importance of these types of oranges.

CHAPTER V

PRODUCTION CHARACTERISTICS, METHODS AND PROBLEMS

Within the state of São Paulo citrus is produced with varying degrees of proficiency. The extent to which scientific techniques are practiced depends on the knowledge, background, and financial resources of the fazendeiro. Generally the larger commercial farms are characterized by higher efficiency and greater productivity. The Otto H. Mahle citrus fazenda is an example of one of the state's large commercial farms.

The Otto H. Mahle Citrus Fazenda¹---The Otto H. Mahle citrus fazenda is located in the município of Bebedouro, approximately 325 kilometers northwest of São Paulo. It consists of 2,200 hectares, of which more than half are devoted to citrus production.

The fazenda has 350,000 producing orange trees and 35,000 young trees. Of the producing trees, some 60 per cent are of the Pêra variety, 25 per cent are Valencias and Natsals, and the remaining 15 per cent are Hamlins. No other citrus varieties are produced commercially.

¹On March 12, 1970, the writer spent approximately four hours visiting with Mr. Mahle, the owner of the largest citrus fazenda in the state of São Paulo. Mr. Mahle came originally from the Black Forest of southern Germany. He has spent 44 years in Brazil, 20 of which have been devoted to citriculture in the Bebedouro area.

Citrus yields average 2 1/2 boxes per tree.² Some trees produce as many as 15 boxes per tree, depending on age and variety. Generally, trees begin producing two or three years after being transplanted, and most are under 12 years of age.

Citrus production in the vicinity of the Mahle fazenda is strongly influenced by the variability of precipitation. Unfortunately, the high cost of irrigation equipment in Brazil prohibits its widespread use, even on the more prosperous farms. During the drought of 1969 only 20 per cent (70,000) of the trees on the fazenda were irrigated, and some 500 trees died. Planned increases in irrigation equipment will provide additional security during periods of drought. Experience on the farm has also shown that irrigation helps to pay for itself by increasing production during years of normal rainfall.

Local soils within the area are not exceptionally rich, but they generally are well-drained and permit the production of fair yields even without the use of commercial fertilizers. Nevertheless, the application of fertilizers has increased yields and profits.

Labor on the fazenda is derived from two sources. Full time employees live on the farm in quarters provided by the fazendeiro. Part-time workers come from nearby towns and are transported to the farm by truck when additional help is needed for harvesting or weeding. Workers consist mainly of men and older boys; however, a few women

²Average production per tree for the state of São Paulo is 1 1/2 boxes. Boxes referred to are 40 kilo boxes.

are also employed. The availability of inexpensive labor is a significant factor in the operation of the farm.

The Mahle fazenda plants corn, rice, beans, peanuts, pumpkin, bananas and chili peppers between the rows of young nonproductive orange trees. Other crops such as pineapple (300,000 plants), rubber trees (3,500 trees), cotton, coffee, figs, grapes, and papayas are also grown. In addition to the land occupied by crops, a relatively small area is devoted to pasture, which supports both dairy and beef cattle. Diversification does not lessen the importance of citrus as the principal crop on the farm; but it results in increased profits, less fluctuation in labor requirements, and a steadier income throughout the year.

Machinery and other types of farm equipment are expensive in Brazil. Nevertheless, operations such as plowing, disking, spraying and the application of fertilizer are completely mechanized. There are no facilities for packing or processing citrus, but the construction of a small plant for the production of frozen concentrated orange juice is under consideration. Citrus is presently sold to packing houses and processing plants in Bebedouro.

The Size of Paulista Citrus Fazendas.--The Otto H. Mahle fazenda is much larger than most of the state's citrus farms. The 1960 agricultural census published by the Brazilian government indicates that 51 per cent of the state's citrus farms were smaller than 10 hectares.³

³A farm is classified as a citrus farm if citriculture is the predominant activity.

Forty-three per cent were between 10 and 100 hectares and only 6 per cent were larger than 100 hectares.⁴

Citrus farms within the major producing regions are somewhat larger than the average for the entire state. Data contained in Table X indicate that in the município of Araras⁵ approximately 26 per cent were smaller than 10 hectares, 62 per cent were between 10 and 100 hectares, and 12 per cent of the citrus farms had an area of more than 100 hectares. Recent statistics for the município of Bebedouro in the Northern Citrus Region show that 40 per cent of the farms with citrus were smaller than 10 hectares, and most of the remaining farms probably had an area of between 10 and 100 hectares.⁶

The importance of large commercial farms is indicated by the fact that holdings with less than 10 hectares comprised only 8 per cent of the area occupied by citrus farms (1960). Holdings from 10 to 100 hectares accounted for 44 per cent, whereas those with 100 hectares or more contained 48 per cent of the area devoted to citrus farms.⁷

⁴VII Recenseamento Geral do Brasil; Censo Agrícola de 1960, Serie Regional, Vol. II, Tomo XI, Parte 1. Serviço Nacional de Recenseamento, Rio de Janeiro, 1967, pp. 8-10.

⁵The município of Araras is located near the core of the Southern Citrus Region and is one of the older citrus producing areas.

⁶Shackford Pitcher and Robert B. Tisch, Citrus Processing in Brazil, Foreign Agricultural Service, U.S.D.A., 1970, p. 6. Data for the município of Bebedouro were not complete.

⁷VII Recenseamento Geral do Brasil, loc. cit.

TABLE X.

CITRUS FARMS ACCORDING TO NUMBER AND SIZE

FOR THE MUNICIPIO OF ARARAS, 1969

Farm Size Hectares	Average Number of Hectares Per Farm	Total Number of Farms	Number of Citrus Farms	Per cent. of Total Number of Citrus Farms
0.1 - 9.9	5.8	128	123	26.1
10 - 19.9	15.2	152	120	25.4
20 - 49.9	30.6	157	126	26.7
50 - 99.9	66.3	68	47	9.9
100 and more	472.9	<u>92</u>	<u>55</u>	11.6
		597	471	

Source: Shackford Pitcher, "Brazil's Citrus Processing Industry" (unpublished manuscript), p. 7.

Methods of Cultivation.--The development and production of high quality trees are important aspects of citriculture. Most of São Paulo's nurseries are concentrated in two principal citrus regions. Limeira, the leading município, has more than 200 nurseries. Bebedouro and Araras are also important nursery centers. The quality of trees produced is usually good, with much of the budwood and clonal material coming originally from the Limeira Experiment Station.⁸

The propagation of citrus trees in a Paulista nursery includes four main operations. First, a large number of seeds are planted in seedbeds. Secondly, when the seedlings reach a height of about 10 centimeters they are either placed in small containers or in nursery rows. The third step consists of the grafting or budding process. This normally takes place when the plant has attained a height of about 30 centimeters and has developed enough woody material to make the operation possible. The fourth step is an examination to ascertain if the scion has successfully united with the rootstock. If the union has developed normally, the plant is ready for sale.⁹

⁸Interview with J. P. Junior, chief citriculturist at the Estação Experimental de Limeira, Cordeiropolis, SP, July 29, 1969. The term clone refers to plants derived by asexual propagation from a single original plant. Thus all trees produced from buds obtained from a given orange tree could be considered "branches" of the original tree. The use of good clonal material improves yields substantially.

⁹Interview with Antônio Zambuzzi, foreman at the fazenda of João Dierberger, in the município of Limeira, SP, July 30, 1969. The scion is the budwood or clonal material that is united to the rootstock in the grafting or budding process.

The type of rootstock used in the propagation of citrus trees in São Paulo is very significant. Only a few varieties are resistant to tristeza, the disease that almost destroyed the industry during the 1940's. At that time most of the trees were based on sour orange rootstock which is highly susceptible to tristeza. The advent of this disease forced citrus growers to replant their groves using different rootstock. In 1969 approximately 70 per cent of the state's orange trees were based on Rangpur lime. About 20 per cent were based on Caipira stock,¹⁰ and the remaining 10 per cent were based on rough lemon, sweet lime, and other types of rootstocks.¹¹

The young citrus plants generally are transferred to fields during the height of the rainy season (January and February). On the better farms preparation for planting normally includes plowing and the construction of drainage furrows. Holes are then dug at regular intervals and small amounts of commercial fertilizer and/or calcium carbonate (lime) are mixed into each hole. Following the planting operation each tree is carefully watered.¹²

The spacing of the young trees is an important factor in the eventual productivity of the groves. In São Paulo overcrowding is frequently a problem. Statistics for the município of Limeira provide an example of conditions encountered throughout the state.

¹⁰A wild variety of orange that has spread throughout much of Brazil.

¹¹Junior, loc.cit.

¹²Zambuzzi, loc.cit.

In Limeira the spacing is usually from 250 to 350 trees per hectare.¹³ As a general rule the small to medium sized farms plant an average of 350 trees per hectare. The large commercial farms producing fruit primarily for export usually place about 250 trees per hectare. Wider spacing permits easier access for farm machinery and helps to deter the rapid spread of disease that sometimes ravages crowded groves. Experience has shown that the yield per hectare is larger for mature groves when the trees are not overly crowded. The present trend in São Paulo is toward the more widely spaced groves.¹⁴

One of the problems faced by citriculturists is the effective utilization of grove space while the trees are still young. Growers frequently need to earn an income from the land before the citrus trees begin producing. In response to this need citrus growers frequently resort to interculture. Profits obtained in this manner help to offset the expense involved in establishing the grove. Interculture is usually discontinued when citrus production commences.¹⁵

An unfortunate deficiency of the Paulista citrus industry is the widespread lack of adequate irrigation equipment. Citrus yields

¹³L. W. Ziegler and H. S. Wolfe, Citrus Growing in Florida, (Gainesville: University of Florida Press, 1961), p. 121. In Florida the figure runs from 170 to 240 trees per hectare.

¹⁴Antonio Olivio Ceron, "Aspectos Geográficos da Cultura da Laranja no Município de Limeira," (unpublished Ph.D. dissertation, Dept. of Philosophy, Sciences and Letters, University of Campinas at Rio Claro), p. 187.

¹⁵Mahle, loc. cit. Crops commonly grown between the rows of citrus trees are mentioned on page 64. A list of all the crops produced in the município of Bebedouro is shown in Table XXIX in the Appendix.

decline sharply when droughts occur. Large numbers of trees are either injured or destroyed. Much of this loss would be averted if irrigation were more widely practiced. The reasons for this deficiency are attributed to the high cost of irrigation equipment, the unavailability of attractive loans and the hesitancy on the part of some growers to invest in their groves.¹⁶

Although irrigation is practiced on a limited scale only in São Paulo, some of the more prosperous growers have benefited by irrigating portions of their groves. Yields have been increased during years of normal precipitation and substantial savings have been realized during periods of drought. Some growers have been able to pay for their equipment within two years.¹⁷

The system of irrigation most commonly used in São Paulo is overhead sprinkling. Furrow irrigation is usually avoided because few of the groves are on level land and the porosity of the soils would require large amounts of water. None of the main citrus producing regions lack water for irrigation, but during prolonged dry spells small surface reservoirs usually dry up.¹⁸

Soils within the main citrus growing regions are generally of low fertility and require regular applications of mineral fertilizers. Studies conducted by citrus experts at the Campinas

¹⁶Ibid. The problem of seasonal and annual precipitation contrasts is discussed on pages 26-30.

¹⁷Pitcher and Tisch, op. cit., p. 7.

¹⁸Ibid.

Agronomic Institute show that the principal deficiencies in citrus nutrients are nitrogen, phosphorous, potassium, calcium and magnesium. Traces of sulphur, zinc and manganese are also lacking. Deficiencies of copper, boron, iron and molybdenum are rare.¹⁹

Varying soil types in the citrus producing areas require different combinations and amounts of fertilizers to correct mineral deficiencies. Before commencing a fertilizer program, the mineral and humus content of the soil should be analyzed and the pH factor ascertained. An examination of the leaves and trees in general, as well as a consideration of insect pests, production history and previous fertilizer programs is also useful.²⁰

The application of fertilizers in São Paulo usually depends on the experience and ability of the citriculturist. In some cases the groves are carefully analyzed by citrus experts and a recommended program of soil amendments²¹ is followed. In other cases nature seems to take its course with little interference from man. An example of the manner in which fertilizers are applied can be found in the município of Limeira, the heart of the Southern Citrus Region.

In Limeira a detailed soil amendment program is followed by the large commercial companies and some of the more prosperous medium sized farms. Calcium carbonate (lime) is applied regularly

¹⁹Ody Rodriguez, "Adubação mineral de citros," Coopercotia, v. XXIV, no. 215 (Sept. 1967), pp. 51-54.

²⁰Ibid.

²¹The term soil amendment refers to the application of deficient plant nutrients and other materials that make the soil more favorable for plant development (Ziegler and Wolfe, op. cit., p. 167).

to reduce the acidity of the soil.²² Mineral deficiencies are analyzed and supplied, and organic matter is provided in the form of green manure crops. Unfortunately, the smaller and poorer farms do not follow the program described above. Usually they apply small quantities of calcium carbonate, but little attention is paid to specific plant nutrients. As a result, citrus yields are relatively low.²³

In order to stimulate agricultural production the Brazilian government has instituted a program (FUNFERTIL) that enables the farmer to purchase necessary amounts of fertilizer and defer payment until 45 days after his crops have been harvested. The government subsidizes the interest costs and assures the farmer the original buying price. Many citrus growers in São Paulo have taken advantage of this program and are experiencing higher yields as a result of increased applications of fertilizer.²⁴

The lack of adequate weed control is a common problem on Paulista citrus farms. Warm, moist summers encourage the rapid development of annoying weeds. Citrus experts recommend spraying

²²Climatic conditions in São Paulo favor the process of leaching. Leaching removes the soluble minerals and increases the acidity of the soil. This in turn reduces the ability of the plant to obtain a balanced supply of nutrients. Citrus trees assimilate plant foods with the greatest facility when the pH factor is 6.0 or when the soil is mildly acidic. Paulista soils are frequently very acidic and need periodic correction (Rodriguez, op. cit., p. 53).

²³Ceron, op. cit., p. 185.

²⁴Interview with Shackford Pitcher, Agricultural Attaché, U.S. Consulate in São Paulo, Brazil, Feb. 19, 1970.

or disking as a means of controlling unwanted plants. Nevertheless, many farmers rely solely on the hoe to clear their groves. Frequently, weeds are left between the trees to act as a cover crop. This practice may protect the soil from erosion, but it also robs the citrus trees of essential nutrients and results in reduced yields. In order to increase production the large, commercial farms usually remove weeds by spraying and disking.²⁵

Pruning on Paulista citrus farms occurs once a year. Undesirable sprouts and dead wood are removed to help prevent the spread of disease. Usually little attention is paid to the spacing of limbs and the general symmetry of the trees. Pruning is frequently omitted on the small farms.²⁶

There is generally an abundant supply of labor in the citrus growing regions. The larger fazendas employ full-time workers who live on the premises and seasonal laborers who come from nearby cities or communities. On the smaller farms, most of the work is done by the owner, with little outside help.²⁷

Normally, the workers are men and older boys from lower income groups within the urban centers. Sometimes the workers are new residents of the state who have moved from other parts of Brazil

²⁵Kurt von Hertwig, "Erva daninha rouba produção de citrus," Coopercotia, v. XXVII, no. 249 (July 1970), p. 38.

²⁶Citrus trees on the large commercial farms compared favorably with those seen in Florida, but trees on the smaller farms showed little evidence of pruning.

²⁷Pitcher and Tisch, op. cit., p. 7.

in search of better opportunities. Itinerant or migrant labor is uncommon.²⁸ The minimum monthly wage is approximately \$40.00 (U.S. equivalent). This will undoubtedly increase as time goes on, but labor will probably continue to be a relatively inexpensive aspect of Paulista citrus production.²⁹

A serious problem facing citriculturists in São Paulo is the threat of citrus pests³⁰ and diseases. No other problem has caused more concern and resulted in greater loss. Millions of trees have been killed. Production and exports have experienced periodic declines, and the distribution of citrus farms within the state has been changed. In brief, the survival of the Paulista citrus industry as a viable economic activity depends on the successful control of this problem.

Various types of citrus pests are common in São Paulo. The single most damaging type is the fruit fly. Large amounts of citrus are spoiled when fruit flies deposit their eggs beneath the skin of the developing fruit.³¹ Controlling the fruit fly menace in São Paulo

²⁸Ibid.

²⁹Interview with Horst J. Happel, Manager of Citrosuco Paulista, Matão, SP, March 13, 1970.

³⁰The term citrus pests refers to a variety of insects and mites that are commonly found in citrus groves. They inflict damage on both the tree and the fruit. Mites are spider-like creatures with eight legs. Insects have six legs.

³¹The life cycle of the fruit fly begins with the laying of eggs in the fruit. The eggs soon develop into fruit-eating larvae. Damage inflicted by the larvae usually causes the fruit to fall to the ground where pupation occurs. If the ground under the trees is cleared regularly, the larvae do not have time to enter the ground and an interruption of the life cycle takes place.

is hindered by the failure of some growers to spray their trees and to remove decaying fruit from the groves. Also, non-citrus crops such as coffee act as hosts for fruit flies.³²

Citrus scales constitute another type of insect pest. In São Paulo the Florida red and purple scales are the most harmful. They feed on the leaves, fruit rinds, twigs, and branches. As a result the fruit fails to mature properly, and the affected leaves are unable to produce a normal amount of food for the tree. Citrus scales can be controlled by predatory parasites. Unfortunately, many kinds of sprays used by citrus growers kill the predatory parasites without destroying the scales. Consequently, it is usually necessary to spray the trees with special scalicides.³³

Another citrus pest that feeds on leaves, fruit and young twigs is the Rust mite. This exceedingly small, spider-like creature is present in all parts of São Paulo.³⁴ Damage inflicted by the Rust mite consists of fruit discoloration and tree defoliation. Spraying and dusting are necessary for effective mite control.³⁵

The black aphid is another citrus pest that thrives in São Paulo. Aphids are sometimes referred to as plant lice and constitute a hazard in citrus groves because they are vectors of

³²J. Henry Burke, Citrus Industry of Brazil, Foreign Agricultural Report no. 109 (Washington: U.S. Government Printing Office, 1958), p. 13.

³³Ibid.

³⁴Ibid.

³⁵Ziegler and Wolf, op. cit., pp. 185-189.

tristeza. They also feed on young shoots during the growing season. Aphid control can be accomplished by the application of aphicide sprays.³⁶

Tristeza has inflicted greater damage in São Paulo than any other disease. It was carried from South Africa to Argentina with a shipment of nursery plants during the 1930's. From Argentina it spread to São Paulo where it first appeared in the município of Taubaté in 1937. Within a few years some ten million trees in the state died.³⁷ Trees with sour orange rootstock³⁸ developed necrosis at the point of union between the rootstock and the scion, thereby cutting off the food supply for the tree. Trees based on different types of rootstock such as Rangpur lime, sweet orange, the Cravo orange and others were resistant to the tristeza virus. It was therefore necessary to undertake the tremendous task of replanting Paulista groves with new trees.³⁹

Another disease that has damaged groves in São Paulo is citrus canker. It was first identified in the far western corner of the state near the town of Presidente Prudente in 1957 and was reported to be of the "A" or virulent strain.⁴⁰ It gradually spread through-

³⁶Burke, loc. cit.

³⁷Junior, loc. cit.

³⁸In 1937 practically all the state's citrus trees were based on sour orange rootstock.

³⁹Junior, loc. cit.

⁴⁰Burke, op. cit., p. 15.

out the western part of the state but remained entirely south of the Tietê river. In order to combat the problem, the state government introduced an eradication program in which more than 1.1 million citrus trees were destroyed. Citrus plantings were suspended in the infected areas until October 1968, after which only small groves were permitted under the strict control of the São Paulo Department of Agriculture (SPDA).⁴¹

Paulista groves have also been affected by Exocortis, Xyloporosis and Psorosis. These virus diseases have not been as devastating as tristeza and citrus canker, but have occasionally reduced yields. The Limeira Experiment Station has endeavored to combat these diseases by providing the nurseries with uncontaminated bud and grafting material, and by encouraging the use of appropriate stock and scion combinations.⁴²

Other citrus diseases present in São Paulo are gummosis, rubelosis, melanose, stem-end rot, and scab. These diseases are of lesser importance than those mentioned above but gummosis and melanose occasionally inflict serious damage.⁴³ Gummosis, or "foot-rot", attacks the trunk, causing the bark to rot. If gummosis is detected in its early stages the tree can be saved by applying fungicides to

⁴¹Pitcher and Tisch, op. cit., pp. 4-5. The initials SPDA will be used throughout the remainder of this chapter in order to provide greater brevity.

⁴²Junior, loc. cit.

⁴³Burke, loc. cit.

the affected areas.⁴⁴ Melanose is a fruit-damaging disease that reduces the value of the fruit by blemishing the rind. It can be controlled by the application of copper sprays.⁴⁵

Main Citrus Varieties.--The rise of the São Paulo citrus industry to its present place of importance is related in part to the selection of the Pêra as the state's major citrus variety. Before the Second World War most of the growers produced the larger, but less productive, Bahia navel orange which failed to attract European buyers. As a result, prewar exports from São Paulo fell behind those of the state of Rio de Janeiro where the principal variety was the Pêra. After the war when Paulista growers were replanting their groves with tristeza-resistant rootstock, they switched to the Pêra because of its popularity at home and overseas. The importance of the Pêra has gradually increased until today it is the state's main citrus variety.⁴⁶

The Pêra is a juicy, medium sized orange with a thin skin. It is ideal for the domestic market because it can be tree-stored for a relatively long period of time and harvested when needed.⁴⁷ The high quality of its juice has helped to make it one of the main

⁴⁴Junior, loc. cit.

⁴⁵Burke, loc. cit.

⁴⁶Ceron, op. cit., pp. 183-184.

⁴⁷Storage facilities are limited in São Paulo. See page 110.

types of oranges used in the processing industry. The Pêra is similar to the Valencia in appearance and is also a late ripening orange.⁴⁸

Another important variety is the Hamlin, an early ripening orange from Florida. Because of its acidity, it is not in great demand on the domestic market. It is grown primarily for export and for use in the processing plants. Another early ripening orange is the Bahianinha, or Little Bahia orange. It is known for its sweetness and high juice content, and is very popular among Brazilians.⁴⁹

Other varieties such as the Pineapple orange, the Valencia, the Natal and the Barão are of minor importance commercially. They ripen at various times and help to provide a steady supply of fruit during the year.⁵⁰

Government Assistance.--The São Paulo Department of Agriculture has actively promoted the growth and development of the Paulista citrus industry. Most of the assistance has been in the form of research, disease control, education (publications) and legislation.⁵¹ Without the help of the SPDA and its research and experimental centers it is doubtful that the state's citrus industry could have attained its present level of prosperity.

⁴⁸Ceron, loc. cit.

⁴⁹Ibid.

⁵⁰A list of some of the more common Brazilian citrus varieties is found on page 172, Table XXX. Unfortunately, production data according to variety do not exist.

⁵¹Government control is more limited in Brazil than in countries such as Israel or South Africa.

The most important agricultural research center in São Paulo is the Campinas Agronomic Institute located approximately 100 kilometers northwest of the state capital. The institute is under the control of the SPDA and is one of the most modern and active centers of agricultural research in Latin America.

Within the Campinas Agronomic Institute is a separate section that deals specifically with citricultural problems. Much of the research is carried out in experiment stations operated by the institute or on fazendas that cooperate on a voluntary basis. The Limeira Experiment Station is primarily concerned with citrus research and is the foremost center of its kind in Brazil.⁵²

The Limeira Experiment Station is located near Cordeiropolis, approximately 158 kilometers northwest of the city of São Paulo.⁵³ It is situated on 189.9 hectares of nearly level terrain at an elevation of 680 meters above sea level. The station was founded in 1928 and originally consisted of only 72.6 hectares. The land had been in pasture for a long time with no existing facilities such as housing, running water or electricity. The first development was a well, and before long buildings were also constructed (Figure 13). Subsequent purchases of land increased the station to its present size.⁵⁴

⁵²The institute operates 17 experiment stations in different parts of the state. Several of these stations study citrus problems.

⁵³Visits to the Estação Experimental de Limeira were made on two occasions, July 29, 1969, and March 13, 1970. Interviews were with George Pompeu Junior, the chief citriculturist at the station.

⁵⁴Limeira Experiment Station Guide, Instituto Agrônômico de Campinas (Campinas: Instituto Agrônômico de Campinas, 1963), p. 3.

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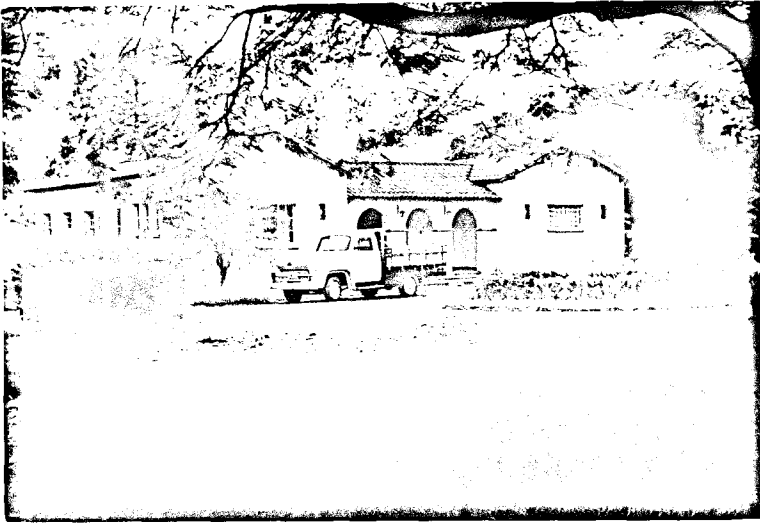


Figure 13. Administrative building of the Limeira Experiment Station near Cordeiropolis.

This is Brazil's most important citrus research station.

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Figure 13. Administrative building of the Limeira Experiment Station near Cordeiropolis.

This is Brazil's most important citrus research station.

The first major contribution of the experiment station was to discover a method for the control of tristeza. By analyzing the cause of the disease and discovering the more tolerant rootstocks, the citrus specialists at the station were able to direct the fazendeiros in reestablishing their groves.⁵⁵

The station has also carried on extensive research in connection with other pests and diseases, and has helped farmers with such matters as fertilization, soil management practices, irrigation, and assistance in citrus selection. Nucellar clones⁵⁶ have been developed from registered trees and distributed among the growers. As a result of the research conducted at the station it has become known internationally and performs experiments for a number of other countries.⁵⁷

The Limeira Experiment Station is closely tied to the citricultural section of the Campinas Agronomic Institute. Findings at the station are reported to the citricultural office and from time to time articles by the citrus specialists are published in Bragantia, a publication of the institute. Material is also circulated among the agronomists in the citrus producing areas.

Besides promoting research, the SPDA collects and prepares statistical data that are useful in analyzing the needs and problems

⁵⁵Ibid., p. 2.

⁵⁶Seeds frequently contain embryos formed from the nucellus, the chief part of the ovule. These nucellar embryos are derived entirely from the mother plant and reproduce it with as much certainty as buds and grafts. Ziegler and Wolfe, op. cit., p. 14.

⁵⁷Limeira Experiment Station Guide, op. cit., p. 1.

of the citrus industry. Each year information such as crop areas, yields, and values are recorded by the department's representatives in each município. These, in turn, are forwarded to the central statistical office in the city of São Paulo.

The SPDA is also responsible for publishing useful material for the agronomist and farmer. An informative bulletin entitled Agricultura em São Paulo is an example. This publication contains helpful articles on various phases of Paulista agriculture, including citrus. There are also many other publications treating a wide variety of agricultural topics.

In order to provide a link between the SPDA headquarters and the farmer, a branch office has been established in each município.⁵⁸ These offices are manned by agronomists who have the responsibility of collecting statistical data, disseminating useful information to the farmers, and furthering the cause of agriculture in their areas.

Another activity of the SPDA is the inspection of fruit and trees. Out-of-state citrus is examined at the state border and diseased fruit is destroyed. Infested trees within the state are either treated or destroyed. Quarantine programs have also been conducted.

One of the functions of the SPDA is to promote legislation that will benefit the industry. An example of this type of assistance is the law which exempts fresh citrus from a 17 per cent value-added tax (ICM) on exports.⁵⁹

⁵⁸The SPDA headquarters is located on Rua Anchieta No. 41 near the center of the city of São Paulo. Each município has a branch office known as the Casa da Agricultura.

⁵⁹Pitcher and Tisch, op. cit., p. 17.

Prospects for Paulista Citriculture.--Any prognosis concerning the future of Paulista citriculture must be stated in terms of a number of factors that influence the prosperity of the industry.

1. The foremost climatic variable facing the state's citrus growers is the possibility of occasional drought. Production totals could be slashed considerably in the event of an extended dry period. However, this variable will decrease in significance as irrigation equipment becomes more widespread.

2. The most important economic variable is the state of the citrus market. For the past 20 years Paulista citrus production has been increasing rapidly. From Table VI on page 36 it can be noted that 89,500 tons of oranges were produced in 1952. In 1969 the total had risen to 1,393,200 tons. The SPDA estimated the 1970 and 1972 crops at 1,792,000 tons and 1,953,600 tons, respectively. By 1975 it is estimated that the total yield will be about 2,400,000 tons.⁶⁰ After noting these projections, the question that arises immediately is the ability of the market to absorb these increases.⁶¹ Will growing productivity be matched by an expanding market? Since the answer to this question rests primarily on the prosperity and size of the market, it will be considered in Chapter VII where the market situation is examined in greater detail.

⁶⁰Antonio A. Amaro, "Laranja com sinal amarelo," Correio Agro-Pecuário, X (February, 1970), p. 17.

⁶¹The state of São Paulo has a tremendous potential for increasing its citrus production. Theoretically, it could probably supply the entire world with citrus fruit; however, the likelihood of achieving this end is remote.

3. Another variable is disease. Should the SPDA relax its vigilance in controlling certain types of citrus diseases, the groves in the state could rapidly become infected and a decline in production would soon result. At present this problem appears to be minimal since the lesson learned from tristeza has left an indelible impression on the minds of government experts and citrus growers.

4. Lastly, the prosperity of Paulista citrus growers will be strongly influenced by governmental action concerning several important factors such as inflation, tax incentives, aid in stimulating trade, and the general development of the state. Greater governmental assistance in these matters would strengthen the economic base of the citrus industry.

CHAPTER VI

THE RISE OF THE CITRUS PROCESSING INDUSTRY

One of the most significant economic developments in the state of São Paulo has been the rise of the citrus processing industry. The first factory was constructed in 1962, and within four years São Paulo had become a major exporter of frozen concentrated orange juice.¹

The establishment of processing plants has benefited the citrus industry and the economy of the state in several ways. The most significant contribution has been an increase in the capacity and flexibility of the citrus market. Between 1963 and 1970 citrus processing plants purchased approximately 40,000,000 boxes of oranges.² Fruit that has failed to meet export standards due to unsatisfactory size or rind appearance has been channeled to the processing plants.³ In this manner profits have been realized that were formerly lost. The processing plants have also absorbed excess fruit when exporters and domestic wholesalers or retailers were over supplied.

¹Table XXIII on page 144 shows world exports of frozen concentrated orange juice.

²See Table XXXI in the Appendix.

³No statistics showing the percentage of fruit that failed to meet export standards were available, but Brazilian fruit is frequently either too large or the rind is blemished.

Improved market conditions have established confidence among citrus growers and have stimulated an increase in the number of hectares devoted to citrus production.⁴ This, in turn, has created a greater demand for nursery plants, irrigation equipment, fertilizer, transportation, and other accessory items that accompany citrus production. Employment opportunities in the citrus producing areas have also been improved.⁵

The citrus processing industry has provided Brazil with another important export commodity. In 1968 frozen orange juice was the nation's third most valuable export (\$11,600,000) in the processed food category.⁶ The total value of the juice is not large when compared with the nation's total exports (\$881,000,000) but is significant when viewed within the context of Brazil's need to reduce its sizeable trade deficits.⁷

Factors Responsible for the Rise of the Processing Industry.--

Prior to 1962, the Paulista citrus industry was primarily concerned

⁴See Table VI on page 36.

⁵Approximately 500,000 people are connected in some way with the production and commercialization of citrus in the state of São Paulo. "MA enfrenta cancro-citrico," Coopercotia, v. XXVI, no. 238 (August 1969), p. 5

⁶Shackford Pitcher and Robert B. Tisch, Citrus Processing in Brazil (Foreign Agricultural Service, U.S.D.A., 1970), p. 2. Orange juice was exceeded by canned beef and soluble coffee.

⁷Anuário Estatística do Brasil - 1969, Vol. 30 (Rio de Janeiro: Instituto Brasileiro de Estatística, 1969), pp. 266, 269. Brazil's imports exceeded its exports by \$251,000,000 in 1968. The Paulista portion of this deficit was \$66,601,031 or about 27 per cent of the nation's total. Orange juice exports reduced the Paulista trade deficit by about 16 per cent or the national deficit by approximately 4 per cent.

with the production and packing of fresh fruit. Only small amounts of citrus preserves and beverages were manufactured for the local market. No modern plants designed to produce frozen orange juice existed.

The initial factor that lead to São Paulo's entrance into the juice processing industry was adverse weather in the Florida citrus region of the United States. In October and November of 1962, Florida experienced freezing conditions that resulted in serious crop losses.⁸ Citrus production declined by 30 per cent from the previous year.⁹ The number of oranges available for use by the processing plants dropped 32 per cent. The quantity of citrus fruit shipped out of the state decreased by 47 per cent. During the same period the amount of concentrated orange juice produced fell by 56 per cent.¹⁰ As a result of the temporary decline of the Florida citrus industry during the 1962-63 season, an orange juice shortage was created and prices soared throughout the world.¹¹

In order to take advantage of the unusually high prices, several countries immediately introduced plans to increase or commence

⁸Lance S. Belville, "Infant Industry Has Bright Future," Brazilian Business, XLV (March, 1965), p. 1.

⁹Citrus Fruits by States, 1909-10 ---- 1964-65, Statistical Bulletin No. 380, January 1967 (Washington, D.C.: Statistical Reporting Service, U.S.D.A.), p. 18.

¹⁰Doyle Conner, Division of Fruit and Vegetable Inspection, 1967-1968 Season Annual Report, August 1968 (Tallahassee, Florida: Florida Department of Agriculture), pp. 8, 14, 15.

¹¹Interview with Shackford Pitcher, Agricultural Attaché, U.S. Consulate in São Paulo, Brazil, Feb. 19, 1970.

the production of frozen orange juice. Spain decided to expand its output. Israel rapidly set up processing and freezing plants that were flown from Florida, piece by piece. Even some of the companies operating in Florida looked elsewhere for juice. Salada Foods, Inc., moved a plant to Honduras in January, 1963, and was importing juice into Florida by May.¹² In São Paulo a small plant had been erected near Bebedouro in 1962 prior to the Florida freeze. However, its capacity was small, and it was unable to place large amounts of juice on the international market.¹³

Recognizing the economic advantages and possibilities, another Brazilian company, Toddy do Brasil, began construction of a large, modern plant for the production of frozen orange juice. Within four months the plant, Suconasa, was producing frozen orange juice for sale overseas.¹⁴

One of the factors that influenced the Toddy Group to enter the processing business was Brazil's advantageous location in the Southern Hemisphere. When Florida's freeze took place it was summer in Brazil and the Toddy Group had until the following April or May before their own orange crop would start maturing. By then the United States and Europe would begin to feel the effects of the juice shortage. Suconasa was established during this period and by

¹²Belville, op. cit., p. 3. The headquarters of Salada Foods, Inc., is in Toronto, Canada.

¹³Interview with the plant foreman of Companhia Mineira de Conservas, S.A., March 12, 1970.

¹⁴Suconasa, (São Paulo: Toddy do Brasil, n.d.), p. 9.

May, 1963, it was reaping the rewards of a temporarily under supplied market.¹⁵

Several other factors gave São Paulo a competitive base for entering the international orange juice market. The availability of capital and the existence of an expanding citrus industry were distinct advantages for the rapid establishment of the processing industry. The high quality of Paulista orange juice and the low cost of labor were also significant.¹⁶

A Survey of the Paulista Processing Plants.--Five processing plants were in operation within São Paulo in March 1970.¹⁷ Each of these plants produced approximately the same items and followed similar manufacturing procedures. However, certain important differences among them, such as ownership, size, capacity, and location, make a brief description of each plant helpful in gaining a clearer picture of the processing industry. The following survey is arranged chronologically according to the date when each plant was established (Figure 14).

Companhia Mineira de Conservas, S.A. - The first processing plant was erected in a rural setting only five kilometers northwest

¹⁵Belville, op. cit., p. 3.

¹⁶Interview with H. J. Happel, manager of Citrosuco Paulista, S.A., Matão, SP., March 13, 1970.

¹⁷There are also several smaller plants that have gone out of business and are presently standing idle (March, 1970). These plants were only marginal producers and of little significance to the industry as a whole. They will therefore not be treated in this survey.

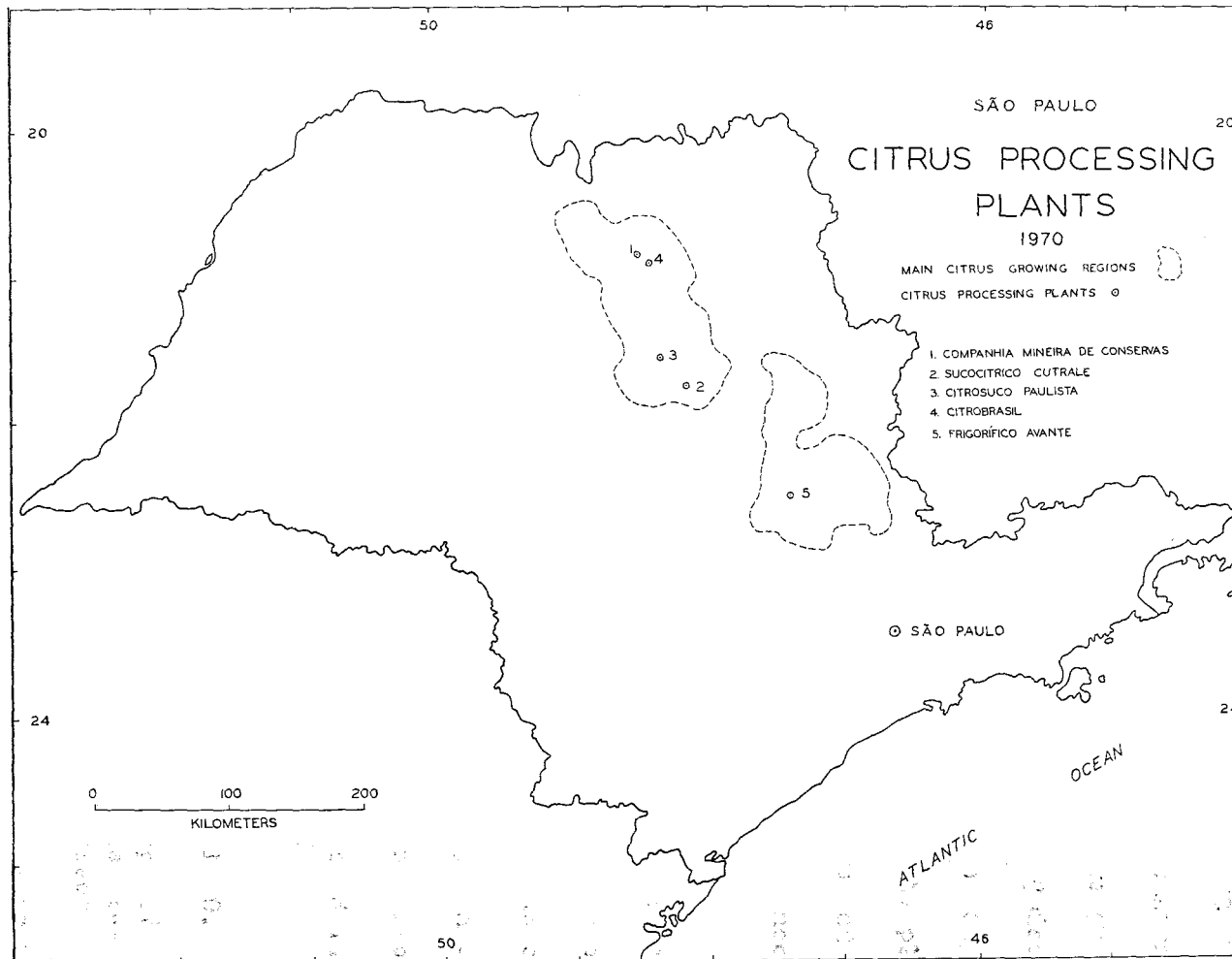


Figure 14. Citrus Processing Plants.

Source: Files of the São Paulo Department of Agriculture.

of Bebedouro (Figure 15). The name of the company is Companhia Mineira de Conservas, or the Mineiro Preserves Company, and it is owned by the Brazilian concern, Sanderson do Brasil. The plant, constructed in 1962, is the smallest of the processing plants presently operating. The principal source of fruit is from the surrounding citrus fazendas and the products are sold primarily on the foreign market.¹⁸

The main product of this plant is frozen orange juice. It is generally concentrated to 65° Brix and then packaged in large metal drums with a capacity of approximately 190 liters.¹⁹ The plant also produces some hot pack orange juice, but this is of limited importance.²⁰ Other products include some lemon juice concentrate, as well as orange essence and oils.²¹

Sucocitrico Cutrale, S.A. - The next processing plant to be erected went into production on the south side of the city of Araraquara in May, 1963 (Figure 16). This plant was originally financed by the Toddy Group and was named Sucos e Conservas Nacionais, S.A., or Suconasa for short. In 1967 the plant was sold to a new group and renamed Sucocitrico Cutrale.²² This plant has the second largest

¹⁸Interview with the plant foreman, March 12, 1970.

¹⁹Brix is the name of a scale expressing the specific gravity of liquids. In the case of orange juice the scale measures the concentration of sugar by weight. Brix is stated in degrees.

²⁰Hot pack is a method of canning in which the item is partly cooked before being placed in a container and sterilized.

²¹Interview with the plant foreman, March 12, 1970.

²²The name "Cutrale" refers to the president of the company, Sr. Cutrale.

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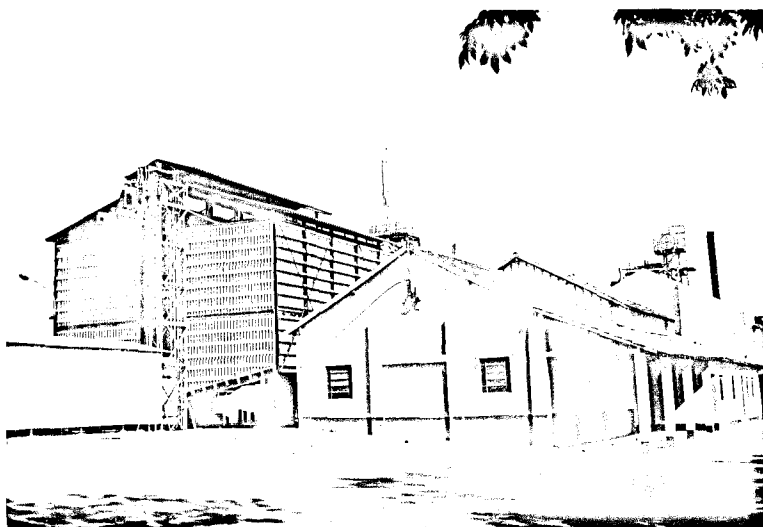


Figure 15. Companhia Mineira de Conservas, S.A., the oldest processing plant in São Paulo.

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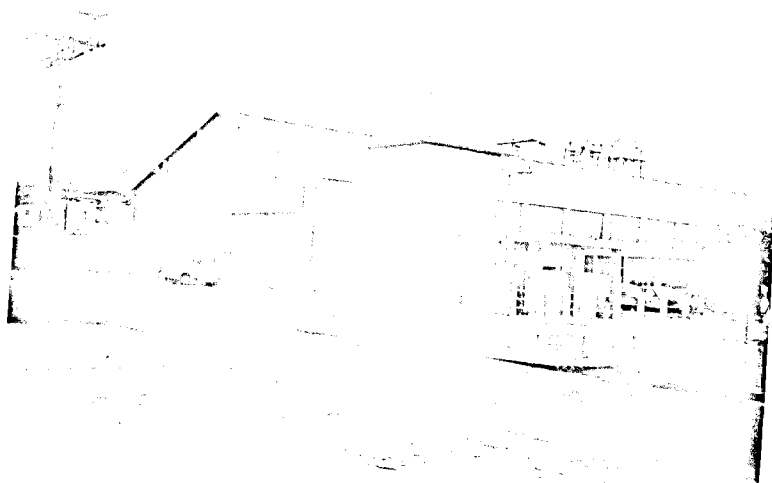


Figure 16. Sucocitrico Cutrale, S.A., the second largest processing plant in São Paulo.

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Figure 15. Companhia Mineira de Conservas, S.A., the oldest processing plant in São Paulo.

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Figure 16. Sucocitrico Cutrale, S.A., the second largest processing plant in São Paulo.

production capacity of any within the state and is of modern design and construction. The plant's laboratory keeps a constant check on the quality of the fruit and juice. The fruit supply comes primarily from the Northern Citrus Region and most of the products are sold on the foreign market.²³ Frozen orange juice is the main item produced, but byproducts such as orange essence and oils are also manufactured. Another less profitable byproduct is cattle food.²⁴

Citrosuco Paulista, S.A. - In October, 1964, the state's largest processing plant, Citrosuco Paulista, S.A., began production. It was originally affiliated with Pasco of Florida but is presently under Brazilian and German ownership. The plant is located on a gentle hillside near the northwestern edge of the city of Matão (Figure 17). The grounds are neat and clean with an attractive flower garden beautifying the front of the plant. The buildings are new and of modern design. A tall water tower and adjacent purifying plant is evidence of the need for an abundant supply of pure water.²⁵

Citrosuco Paulista also has its own laboratory and specialists that keep constant check on the quality of the fruit. Samples taken when the fruit enters the bins at the unloading docks are carefully inspected. Juice samples are also examined during the processing

²³Interview with Mauro Cesar Grato, of Sucocitrico Cutrale, August 10, 1969.

²⁴Ibid.

²⁵Interview with Mr. Horst J. Happel, manager of Citrosuco Paulista, S.A., March 13, 1970. Mr. Happel is a German businessman, with many years of experience in the citrus business in Florida. He recently moved to Brazil to become the manager of Citrosuco Paulista, S.A.



Figure 17. Citrosuco Paulista, S.A., in Matão is São Paulo's largest processing plant.



Figure 17. Citrosuco Paulista, S.A., in Matão is São Paulo's largest processing plant.

operation. The laboratory performs an important service in endeavoring to maintain products that are of the highest quality.

Besides orange juice, Citrisuco Paulista also produces small amounts of tangerine and pineapple juice, as well as orange essence and oils. Most of the products are sold on the foreign market, but a small amount of frozen juice is retailed in some of the major urban centers of Brazil, such as São Paulo, Rio de Janeiro and Pôrto Alegre.

Citrobrasil, S.A. - Early in 1965 another large processing plant, Citrobrasil, was completed. This plant is probably the state's third largest producer of frozen orange juice and is entirely Brazilian owned. It is located on a rail siding in the eastern portion of the city of Bebedouro. The buildings are of modern design and the grounds are neat and well kept (Figure 18). The plant also operates a laboratory in order to maintain a product of high quality.²⁶

Citrobrasil is located on the premises of a large packing house owned by the same company. It is not unusual for packing houses to be affiliated with processing plants, but this is the only case in São Paulo where both are located on the same site. The fruit supplying this plant comes from both the Northern and Southern Citrus Regions, and the products sold are primarily for the foreign market although a growing amount is now being sold within Brazil. Besides frozen orange

²⁶Interview with Jacques Schuermans of Citrobrasil, S.A., March 12, 1970.

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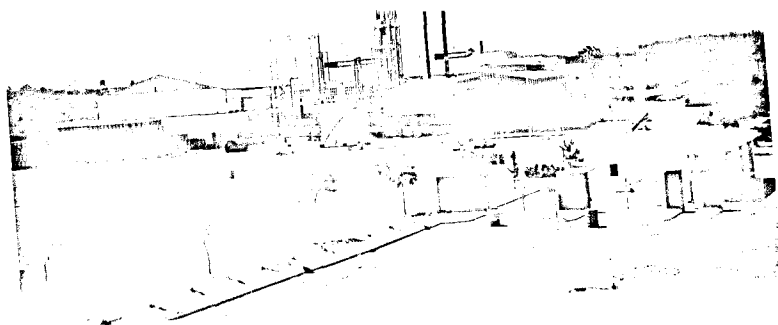


Figure 18. Citrobrasil, S.A., located at Bebedouro, is the state's third largest processing plant.

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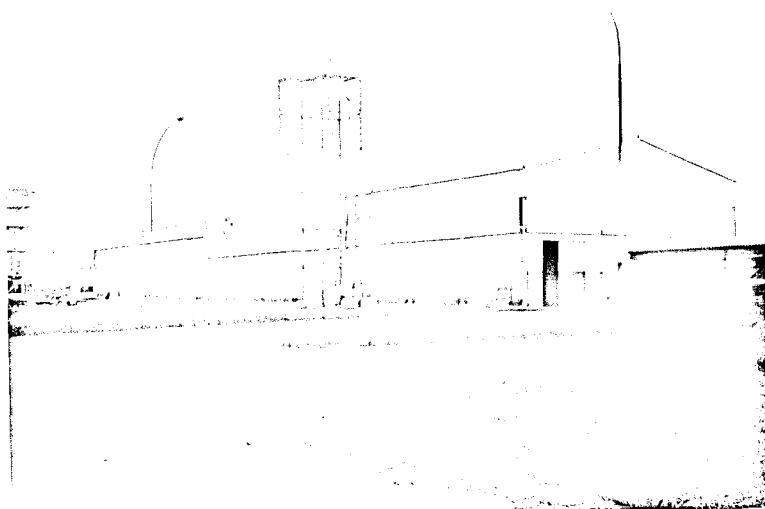


Figure 19. Frigorífico Avante, S.A., near the city of Limeira, is the only processing plant located in the Southern Citrus Region.

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Figure 18. Citrobrasil, S.A., located at Bebedouro, is the state's third largest processing plant.

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Figure 19. Frigorífico Avante, S.A., near the city of Limeira, is the only processing plant located in the Southern Citrus Region.

juice, small amounts of lemon juice, passion fruit juice, and orange essence and oils are also manufactured.

Frigorífico Avante, S.A. - In 1967 another citrus processing plant was constructed (Figure 19, page 97). It was originally known as the Industria e Comercio de Sucos e Conservas Ltda. and was also Brazilian owned. Due to financial difficulties the plant closed for the 1969 season. Early in 1970 it resumed production under different management and with a new name, Frigorífico Avante.²⁷

Frigorífico Avante is located near the city of Limeira on Via Anhangüera, and is modern in construction and design. The plant presently has a limited capacity for production, ranking as one of the smaller plants of the state; however, there is space for expansion and the capacity will probably increase in the future. The fruit supplying this plant comes from the Southern Citrus Region and its products are sold primarily on the foreign market. Besides frozen orange juice other items such as lemon juice, passion fruit juice, and orange essence and oils are produced. Located on the same premises is an older factory that produces rum from sugar cane.²⁸

General Characteristics of the Processing Industry.--Certain characteristics are common to most of the Paulista processing plants. All are located within the two major citrus regions of the state, and in each case large numbers of producing trees are found nearby. Most

²⁷Interview with one of Frigorífico Avante's laboratory technicians, March 13, 1970.

²⁸Ibid.

of the processing companies have established citrus groves and packing houses in order to assure greater control over their sources of fruit.

All of the plants are located on or near a major highway and depend on motor trucks for their principal means of transportation. They also have railway facilities close at hand for use when needed.

Equipment utilized within the plants is generally modern and well maintained. Most of it was manufactured in Brazil and was new at the time of installation, but some of the more specialized items were imported from Florida.²⁹ All of the plants are equipped with laboratories to keep a strict control on the quality of the products manufactured. The state and federal governments do not provide inspection or laboratory facilities as is the case in some parts of the world.³⁰

One of the problems faced by all the companies has been inflation. Between 1962 and 1969 Brazil experienced a tremendous devaluation of its currency.³¹ During this period the cost of living went up sharply, and interest rates were high. The following quotation summarizes some of the problems faced by the processing companies:

²⁹Antonio A. Amaro, "Laranja com sinal amarelo," Correio Agro-Pecuário, X (February, 1970), p. 17.

³⁰Interview with H. J. Happel, Manager of Citrosuco Paulista, S.A., Matão, SP., March 13, 1970.

³¹A list of cruzeiro values is found in Appendix B.

It should be pointed out that the plants were built during the period of near runaway inflation, which has now abated somewhat. The cost-of-living increase during 1968 was 24 percent, compared to about 90 percent in 1964 and over 40 percent in both 1965 and 1966. High interest rates continue to prevail, with the current prime rate averaging about 24 percent a year. As great sums of working capital are needed by the companies during the processing season, high interest rates weigh heavily in the real cost of operating the plants.³²

Regardless of the financial difficulties, the processing industry grew rapidly. By 1968 the state of São Paulo had become the world's largest exporter of frozen orange juice. Although no production statistics are available, some indication of the amounts produced can be gained from the export statistics (Table XXIV, page 146). Even though most of the orange juice is destined for the foreign market, small amounts are beginning to be used domestically.

The citrus processing industry operates during the main harvest period, which runs from about June to November or December in the state of São Paulo. Since the periodic closing of the plants tends to disrupt normal employment practices as well as to reduce annual profits, several of the companies have begun to process other fruits (passion fruit and pineapple) in order to utilize their facilities during a greater portion of the year.

The principal types of oranges used by the processing industry are the Pêra (75 per cent) and the Hamlin (between 15 and 20 per cent). The remaining portion includes such varieties as the Cravo orange, the Valencia and the Natal.³³

³²Pitcher and Tisch, op. cit., p. 11.

³³Ibid., pp. 12, 15.

The Paulista processing industry was developed largely by private capital. Government assistance has been limited primarily to financial incentives and loans. A pilot citrus juice plant established by the SPDA has also been helpful in conducting research.³⁴

Prospects for the Processing Industry.--The future of the Paulista processing industry appears to be good; however, a number of variables need to be considered.

Production - It appears that the Paulista processing industry will be well supplied with fruit in the foreseeable future. Present production trends are strong and a large number of young trees have been recently planted. A severe drought might cause a temporary decline, but an increased dependence on irrigation lessens this hazard.

Markets - The future of the Paulista processing industry depends primarily on the continued prosperity of the European and Canadian economies. It is also conceivable that the United States would be an important buyer of Brazilian orange juice when supplies from Florida are curtailed by freezes. At the same time, Paulista processors can expect competition for the lucrative European market from other countries such as Israel, Spain and South Africa.

The processing industry recognizes the need for expanding the domestic market. Home freezers have only recently come into use, but the urban centers of Brazil should provide a steady market for Paulista orange juice when freezing equipment becomes more widespread.

³⁴Ibid., p. 17.

An important reason for the expected growth of the home market is the demand for orange juice in the urban centers during the warm summer months when oranges are high priced and relatively scarce. Frozen orange juice is already making its way into hotels, bars, and the homes of some of the wealthier citizens. As urbanization and industrialization continue to grow (and as the standard of living rises), so should the demand for convenient and easily prepared foods such as frozen orange juice.

Another factor in São Paulo's favor is that there is only one processing plant in Brazil outside of the state of São Paulo. During 1970 a small plant was constructed in Montenegro, Rio Grande do Sul, but it will not subject Paulista processors to serious competition in the foreseeable future. Juice from this plant is expected to be marketed in the state's capital, Porto Alegre, and in Germany.³⁵

Changes Within the Processing Industry - In the future the processing industry will probably have to adjust to certain internal changes. For example, it is unlikely that wages will remain as low as they are at present. As the minimum wage level rises the industry will have to increase efficiency and productivity. The industry will also have to pay higher prices for fresh fruit, thereby reducing the margin of profit.

Greater diversification is another possibility for the Paulista processing industry. At present, very little besides frozen orange

³⁵Interview with Antônio Reginaldo de Oliveira Araújo of the Associação Sulina de Crédito e Assistência Rural in Montenegro, RS., March 19, 1970.

juice is produced. It would appear that a greater variety of products could be sold on both the external and internal markets.³⁶ In this manner the plant equipment could be utilized throughout the year and greater profits realized. However, the processing companies would need to advertize and actively promote the sale of their products. At present very little of this is done.

³⁶Pineapple, passion fruit and other tropical fruit juices could be produced.

CHAPTER VII

MARKETING DEVELOPMENTS AND CHARACTERISTICS

Marketing procedures vary greatly within the state of São Paulo. Citrus selected for export is carefully processed, packaged, and shipped to its destination. Fruit sold on the domestic market normally undergoes little preparation besides washing and sorting. Differences in marketing procedures reflect the preferences and economic levels of the respective buyers. Since the prosperity of the industry is largely determined by the success of the marketing process, the following analysis will consider each step of the operation beginning with the initial purchase of the fruit on the tree. The marketing of frozen orange juice and essential oils will also be analyzed.

Initial Purchase of the Fruit.--The commercial citrus crop is usually purchased from the grower well in advance of the harvest season. The timing of the purchase is related to the quantity of fruit expected for a given year. Anticipated fruit shortages encourage advance buying. Packing house representatives may negotiate with citrus growers even before the fruit has set on the trees. Contracts are informal, with only a minimal amount of paper work involved. After the agreement has been made, the buyer is usually responsible for expenses such as spraying and disease control, and

the grower cultivates and maintains his grove.¹ Unfortunately, advance buying reduces the grower's incentive to care for his trees, and often has an adverse effect on productivity.² Packing houses and processing plants that have established their own groves are able to obtain a portion of their fruit without negotiations. Small growers usually harvest their own fruit, selling it directly to the public, to urban wholesalers, or to processing plants.

The cost of Paulista citrus is an important factor in making it competitive on the international market. Data found in Table XI show that the prices received by citrus growers in São Paulo are low.³ This has been an advantage for Paulista fruit on the European market where heavy competition from South Africa and the United States are encountered. It has also been a contributing factor to the rapid rise of the juice industry.⁴

The Harvesting Process.--The harvesting of the commercial citrus crop is usually undertaken by the buyer, but groves belonging to the processing plants and those on the smaller farms are harvested

¹Shackford Pitcher and Robert B. Tisch, Citrus Processing in Brazil, Foreign Agricultural Service M 215, U.S.D.A., March 1970, p. 8.

²J. Henry Burke, Citrus Industry of Brazil, Foreign Agricultural Service, Foreign Agricultural Report no. 109, U.S.D.A., June 1958, p. 21.

³Price data for São Paulo are not readily available and the statistics shown in Table XI are merely averages. Nevertheless, they are significant because they reveal the low prices received by Paulista producers.

⁴Interview with H. J. Happel, manager of Citrosuco Paulista, S.A., Matão, SP. March 13, 1970.

TABLE XI

AVERAGE PRICES RECEIVED PER BOX OF ORANGES BY GROWERS

IN SÃO PAULO AND FLORIDA, 1960-1969^a

Year	São Paulo (Entire Season)	Florida (Early and Mid-Season)	Florida (Late Season)
1960	\$0.52 ^b	\$2.90	\$3.08
1961	0.46	1.99	1.81
1962	0.64	2.17	3.50
1963	0.71	4.43	4.45
1964	1.42	2.57	2.28
1965	2.35	1.44	1.97
1966	0.86	0.81	1.08
1967	0.63	1.85	2.28
1968	0.84	1.56	1.83
1969	0.92	1.15	1.13

^aSão Paulo, 40 kilo boxes; Florida, 40.8 kilo boxes.

^bAll values are in U.S. dollars. Exchange rates in appendix B were used to calculate São Paulo prices.

Source: São Paulo data for 1960-1965 were published in Agricultura em São Paulo, Vol. XII, nos. 1/2 (January-February) 1966, p. 19. Data for 1966-1969 were published in Correio Agro-Pecuário, Vol. X, no. 160 (February) 1970, p. 17. Florida data for 1960 were published in Florida Agricultural Statistics: Citrus Summary 1966 (Tallahassee, Fla.: Florida Department of Agriculture), pp. 22-23. Data for 1961-1969 were published in Florida Agricultural Statistics: Citrus Summary 1971 (Tallahassee, Fla.: Florida Department of Agriculture), pp. 24-25. Florida statistics are listed under the year in which the season commences, i.e. 1960 refers to the 1960-61 citrus season, etc.

by the owner. In either case the pickers are temporary employees recruited from nearby towns or communities. There is little need for itinerant workers even during the picking season since an ample supply of labor is usually available within a radius of about 50 kilometers.⁵ Truck loads of workers traveling to and from fazendas are a familiar sight on the Paulista landscape.

The harvesting of citrus fruit in São Paulo takes place between May and December, but most of the fruit is picked during the low sun period from early July to late September. Some varieties of citrus ripen during the summer months, but they are relatively unimportant.

All citrus fruits in São Paulo are picked by hand. The fruit is first placed in canvass bags and then emptied into 40 kilo field boxes that have been placed between the rows. Fruit that has been selected for export is shipped to the packing house in field boxes. Fruit picked for juice purposes is usually piled onto trucks and sent to the processing plants in bulk. Fresh fruit for the domestic market may be transported from the field in boxes or in bulk.⁶

Packing House Procedures and Characteristics.--The packing procedure is a very important step in preparing the fruit for market. A large number of packing houses operate within the state, but only eight plants prepare fruit for export.⁷ A description of the

⁵Pitcher and Tisch, op. cit., p. 7.

⁶Ibid., pp. 7, 8.

⁷See Table XXII on page 142.

Citrobrasil packinghouse in Bebedouro will be given in order to show the characteristics of one of the state's main exporting companies.⁸ It should be emphasized that the Citrobrasil plant is not typical of the smaller packing houses that prepare fruit solely for the domestic market.

The first step in the packing operation is the elimination of fruit that is of undesirable size or quality.⁹ Fruit that is either too large or too small is channeled mechanically onto a conveyor belt that transports it to the neighboring juice processing plant. Diseased fruit is removed by hand. The fruit that is accepted for packing is then washed and treated with a fungicide solution. Since most of the citrus that enters the plant is still somewhat green, it is necessary to change the color by subjecting the fruit to a heating and gassing process. This takes place in several small rooms in which temperatures are maintained at approximately 32° C. The rooms are filled with ethylene gas which helps to speed up the ripening process.¹⁰ As much as 42 hours may be required to change

⁸Table XXII also shows that Citrobrasil was responsible for 40 per cent of the state's fresh citrus exports in 1967.

⁹Interview with Antonio Viachiato, plant foreman at Citrobrasil's packing house, August 10, 1969. Citrobrasil's juice processing plant is located next to the packing house on the same grounds. The facilities compared quite favorably with some of the better plants visited in Florida. A description of Citrobrasil's processing plant is found on pages 96-98.

¹⁰"The highest rind color of citrus fruits is developed under conditions of bright sunshine, low atmospheric humidity, and relatively low temperature during the maturing period." L. W. Ziegler and H. S. Wolf, Citrus Growing in Florida, Gainesville, University of Florida Press, 1961, p. 225. The state of São Paulo has bright sunshine and

the color of the fruit. Following this process the fruit generally possesses a beautiful orange color and its market value is enhanced.

Following the coloring process the fruit is transported to the packing room on conveyor belts. There it is wrapped in diphenyl-treated wrapping paper and placed in boxes. As the fruit is wrapped it is given a final inspection and any fruit that appears inferior is sent to the adjacent processing plant.

Wages in the packing house are not high. Each worker receives a weekly salary plus a bonus for the number of boxes packed. Even with this incentive the average pay is not much above the minimum government wage level of approximately \$40.00 (U.S. equivalent) per month.

The care given to citrus sold on the domestic market differs considerably from that described above. No general system of standardized packing exists. In some cases the fruit is washed and sorted according to size. Sometimes it is only sorted and placed in open boxes. A small amount of fruit is supplied by the major exporting companies and is similar in appearance to that sold overseas.¹¹

low atmospheric humidity during most of the ripening period. The principal factor responsible for the failure of much of the fruit to turn orange is the general absence of low temperatures. Only a few areas are cold enough to cause the chlorophyll to decrease so that the orange pigment in the rind can be seen. In the packing house the ethylene gas is the agent responsible for the decrease in chlorophyll.

¹¹Unfortunately, a list of all the Paulista packing houses along with their locations does not exist. Visits to several packing houses in the município of Limeira and to stores and wholesale markets in the city of São Paulo provided information on the packing of domestic citrus.

Packing houses that serve the domestic market are usually small. They are numerous and tend to be concentrated in the two main citrus producing areas, particularly in the Southern Citrus Region. Limeira alone has 68 packing houses.¹²

Storage Facilities.--Storage facilities for fresh fruit are very limited in São Paulo. Generally, boxed fruit must be quickly removed from the packing houses in order to permit the continued operation of the plants. Warehouse facilities at Santos, the state's principal port, are also limited.¹³ Fruit awaiting shipment overseas occasionally remains outside in the sunshine. Fortunately, most of the citrus is exported during the relatively cooler season.

Shortages also exist in storage facilities for frozen orange juice. With the rapid increase of production, all available space at the processing plants and in the port of Santos has been severely taxed, and additional storage facilities are needed if the processing industry is to grow.¹⁴

Transportation Facilities.--The Paulista citrus industry could not have attained its present level of development without the presence of excellent transportation facilities. São Paulo has one

¹²Interview with George Pompeu Junior, chief citriculturist of the Estação Experimental de Limeira, July 29, 1969.

¹³Interview with Antonio Viachiato, loc. cit.

¹⁴Antônio A. Amaro, "Laranja com sinal amarelo," Correio Agro-Pecuario, X (February, 1970), p. 17.

of the most highly developed road and rail systems in Latin America (Figure 20). A brief description of this transportation network is necessary in order to explain the movement of citrus from the farms to the numerous urban markets in Brazil and to the port of Santos.

During the coffee boom of the last century many railway lines were constructed to provide transportation from the interior to Santos. Since then the railroads have extended their services to most parts of the state. By 1968 a total of 10,619 kilometers of track was owned and operated by nine different companies.¹⁵ Service supplied by these companies is generally adequate, but the movement of goods is slow and the rates are high.

In the early days of the citrus industry, the railways carried a much higher percentage of the output than they do today. A study of the citrus and rail maps for the 1930's suggests a relationship between the location of citrus producers and several of the main railway lines extending to the north, east, and west of the city of São Paulo.¹⁶ Since the construction of a network of highways, however, citrus growers have become more dependent on the truck as a means of transport.

Most of São Paulo's improved highways have been constructed since the end of the Second World War. By 1968 the state had a total

¹⁵Anuário Estatística do Brasil - 1969, Vol. 30 (Rio de Janeiro: Instituto Brasileiro de Estatística, 1969), p. 356. A small portion of the track indicated above extends outside the state of São Paulo.

¹⁶In his book Latin America, 4th ed. (pages 457, 486 and 487), Preston E. James points out the relation between economic development and the location of railway lines in certain parts of São Paulo. In this context fruit and oranges are specifically cited.

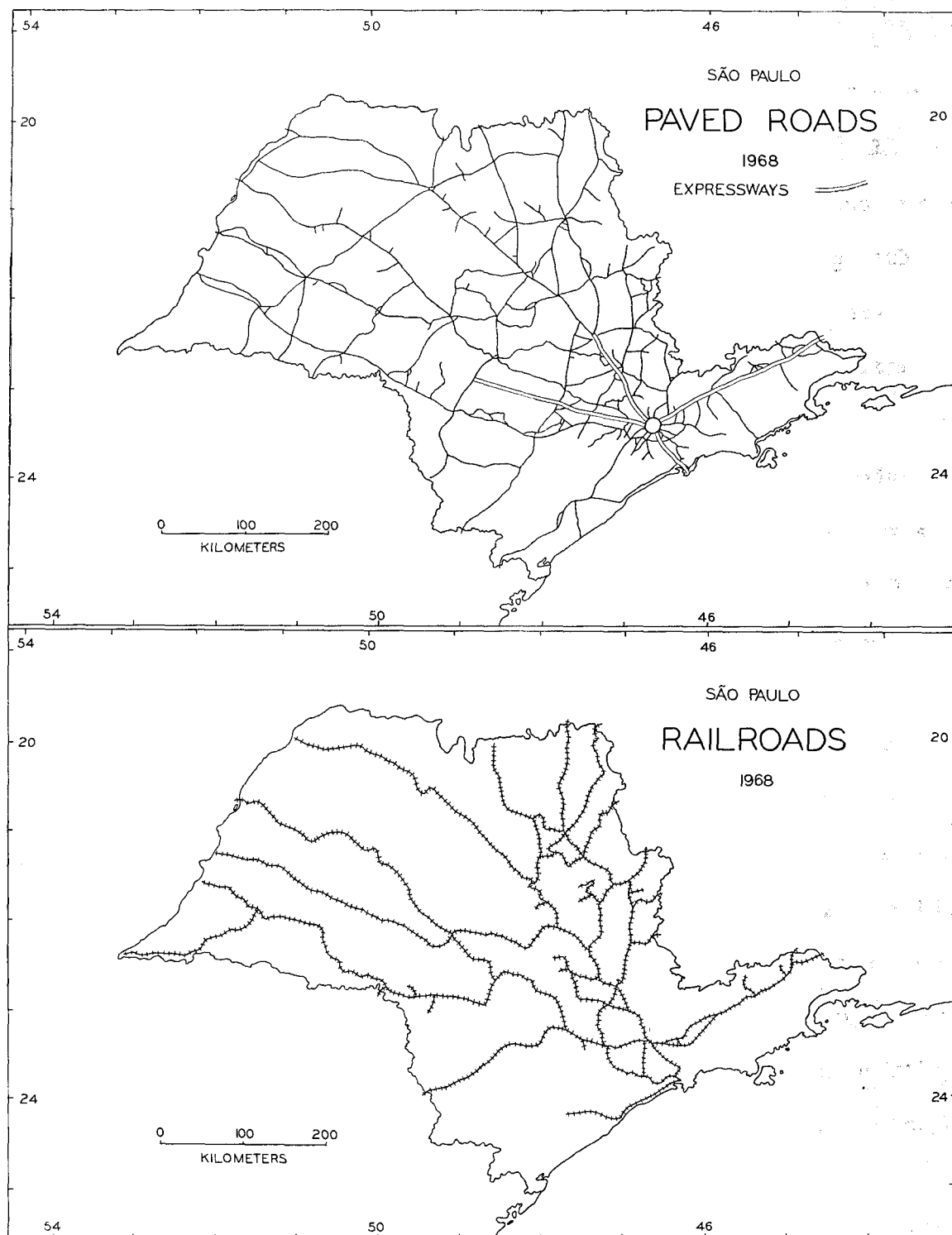


Figure 20. Surface Transportation Routes.

Source: Guia Rodoviário e Turístico do Estado de São Paulo.

of 168,866 kilometers of roads, approximately 10 per cent (16,303 kilometers) of which were surfaced with asphalt or cement. Gravel secondary routes branch out from the paved highways, linking all sections of the state. Of particular importance to the citrus growers are the many miles of farm roads that connect their fazendas with nearby towns or highways.¹⁷ The farm roads are frequently very dusty during the dry season and are occasionally impassable after heavy rains.

The main citrus producing regions are well served by major federal highways. Connections with São Paulo and Santos are among the best in Brazil. The road that links Bebedouro with Santos might be called the "Citrus Highway" because a large percentage of the state's citrus passes over it. From Bebedouro, the center of the Northern Citrus Region, a two lane macadamized highway runs south-eastwards to the município of Limeira. Near Limeira the "Citrus Highway" becomes a four lane limited access expressway, known as the Via Anhangüera. This road connects the Southern Citrus Region with the city of São Paulo. Southeastward from São Paulo another expressway, the Via Anchieta, descends the escarpment to Santos. One characteristic of all trunk roads in the state is that they usually bypass the cities and towns. São Paulo, the hub of the state's highway network, is the main exception.¹⁸

¹⁷A table showing the various categories of roads within the state has been included on page 174 in the appendix. Percentages of each category that had been paved by 1968 are also shown.

¹⁸At the present time a beltway is being constructed around the city of São Paulo. This sprawling metropolis is a bottleneck for the transport of goods between the coast and the interior.

Truck transport is used almost exclusively for supplying the domestic market with citrus. Trucks haul the fruit from the groves to the processing plants and packing houses. They also supply fruit to the cities, towns and villages scattered across the state. Table XII shows the outstanding importance of the truck as a means of hauling oranges to the state capital. In 1967 over 99 per cent of the oranges shipped to São Paulo were transported by truck.

Most of the fruit that is destined for export is also transported by truck but in this case railways are relatively more important. Exact figures showing the type of carrier handling export fruit are not available, but an employee of the state's largest packing house indicated that fruit from their plant was frequently shipped to Santos by rail.¹⁹

All of the state's frozen orange juice is transported by truck. Drums of frozen juice are shipped under a cover of several layers of tarpaulin. Packed in this manner the temperature of the juice remains below freezing during the entire journey and arrives at the cold rooms in Santos unharmed.²⁰

Truck transport dominates citrus shipments for several reasons. The greater versatility of the truck permits direct service to all packing houses and processing plants, even if they are located in

¹⁹Interview with Antonio Viachiato, loc. cit.

²⁰Representatives of each of the processing companies indicated that all of the state's frozen orange juice is shipped by truck and that the tarpaulin cover is sufficient to protect the juice for the 8 to 12 hour journey.

TABLE XII
SHIPMENT OF ORANGES TO THE CITY OF
SÃO PAULO, 1967

Month	Boxes Shipped by Train	Boxes Shipped by Truck	Totals*
January	5,373	484,318	489,619
February	3,170	546,409	549,579
March	2,750	657,314	660,064
April	3,945	1,257,084	1,261,029
May	7,316	1,964,699	1,972,015
June	12,394	4,169,387	4,181,781
July	6,415	1,982,851	1,989,266
August	3,308	1,946,920	1,950,228
September	2,114	1,811,587	1,813,701
October	1,890	1,230,826	1,232,716
November	---	902,923	902,923
December	---	861,229	861,229
Totals	48,675	17,815,547	17,864,222

*Data refer to 40 kilo boxes.

Source: Files of the Secretaria da Agricultura de São Paulo.

remote areas. The same versatility can be applied at the market end of the journey. Truck service is also less time consuming. The direct shipment of goods between any two points eliminates the need for transfers from one type of carrier to the other. The loading operation is generally much quicker for the truck than for the train. Also, the shipment of citrus and citrus products is usually less expensive by truck.²¹

The Domestic Market.--The level of economic development is higher in southeastern Brazil than elsewhere in the country. Most of the nation's industrial, commercial and financial establishments are concentrated in this area.²² The largest cities and principal food markets are here.²³ It is also the most important region for the marketing of citrus in Brazil. Since citrus trees are grown in nearly all parts of the country, the large urban centers constitute the only significant market areas for fresh fruit. The development of the

²¹Interview with H. J. Happel, loc. cit.

²²Even though the states of São Paulo and Guanabara had only 23 per cent of Brazil's population in 1968, they consumed 56 per cent of the country's electricity, employed 60 per cent of the industrial workers, and paid 67 per cent of the nation's income taxes. (The states of Minas Gerais, Rio de Janeiro and Espírito Santo are also part of southeastern Brazil.) Anuário Estatístico do Brasil - 1969, Vol. 30 (Rio de Janeiro: Instituto Brasileiro de Estatística, 1969), pp. 41, 192, 195, 456, 672.

²³Urbanization has developed on a larger scale in southeastern Brazil than elsewhere in the country. In 1970 approximately one out of every six Brazilians lived in metropolitan São Paulo (8,431,000) or Rio de Janeiro (7,502,000). The New York Times Encyclopedic Almanac 1971 (New York City: The New York Times Book and Educational Division, 1971), p. 734.

domestic citrus market is therefore closely related to the growth of urbanization.²⁴

Statistical data pertaining to the sale of Paulista citrus on the domestic market are meager. An analysis made by the São Paulo Department of Agriculture in 1966 was the single most important source of published data available.²⁵ Other information was obtained from knowledgeable individuals and from personal observations in numerous market areas.

In 1966 the domestic market consumed 13,000,000 boxes of citrus or 66 per cent of the state's commercial crop (Table XIII). It is estimated that more than 10,000,000 boxes of citrus were either consumed locally (non-commercial fruit) or lost through spoilage.²⁶ Of the 13,000,000 boxes sold on the domestic market, 12,000,000 were purchased by Paulistano wholesalers and 1,000,000 were shipped to other urban markets by wholesalers located near the producing areas.²⁷ Because of the importance of the state capital as a citrus market, it is considered in greater detail.

²⁴See Table XXXIII in the Appendix for statistics pertaining to the growth of urbanization in Brazil since 1940.

²⁵"Comercialização de Produtos," Agricultura em São Paulo Vol. XV (March-April) 1968, pp. 25-28. This article constitutes the source of all the data in the remaining part of this section unless otherwise stated.

²⁶The quantity of fruit lost through spoilage can sometimes be large. Included in this category is fruit that is rendered unusable by disease, drought or a slump in the citrus market. The estimated citrus production for a given year is the total potential supply of fruit on the trees fairly early in the season.

²⁷The term Paulistano refers to the city of São Paulo and is used in this chapter in order to reduce the possibility of confusing the city with the state. The term can be used as an adjective or a noun.

TABLE XIII
COMMERCIAL USES OF THE SÃO PAULO ORANGE CROP, 1966

Usage	Boxes of Oranges ^a
Fruit Used by the Processing Plants	4,240,000 ^b
Fruit Exported	2,500,000 ^c
Fruit consumed on the Domestic Market	<u>13,000,000</u>
Total Commercial Usage	19,740,000
Total Estimated Production	29,800,000 ^d

^a40 kilo boxes.

^bMost of the juice produced by the processing plants is exported. Fruit that supplies these plants is therefore classified with citrus exports in this chapter.

^cPublished export totals for 1966 differ slightly in other sources. See Table XVI on page 128.

^dApproximately 10,000,000 boxes of oranges were not used commercially.

Source: "Comercialização de Produtos," Agricultura em São Paulo, Vol. XV (March-April) 1968, pp. 25-28.

The city of São Paulo is Brazil's most important commercial center. The market process is more efficiently organized here than in the other cities of the country, and the population is more affluent. As a result of size and relative prosperity, São Paulo has become the largest market and entrepôt for citrus in Brazil.

The Paulistano market receives a large proportion of its citrus from a relatively limited number of municípios. Table XIV shows that 81 per cent of the citrus shipped to São Paulo in 1966 came from only seven municípios. Two municípios, Limeira and Araraquara, provided more than half of the total. Most of the city's fruit came from the Southern Citrus Region, within a distance of about 200 kilometers.

The reason for the importance of the Southern Region as a source for Paulistano fruit is mainly due to lower transport costs. The price for shipping a 40 kilo box of oranges from Limeira to São Paulo by truck in 1966 was \$0.12 (U.S. equivalent). In comparison, the charges for transporting the same item from Araras, Araraquara or Bebedouro to the state capital were \$0.14, \$0.26 and \$0.31 respectively. This differentiation in transport costs has made it difficult for producers in the more distant areas to compete for the Paulistano market. Consequently, they sell most of their fruit to exporters and processing plants.

The most important types of oranges sold on the Paulistano market are the Pêra, Baianinha, Hamlin, Lima and Barão. Several types of mandarin oranges such as the Mexerica and Ponkan are increasing in popularity. The lemon and sweet lime are consumed on a more limited

TABLE XIV
MUNICIPIOS SUPPLYING CITRUS TO THE CITY
OF SÃO PAULO, 1966

Município	Percentage	Distance in Kilometers from the Capital
1. Limeira	42%	170
2. Araraquara	10%	362
3. Monte Alto	9%	430
4. Sorocaba	8%	101
5. Jaguariuna	4%	109
6. Araras	4%	196
7. Bebedouro	4%	394
8. Others	<u>19%</u>	
Total	100%	

Source: "Comercialização de Produtos," Agricultura em São Paulo, Vol. XV, nos. 3-4 (March-April) 1968, p. 25.

scale. Unfortunately, a numerical breakdown showing the relative importance of each citrus variety sold within the city does not exist.

Wholesalers were responsible for 99 per cent of the fruit that entered the Paulistano market in 1966. (The remaining 1 per cent was apparently sold directly to the public by growers.) Of this about 95 per cent was bought from growers, with the remaining 5 per cent coming from other wholesalers such as exporters, rural buyers and cooperatives. The high percentage of fruit obtained directly from the growers represents an endeavor to keep fruit costs down by limiting the number of intermediate transactions between the grower and the consumer.

Within the city of São Paulo, the main wholesale food market is CEASA.²⁸ This center is the largest wholesale market in Brazil. It resembles a "food city" rather than just a large market.²⁹ Items available range from fresh produce³⁰ to prepared foods (including frozen orange juice) and dry goods. At least one wholesale supermarket is located in the area. In order to make it possible for retailers and the working public to purchase their food more conveniently, CEASA's "working day" commences at sundown and continues through the night.

²⁸CEASA stands for Centro Estadual do Abastacimento de São Paulo. Another large wholesale/retail market in the city is the São Paulo Municipal Market.

²⁹Based on a visit of CEASA, March 7, 1970.

³⁰Many types of fruit are sold at CEASA besides citrus. Apples, pears, plums, grapes, coconuts, persimmons, custard apples, strawberries, guavas, mangoes, papayas, avocados, carambolas, bananas, figs, different types of melons, cactus fruit, and others are also available.

Business transactions at CEASA are informal. Retailers generally negotiate with several wholesalers before making a purchase. Prices for the same type of fruit vary from place to place within the market and bargaining is an accepted part of the transaction. Occasionally farmers truck their citrus to CEASA and dispose of it themselves.

Within the city of São Paulo there are various types of citrus retailers that serve a particular area and class of society. A breakdown according to the type of retailer and the percentage of fruit they purchased in 1966 is found in Table XV. These retailers purchased 69 per cent of all the citrus sold on the Paulistano wholesale market. The remaining 31 per cent was either shipped to other urban centers in Brazil (30 per cent) or purchased directly (1 per cent) by Paulistano consumers.

The most important type of citrus retailer in the city of São Paulo is the feirante, a trader in an open-air market. Feirantes generally purchase their fruit at CEASA during the night and then set up stalls at one of the city's numerous open-air markets the following day.³¹ These markets usually take place in an open square (praça) or on a side street that has been temporarily blocked off. The open-air markets are well-patronized because they provide one of the best

³¹Some purchase their fruit at the São Paulo Municipal Market.

TABLE XV
 TYPES OF CITRUS RETAILERS IN THE CITY
 OF SÃO PAULO, 1966

Retailer	Percentage of Citrus Sold
1. Feirantes	55
2. Ambulantes	13
3. Quitandeiros	10
4. District Markets	9
5. Hotels, Bars, Restaurants	2
6. Super Markets	1
7. Others not specified	<u>10</u>
Total	100

Source: "Comercialização de Produtos," Agricultura em São Paulo, Vol. XV, Nos. 3-4 (March-April) 1968, p. 27.

opportunities to obtain food bargains.³² In 1966 feirantes sold 55 per cent of all the citrus retailed in the state capital.

The second most important type of citrus retailer is the ambulante. These are the itinerant vendors with mobile stands that can be moved from place to place. Generally the ambulante finds a remunerative corner or street and then tends to regard it as his territory. Citrus fruits are frequently sold from these stands one piece at a time to customers desirous of taking a brief "citrus break." Occasionally sweet limes and tangerines are sold in small bags. In 1966 ambulantes sold 13 per cent of the citrus retailed in the city of São Paulo.

The quitandeiros constitute another group of Paulistano retailers. They operate roadside fruit and vegetable stands which cater to residents in the immediate vicinity. Generally these stands are limited in variety and cleanliness, but they serve a useful function in the economic life of their communities. In 1966 quitandeiros sold 10 per cent of the city's retail citrus.

Retailers from the city's district markets also purchased an important amount of citrus. District markets serve a fairly large area and provide a greater variety and quantity of produce than the other retailers. The district markets sold 9 per cent of the citrus in 1966.

³²Most Brazilians buy their food near where they live. Since refrigeration facilities are relatively scarce, food must be bought in small quantities. Traveling a great distance to one of the wholesale markets is impossible for most of the people.

Hotels, bars, restaurants, and supermarkets also buy citrus from the Paulistano wholesalers. It is probable that frozen orange juice will replace a part of the fresh fruit in some of these places as refrigeration becomes more widespread. This group of retailers sold only 3 per cent of the city's citrus in 1966. The remaining 10 per cent is unspecified, but is probably distributed through small grocery stores, hospitals, schools, and other institutions within the city.

Many cities in São Paulo and in other parts of Brazil receive a portion of their citrus from the Paulistano market. Of the 12 million boxes that were handled by the city's wholesalers, 3.6 million (30 per cent) went to markets outside the state capital, 25 per cent went to the ABC cities,³³ 19 per cent to Curitiba, 18 per cent to the city of Rio de Janeiro, 11 per cent to Belo Horizonte, 7 per cent to Santos, and the remaining 20 per cent to other cities including the federal capital, Brasília.

Paulista citrus markets outside the state capital are also active, but they are much smaller and very little data concerning them are available. Besides the 3.6 million boxes sold by Paulistano agents, another one million boxes were sold by Paulista wholesalers located in cities near the major producing areas.

The importance of Paulista citrus in other parts of Brazil can be attributed primarily to the quality of the product and the degree of marketing organization attained by the state's wholesalers and packing houses. It is significant that a large portion of Brazil

³³These cities are Santo André, São Bernardo do Campo, and São Caetano do Sul.

can be supplied with citrus from the state of São Paulo at prices below local production costs. In the Belo Horizonte municipal market Paulista citrus undersells that produced in the surrounding area.³⁴ Even in the heart of the citrus producing region of Rio Grande do Sul, citrus from São Paulo is sometimes cheaper than the local fruit.³⁵

In some of the larger urban centers in the state of São Paulo, the marketing of citrus is similar to that which occurs at the state capital, except that it takes place on a much smaller scale. Direct sales from the grower to the consumer are probably more important in these cities than in the state capital. In the numerous smaller cities and towns scattered across the state, the marketing of citrus tends to follow the more traditional pattern of the open-air market. These markets are a colorful and picturesque sight. They not only provide the farmer with a source of income, but help to satisfy his social needs. Generally, the farmer transports his produce to the nearest or most profitable market and there either barter or sells his products. The presence of open-air markets does not eliminate the need for retail outlets, but they tend to be less important in the interior because the markets are less expensive.

According to the 1966 analysis of the domestic citrus market, the consumption of manufactured citrus products within the country

³⁴Based on interviews while touring the Belo Horizonte Municipal Market.

³⁵Interview with Dr. Ody Rodriguez, chief of the Citrus Section, Instituto Agronômico de Campinas, Campinas, SP., July 23, 1969. Interview with Antônio Reginaldo de Oliveira Araújo of the Associação Sulina de Crédito e Assistência Rural in Montenegro, RS., March 19, 1970.

was nil. Unfortunately, more recent statistical data are not available for the internal marketing of citrus products. However, frozen orange juice and other citrus products such as marmalade are available in the larger cities.

The Sale of Fresh Fruit on the Foreign Market.—The percentage of the state's citrus crop that has been exported in the past has generally been small; however, with the recent development of a processing industry, the combined exports of both fresh fruit and manufactured items now constitute a sizeable portion of the commercial citrus crop (44 per cent in 1970).³⁶ This increase in citrus exports not only has stimulated rapid growth within the industry but also has provided the state with another important export commodity.

Paulista citrus producers have been selling their fruit on the international market for at least fifty years. Annual export records date back to 1926 when European buyers first began importing Paulista fruit.³⁷ Table XVI shows the state's citrus exports for the period 1926 to 1970. A comparison between export and production (Table VI, page 36) statistics reveals an over-all similarity for most of this period.

Between 1926 and 1939 citrus exports from the state of São Paulo increased rapidly. Prosperity continued until 1940 when war and

³⁶See Table XXXIV in the Appendix for a list of export percentages for the period 1931 - 1970.

³⁷Edmundo Navarro de Andrade, Manual de Citricultura, Parte I, São Paulo, Edição da "Chácaras e Quintaes," 1933, p. 148.

TABLE XVI
ANNUAL CITRUS EXPORTS FROM SÃO PAULO,
1926-1970

Year	Boxes Exported*	Year	Boxes Exported
1926	12,824	1951	182,275
1927	43,239	1952	103,920
1928	119,227	1953	120,550
1929	247,000	1954	275,650
1930	213,484	1955	520,055
1931	834,802	1956	917,641
1932	739,084	1957	1,245,556
1933	1,173,423	1958	2,000,052
1934	1,096,451	1959	3,198,581
1935	1,033,164	1960	3,227,005
1936	1,290,967	1961	3,256,459
1937	2,169,023	1962	3,109,268
1938	2,226,029	1963	4,143,479
1939	2,790,653	1964	2,882,535
1940	832,924	1965	4,737,676
1941	227,405	1966	2,328,639
1942	178,402	1967	2,565,096
1943	228,602	1968	2,160,439
1944	274,692	1969	1,690,936
1945	132,962	1970	1,504,977
1946	514,933		
1947	495,592		
1948	370,486		
1949	316,073		
1950	317,390		

*40 kilo boxes.

Source: Files of the Secretaria da Agricultura de São Paulo.

disease resulted in a serious decline. Overseas shipments remained small for 15 years, but by 1955 a steady increase in exports had begun. In 1959 all prewar figures were surpassed and by 1963 more than 4 million boxes were exported.³⁸

In 1964 exports declined abruptly. The decrease amounted to a drop of 30 per cent from the previous year. In 1965 an all time high of 4,737,676 boxes was achieved, which was followed by another large decline (2,499,037 boxes) in 1966. These pronounced fluctuations cannot be explained by internal climatic problems. Rather, the declines of 1964 and 1966 might be considered as returns to normalcy and the export highs of 1963 and 1965 as exceptions. The years of unusually large exports came about as a result of increased purchases of Paulista fruit in the Northern Hemisphere and Argentina where unfavorable climatic conditions had reduced production.³⁹ The average annual shipment of Paulista fruit to foreign countries during the 1960's was about two million boxes.

Europe has been the major market for Paulista citrus, except between 1920 and 1925, and for several years during the Second World War. The relative importance of particular foreign markets for the period 1945 to 1970 is shown in Table XVII. During this period 95 per cent of the state's citrus exports were shipped to Europe. The remaining 5 per cent went largely to South America and North America.

³⁸Additional information on citrus exports is included on pages 39-45.

³⁹Amaro, op. cit., p. 17.

TABLE XVII

TOTAL CITRUS EXPORTS FROM SÃO PAULO, BY DESTINATION,

1945-1970

Continent and Country	Boxes*	Per cent	Boxes	Per cent
North America			613,445	1.5
Canada	533,988	1.3		
Netherlands Antilles	79,457			
South America			1,039,684	2.5
Argentina	1,038,834	2.5		
Uruguay	850	-		
Europe			39,798,500	95.0
Belgium	1,291,029	3.1		
Denmark	9,000	-		
Finland	328,770	0.8		
France	6,013,451	14.4		
Great Britain	11,824,399	28.2		
Ireland	425,594	1.0		
Netherlands	13,168,243	31.4		
Norway	258,863	0.6		
Soviet Union	344,780	0.8		
Sweden	817,884	2.0		
West Germany	5,326,487	12.7		
Asia			336,337	0.8
Nationalist China	336,337	0.8		
Africa			2,000	-
Other (Countries not identified)			87,000	0.2
Totals			41,876,966	100.0

*40 kilo boxes.

Source: Files of the Secretaria da Agricultura de São Paulo.

Between 1945 and 1970 Paulista citrus was purchased by at least 17 countries, but 87 per cent of the total was imported by only four nations: the Netherlands (31.4 per cent), Great Britain (28.2 per cent), France (14.4 per cent), and West Germany (12.7 per cent). The only other significant buyers were Belgium (3.1 per cent), Argentina (2.5 per cent), and Sweden (2.0 per cent). Table XVIII shows the annual quantity of Paulista citrus purchased by each of the major importing nations.

The four leading importers of Paulista citrus are all located in densely populated, highly industrialized, portions of western Europe. They have relatively high standards of living and none of them possess important citrus producing regions within their national borders.⁴⁰ Exports to other European nations are small, but the number of importing countries is growing.⁴¹ None of the newer customers produce citrus except the Soviet Union.⁴² Since Europe's seasons are the reverse of those in southern Brazil, competition between the two areas is minimal, even in the few European nations that produce a portion of their own citrus needs.

⁴⁰During the period 1963 to 1967, France produced an average of 3,400 metric tons of oranges and tangerines. By way of comparison neighboring Spain and Italy produced 1,990,600 and 1,246,600 metric tons respectively. Production Yearbook, 1968, Food and Agricultural Organization of the United Nations.

⁴¹Beside the minor European importers listed in Table XVII on page 130, Austria, East Germany, Luxembourg, Poland, Czechoslovakia and Hungary buy Paulista citrus in small quantities. CACEX, Bank of Brazil.

⁴²The Soviet Union produces citrus in parts of the Crimean peninsula and in the Transcaucasian republics of Georgia and Azerbaijan. Between 1963 and 1967 the Soviet Union produced an average of 37,000 metric tons of oranges and tangerines. Production Yearbook, op. cit.

TABLE XVIII

MAJOR COUNTRIES IMPORTING CITRUS FROM SÃO PAULO, 1945 TO 1970

(1,000 Boxes)*

Year	Netherlands	Great Britain	France	West Germany	Belgium	Argentina	Sweden
1945	-	-	-	-	1	125	-
1946	-	196	-	-	74	70	90
1947	-	144	-	-	102	25	31
1948	-	77	-	-	32	70	-
1949	-	201	-	1	38	7	-
1950	-	217	-	-	-	32	54
1951	-	136	-	-	-	46	-
1952	-	97	-	-	-	7	-
1953	-	109	-	-	-	2	-
1954	2	213	31	2	6	22	-
1955	28	280	63	28	19	98	-
1956	157	375	292	48	41	-	-
1957	227	496	355	99	68	2	-
1958	909	610	128	160	173	-	20
1959	892	988	831	194	255	-	-
1960	681	910	820	420	170	-	48
1961	886	1,168	451	359	132	1	-
1962	1,166	876	472	498	8	1	1
1963	1,456	1,006	724	507	115	19	64
1964	1,202	540	412	294	30	36	78
1965	1,610	948	604	595	18	465	134
1966	1,073	403	89	590	-	10	74
1967	1,182	562	234	472	-	-	90
1968	725	449	200	413	-	-	62
1969	506	437	158	360	1	-	47
1970	465	390	150	288	-	-	26

*40 kilo boxes.

Source: Files of the Secretaria da Agricultura de São Paulo.

The Netherlands was an important buyer of Paulista citrus prior to the Second World War. Imports were resumed in 1954, and by 1962 the Netherlands had become the state's leading buyer of citrus, a position it presently retains. In 1969 the Netherlands purchased 41 per cent of their summer oranges from São Paulo.⁴³ Since the former possesses no citrus producing territories except Surinam, and as there is a large demand for summer oranges, São Paulo's relatively inexpensive fruit is welcomed on the Dutch market.⁴⁴

Great Britain was the principal buyer of Paulista citrus prior to 1939. British capital had played an important role in the economic development of the state, including the establishment of citrus farms and packing facilities.⁴⁵ After the Second World War, Britain began importing Paulista citrus again and for 16 years was the largest buyer of the state's citrus exports. Since 1962 Britain has usually occupied the number two position, not far behind the Netherlands (Table XVIII on page 132). During the last decade Britain has purchased approximately a quarter (26 per cent in 1970) of São Paulo's citrus exports. Strong competition from British or formerly

⁴³Citrus Fruit: World Production and Statistics (Foreign Agriculture Service, U.S.D.A., September 1969), p. 54.

⁴⁴The citrus industry of Surinam is small. Exports are primarily to the Dutch Antilles and to the Netherlands. The quality of the fruit is low due to warm moist conditions. J. H. Burke, Citrus Industry of Surinam (Foreign Agricultural Service, Report no. 89, U.S.D.A., 1956), pp. 1-3.

⁴⁵Frigorífico-Anglo in Pitangueiras is an example of British investment in São Paulo.

British countries in the Southern Hemisphere is largely responsible for decreased sales to the United Kingdom.⁴⁶

France and West Germany have been the next most important buyers of Paulista citrus.⁴⁷ Since the Second World War they have bought 6,013,451 and 5,326,487 boxes, respectively. French imports have tended to decline in recent years, while those of West Germany have increased (Table XVIII, page 132). Although these changes have been relatively insignificant they reflect the fact that Brazil's trade with Germany during the last decade has been much larger and has grown more rapidly than its trade with France.⁴⁸ German investment in the Paulista citrus industry has been an important factor in stimulating exports to Germany.⁴⁹

⁴⁶South Africa is Brazil's major competitor for the European summer citrus market. The South African Co-operative Citrus Exchange provides secretarial and administrative assistance for its members and acts as their selling agent overseas. The Exchange purchases \$7,000,000 worth of packing material, insecticides, and fertilizers each year, thereby realizing substantial savings for its members. It also spends \$1,260,000 on advertizing each year. The Exchange's trade-mark "Outspan" may only be used on fruit that conforms to specified standards. The Paulista citrus industry would be more competitive if similar organization and cooperation could be achieved. Economic, Financial and Statistical Yearbook for the Republic of South Africa, 1971, Da Gama Publishers (Pty) Ltd., Johannesburg, Transvaal, South Africa, pp. 148, 149.

⁴⁷West Germany and France are the world's largest importers of citrus. Approximately 55 per cent of the citrus imported by 11 Western European nations in 1967 went to these two countries. Foreign Agriculture Circular FCF 3-68, Foreign Agricultural Service, U.S.D.A., p. 3.

⁴⁸Anuário Estatística do Brasil, Vol. 30, Instituto Brasileiro de Geografia e Estatística, Rio de Janeiro, 1969, p. 274.

⁴⁹Fischer, S.A., is an example of German investment in São Paulo.

Belgium has been the fifth most important buyer of Paulista citrus, but the amount imported during the period 1945 to 1970 was relatively small, only 1,281,029 boxes. The presence of several large citrus farms owned by Belgian interests has been a contributing factor in stimulating this trade.⁵⁰

Sweden has purchased only 2.0 per cent of São Paulo's citrus exports since 1946. Imports were irregular before 1962, but during the 1960's they became more important. This was the trend in neighboring Norway and Finland, also.

The only non-European country that imported more than a million boxes of Paulista citrus between 1945 and 1970 was Argentina. Besides São Paulo, the states of Bahia, Rio de Janeiro and Rio Grande do Sul have exported citrus, bananas and other tropical fruits to Argentina. In return, Argentina has shipped apples, pears, plums and other deciduous fruits to Brazil. Argentina has been expanding its own citrus industry in recent years, which has resulted in a decline in imports from Brazil. However, Argentina faces the problem of occasional freezes in its southernmost citrus region near Buenos Aires. Its two northern citrus regions, Entre Ríos and Tucumán are separated from the main market area by long and rather expensive rail or truck journeys. Consequently purchases from São Paulo occur from time to time.

Other countries which have imported small amounts of Paulista citrus are Canada, Ireland, Nationalist China, the Soviet Union, the

⁵⁰Interview with Ody Rodriguez, loc. cit.

Netherland Antilles, Hong Kong, Singapore, Sénégal and Uruguay. Citrus exports to a number of these countries have only commenced during the last decade and indicate an expanding market area for Paulista citrus.

The time of year when a country's produce enters the international market can be an important factor in determining the profits gained and the competition encountered. In the case of São Paulo it is particularly important since the state's major foreign market area is north of the equator. Table XIX shows the aggregate amount of citrus exported by months for the period 1945 to 1970.

During the summer months São Paulo neither produces nor exports large quantities of fruit. Between 1945 and 1970 a total of only 699,370 boxes were shipped from the state during the period November to March. The total shipments for February during the same period amounted to only 15,233 boxes or a mere 0.04 per cent of all exports.

The main season for both production and export are the months of May, June, July and August. June, the leading month, accounted for 23.85 per cent, or almost one-fourth of São Paulo's citrus exports (Table XIX).

It is significant that exports for April and October have increased during the last decade. This has come about as a result of greater usage of early and late citrus varieties and the continued expansion of the Northern Citrus Region. Demand in Europe during these months is another contributing factor.⁵¹

⁵¹The relationship between the development of the Northern Citrus Region and market conditions in Europe is discussed on page 48.

TABLE XIX
CITRUS EXPORT TOTALS FROM SÃO PAULO BY MONTH FOR THE
PERIOD, 1945-1970

Month	No. of Boxes*	Per Cent
January	27,571	0.06
February	15,233	0.04
March	192,736	0.45
April	2,540,289	5.98
May	7,305,121	17.21
June	10,122,273	23.85
July	8,241,079	19.42
August	6,468,479	15.24
September	4,913,302	11.57
October	2,155,339	5.08
November	316,368	0.75
December	147,462	0.35

* 40 kilo boxes.

Source: Files of the Secretaria da Agricultura de São Paulo.

Only a few varieties of citrus are exported from São Paulo.

Table XX shows the quantity of each type of citrus exported for the years 1960 and 1966. These two years were selected arbitrarily because they are fairly recent and they provide a general picture of the kinds of citrus exported.

The Pêra, which generally accounts for 60 to 75 per cent of the state's overseas shipments, is the most important export orange. The Hamlin, a Florida orange, ranks second, however the Bahia navel orange occasionally exceeds the Hamlin in importance as an export variety. Usually the three types of oranges mentioned account for more than 90 per cent of the state's citrus exports.

Other varieties of oranges such as the Westin, Barão, Pineapple, Caderna and Rubi are also exported in limited amounts. Grapefruit,⁵² tangerines and lemons are usually sold on the international market, but their importance is only minimal.

During the last 20 years the production of citrus for export has tended to shift northwards. Before the Second World War, most of the citrus was produced in the vicinity of Limeira and Sorocaba, with some fruit also coming from the Paraíba Valley.⁵³ Following the war, the Limeira region continued to be an important supplier of export fruit for many years, but during the 1960's overseas shipments rapidly declined. Unfortunately, annual export statistics for each município are not available for the period 1945 to 1970.

⁵²Small amounts of grapefruit are produced by foreign companies for export.

⁵³Navarro de Andrade, op. cit., p. 150.

TABLE XX

CITRUS VARIETIES EXPORTED FROM SÃO PAULO, 1960 AND 1966

Citrus Varieties	1960	1960	1966	1966
	No. of Boxes*	Per cent	No. of Boxes*	Per cent
Oranges				
Pêra	2,366,022	73.3	1,643,143	70.56
Hamlin	546,052	16.9	458,162	19.67
Bahia	161,047	5.0	164,942	7.09
Westin	-	-	75	0.01
Barão	77,849	2.4	-	-
Pineapple	2,950	0.1	-	-
Caderna	-	-	1,000	0.04
Rubi	-	-	1,235	0.05
Orange Totals	3,153,920	97.7	2,268,557	97.42
Grapefruit	63,410	2.0	55,515	2.38
Tangerines	9,675	0.3	4,567	0.20
Totals	3,227,005	100 %	2,328,639	100 %

*40 kilo boxes.

Source: Files of the Secretaria da Agricultura de São Paulo.

In 1961 the município of Bebedouro produced 35.0 per cent of all the citrus sold overseas (Table XXI). By 1967 this had increased to 46.6 per cent. On the other hand, Limeira's portion of the export total dropped from 33.7 per cent in 1961 to only 5.2 per cent in 1967. During this period the municípios of Matão, Araraquara and Monte Azul Paulista either entered or increased production for the export market. In 1967 more than 80 per cent of the citrus destined for the foreign market originated in the Northern Citrus Region and the remaining portion came mainly from the area north of Limeira in the Southern Citrus Region. Thus the production of export citrus has moved northward.⁵⁴

In 1967 all citrus exports from the state of São Paulo were handled by eight private companies. The three leading companies were responsible for 83 per cent of all the state's overseas shipments (Table XXII). Citrobrasil, the largest company, supplied 40 per cent of the total. The three smallest companies do not operate on a regular basis and their annual sales are of lesser significance.

The Sale of Frozen Orange Juice on the Foreign Market.—Since the establishment of the Paulista processing industry in 1962, Brazil has become one of the world's most important sources of orange juice.⁵⁵

⁵⁴The reasons for this move northward are discussed on pages 46-48.

⁵⁵Since no other Brazilian state produced frozen orange juice during the period 1962 to 1970, the statistics for Brazil are the same as those for the state of São Paulo--hence the use of the term Brazil while discussing the various producing countries.

TABLE XXI

SÃO PAULO CITRUS EXPORT BY MUNICIPIO, 1961 AND 1967

Município	1961	1961	1967	1967
	No. of Boxes*	Per cent	No. of Boxes*	Per cent
Bebedouro	1,140,403	35.0	1,236,758	46.6
Matão	-	-	414,345	15.6
Araras	453,805	13.9	316,294	11.9
Araraquara	217,920	6.7	273,945	10.3
Pitangueiras	304,869	9.4	178,250	6.7
Limeira	1,098,038	33.7	137,000	5.2
Monte Azul Paulista	-	-	99,500	3.7
Porto Ferreira	<u>41,424</u>	<u>1.3</u>	<u>-</u>	<u>-</u>
Totals	3,256,459	100 %	2,656,095	100 %

*40 kilo boxes.

Source: Files of the Secretaria da Agricultura de São Paulo.

TABLE XXII

SÃO PAULO CITRUS EXPORTS BY EXPORTING COMPANY, 1967

Company	No. of Boxes*	Per cent
Citrobrasil	1,051,644	40
Citrícola do Brasil	607,000	23
Fischer S/A	545,232	20
Anglo-Frigorífico	178,250	7
Goodwin Coccozza	109,478	4
São Paulo Citrícola	99,500	4
Citrícola de Araras	39,000	1
Cooperativa Citrícola de Araraquara	<u>26,000</u>	<u>1</u>
Total	2,656,096	100 %

*40 kilo boxes.

Source: Files of the Secretaria da Agricultura de São Paulo.

The significance of this development was underscored in 1968 when Brazil ranked as the world's largest exporter of this commodity. In 1970 Brazil sold 35,394 tons of juice on the international market.⁵⁶ According to a study published by the Food and Agriculture Organization of the United Nations, 11 countries exported citrus concentrates during the period 1963 to 1967 (Table XXIII). Brazil was the world's second largest supplier of orange juice for three of the five years shown. In 1966 and 1967 exports amounted to 23 and 28 per cent of the world's frozen orange juice, respectively.

During the 1960's several other countries experienced rapid increases in their exports of frozen orange juice. Table XXIII shows that Israel became the most important supplier in the Mediterranean area. British Honduras, Morocco and Argentina also increased their overseas shipments significantly. The main reasons for this growth have been the rising popularity of citrus juices in Western Europe,⁵⁷

⁵⁶International statistics showing exports for 1968, 1969 and 1970 have not been compiled. According to Robert B. Tisch of the Foreign Agricultural Service, U.S.D.A., the 38,570 metric tons exported from the United States in 1970 was somewhat greater than that from Brazil. It is difficult to compare orange juice statistics because of the lack of data pertaining to the degree of concentration. Most Brazilian juice is more concentrated than that exported from the United States. The total cited above was converted from gallons at the rate of one gallon per 5.0 kilos--a figure that is correct for orange juice that is concentrated to 65° Brix. Letter from Robert B. Tisch, Agricultural Economist, Commodity Analysis Branch, Fruit and Vegetable Division, U.S.D.A. Foreign Agricultural Service, Washington, D.C., September 21, 1971.

⁵⁷Foreign Agricultural Circular FCF 3-68, op. cit., p. 2.

TABLE XXIII
ANNUAL WORLD EXPORTS OF FROZEN CONCENTRATED
ORANGE JUICE, 1963-1967^a

Country	1963	1964	1965	1966	1967
<u>North America</u>					
British Honduras	500	2,746	2,900	3,186	2,500 ^b
Jamaica	2,268	2,039	2,683	2,587	1,725
Mexico	2,619	4,305	775	465	177
United States	17,352	12,980	14,009	14,770	20,350
<u>South America</u>					
Argentina	300 ^b	576	410	1,144	1,101
Brazil	5,314	3,825	5,760	13,929	18,647
<u>Europe</u>					
Italy	4,549	4,859	3,845	4,685	4,796
Spain	3,721	5,691	5,311	4,542	4,802
<u>Africa</u>					
Morocco	400	337	1,500 ^b	1,151	1,300 ^b
South Africa	4,179	4,833	4,267	6,508	4,270
<u>Asia</u>					
Israel	3,501	6,177	6,816	6,774	8,046
Totals	44,703	48,368	48,276	59,741	67,714

^aStatistics are in metric tons and refer only to concentrated juice.

^bEstimate.

Source: Food and Agriculture Organization of the United Nations, Citrus Products, Part A, Trends in world production and trade, A Report Prepared by the Technical Conference on Marketing and Export Trade of Fruit and Vegetables in the Mediterranean-European Area (Rome: Food and Agriculture Organization of the United Nations, 1969), p. 11.

and the occasional shortage of juice in Florida, the world's major producer of frozen orange juice.⁵⁸

Of the 20 nations that have purchased orange juice from São Paulo (Table XXIV), 13 are located in Europe, three in Asia, and two in North America. Australia has also imported a small quantity of Paulista juice. Between 1963 and 1970 Europe bought more than half (59 per cent) of the state's exports. Countries in North America and Asia purchased 38 and 3 per cent respectively. The three leading importers, West Germany (39 per cent), Canada (19 per cent), and the United States (19 per cent) purchased over three-quarters of the state's exports. Because of their greater importance these countries are considered separately.

West Germany has recently become a significant buyer of Paulista orange juice. During the period 1963 to 1970 a total of 54,677 tons of juice was purchased. Table XXIV, on page 146 shows that imports in 1969 and 1970 were particularly large, amounting to 57 per cent of the total. German investment in São Paulo's processing industry and an expanding market for citrus juice at home have been responsible for this upward trend.

Canada has been the second most important buyer of Paulista orange juice. Between 1963 and 1970 some 26,441 tons of juice were purchased. Normally, Canada buys most of its citrus juice from the United States, but occasional shortages in Florida have made other

⁵⁸Factors responsible for the rise of the processing industry are presented on pages 87-90.

TABLE XXIV

SÃO PAULO EXPORTS OF FROZEN CONCENTRATED

ORANGE JUICE, 1963 TO 1970^a

Importing Countries	1963	1964	1965	1966	1967	1968	1969	1970
<u>North America</u>								
Canada	2,406	1,278	825	4,102	2,569	6,273	4,614	4,374
United States	735	1,880	1,318	2,040	3,403	12,239	3,527	1,108
<u>Europe</u>								
Belgium-								
Luxembourg	-	-	5	278	272	5	55	284
Denmark	-	-	50	271	190	345	302	256
Finland	-	-	-	-	-	-	17	-
France	-	-	-	-	1,001	216	-	34
Italy	-	-	-	-	-	38	-	-
Netherlands	168	-	44	988	2,231	4,070	4,386	4,209
Norway	-	-	-	4	187	-	94	163
Spain	-	-	-	-	-	228	104	163
Sweden	-	-	22	247	281	603	850	1,129
Switzerland	-	-	11	-	-	-	-	-
United Kingdom	70	31	95	369	770	594	514	626
West Germany	1,894	636	3,390	5,041	7,169	5,485	10,957	20,104
<u>Africa</u>								
Mozambique	-	-	-	-	-	-	-	668
<u>Asia</u>								
Israel	40	-	-	589	498	-	684	2,115
Hong Kong	-	-	-	-	-	-	-	150
Japan	-	-	-	-	-	-	-	11
<u>Oceania</u>								
Australia	-	-	-	-	76	-	-	-
Total Number of Metric Tons	5,313	3,825	5,760	13,929	18,647	30,096	26,104	35,394

^aStatistics are in Metric Tons and refer only to concentrated juice.

Source: Data for years 1963-1968: Carteira de Comercio Exterior (CACEX), Bank of Brazil. Data for 1969 and 1970: Correio Agro-Pecuario, Ano XI, no. 174 (March, 1971), p. 15.

sources necessary.⁵⁹ São Paulo's burgeoning juice industry has been able to take advantage of this situation and sales to Canada have been substantial.

The United States has been a regular customer for orange juice from São Paulo. Large amounts of Paulista juice have entered Florida for blending with local juices and for reëxport to other countries. In this manner the Florida citrus industry has endeavored to maintain a constant supply of juice to its regular customers during periods of shortage at home. The attractive prices and high quality of Paulista orange juice have resulted in continued imports even when shortages no longer existed.⁶⁰ Florida citrus growers protested these imports vigorously, and the quantities purchased during 1969 and 1970 were reduced. The following quotation portrays the feelings of many Florida citrus growers towards the import of foreign citrus juice.

A processor-dominated Citrus Commission FINALLY proposes to tax foreign citrus product imports coming into Florida. Mounting Grower complaints FORCED the issue. The proposed remedy is TOO LITTLE, TOO LATE.

The equivalent of 8 cents a box on oranges, 6 cents on grapefruit is TOO LITTLE to stop the rape of a \$300 million industry by any foreign country using slave labor wages or government subsidy to force our Growers into bankruptcy. It is TOO LATE by 12 million untaxed gallons flooding in already.

.....
A discerning 1970 Legislature might well ask a question posed by United: WHY NOT A HIGHER TAX?
.....

⁵⁹Canada is the only nation in North America that has no citrus producing region within its borders, consequently all citrus and citrus products must be imported.

⁶⁰Interview with H. J. Happel, loc. cit.

ONLY A TAX SUFFICIENT TO WIPE OUT THIS UNFAIR COMPETITIVE ADVANTAGE WILL DO THE JOB. UNTIL THE TAX IS RAISED TO THAT LEVEL IT IS FLORIDA'S TRADE THAT IS RESTRAINED! A TOKEN TAX IS NO TAX.⁶¹

The Sale of Essential Oils on the Foreign Market.--Small

amounts of essential oils are obtained from citrus fruits during the juicing process. These are used in the manufacturing of perfumes and flavors, and constitute an additional source of income for the Paulista citrus industry. Table XXV lists these exports by country, according to quantity and value. Shipments of essential oils have increased with the growth of the processing industry, but only 224.48 metric tons valued at \$129,632 were sold on the international market in 1968. During the three year period 1966 to 1968, West Germany was the largest buyer of São Paulo's essential oils. Belgium-Luxembourg, France, the United States, Paraguay and Venezuela were the next most important buyers.

Prospects for Marketing Citrus and Citrus Products.--The

domestic citrus market will probably continue to be the major consumer of Paulista citrus, but exports should remain strong in the foreseeable future and frozen orange juice should continue to be the most important item. Domestic and foreign market conditions differ significantly and will therefore be considered separately.

The growing demand for citrus and citrus products on the domestic market has occurred principally in the urban centers. This

⁶¹I. C. McGee, General Manager of United Growers and Shippers Association, Inc. Post card circular, n.d.

TABLE XXV

ANNUAL EXPORTS OF ESSENTIAL OILS FROM SÃO PAULO, 1966-1968

Importing Countries	Quantity (Kilos)			Value (U.S. Dollars)		
	1966	1967	1968	1966	1967	1968
<u>North America</u>						
Canada	-	175	528	-	78	238
Costa Rica	-	-	24	-	-	221
Mexico	360	1,850	151	3,096	27,375	1,389
United States	1,110	1,800	28,835	10,313	4,191	26,584
<u>South America</u>						
Argentina	400	488	614	816	3,379	4,890
Chile	2,335	3,943	2,150	13,573	29,329	1,769
Colombia	-	-	350	-	-	215
Paraguay	14,000	14,020	-	15,820	14,230	-
Venezuela	-	1,056	26,707	-	1,000	12,048
<u>Europe</u>						
Belgium-Luxembourg	-	-	61,250	-	-	27,453
France	525	25,870	15,910	1,063	18,710	12,348
Italy	-	495	-	-	248	-
Netherlands	-	290	-	-	220	-
Spain	-	700	7,215	-	630	3,935
United Kingdom	8,678	-	-	3,471	-	-
West Germany	7,010	14,787	80,742	10,480	20,723	38,542
Totals	34,418	65,474	224,476	58,632	120,113	129,632

Source: Carteira de Comercio Exterior (CACEX), Bank of Brazil.

trend will probably continue. The population of Brazil is increasing at a rate of about 3 per cent per annum, with the major growth occurring in the cities. Industries and services are largely concentrated in the urban areas, and the buying power of the city dweller is generally higher than his rural counterpart.

There are certain marketing problems that must be faced by the Paulista citrus industry. The presence of citrus trees in most parts of Brazil tends to retard the development of commercial citriculture. The large number of people with an extremely low income level also limits commercial production. Better transportation facilities are needed in many parts of Brazil in order to permit the easier flow of citrus products. A higher degree of organization within the industry, more government assistance, and a greater usage of advertizing and promotional programs are also necessary.

The amount of Paulista citrus sold on the international market varies considerably from year to year. It is unlikely that the industry will be able to increase its exports of fresh fruit appreciably. Competition from South Africa and other countries is strong. In order to meet this competition more successfully, citrus exporters would benefit from greater organization and a more unified promotional program.

The export of citrus products has grown rapidly since 1962. The demand for Paulista orange juice will probably continue as long as it remains competitive on the international market. Presently, the processing industry is optimistic, but its recent prosperity is

based almost entirely on the foreign market. It is therefore unavoidably tied to the economic conditions of Europe and North America.

During the last 50 years, the major problems affecting production and exports have been disease and war. The present ability and alertness of the São Paulo Department of Agriculture would seem to lessen the threat of the former while the possibility of the latter can never be ruled out. Since a large portion of the state's citrus finds its way overseas, the existing level of prosperity could be terminated by unfavorable market conditions in the overseas areas.

On the other hand, certain changes within Brazil itself are tending to offset the state's dependence on the foreign market. Improvements in the promotion and marketing of citrus and citrus products are gradually increasing the importance of the industry at home. The spread of home freezers and refrigerators in the urban areas is encouraging the consumption of citrus products. However, the standard of living, dietary habits and the buying power of a large portion of the Brazilian people must improve significantly before the domestic market alone can support the citrus industry at its current level of productivity.

CHAPTER VIII

SUMMARY AND CONCLUSIONS

Summary.--During the last seventeen years, the state of São Paulo has become one of the world's most important citrus producing regions. Not only has the industry grown quantitatively but its internal structure has also undergone significant changes. The purposes of this study have been to analyze recent developments and trends in the Paulista citrus industry and to explore its prospects for continued expansion and growth.

The Paulista citrus industry began commercial sales of oranges in 1869. The first citrus area was in the vicinity of Limeira, a small town approximately 150 kilometers northwest of the city of São Paulo. Production gradually increased and in 1926 the state commenced regular exports to foreign markets. During the 1930's the industry grew rapidly, particularly in the Limeira, Sorocaba, and Paraíba Valley areas. Paulista fruit sold well on the European market, but the Second World War, and tristeza, a serious tree-killing disease, quickly reduced the industry to a virtual standstill. For many years Paulista citriculturists struggled to overcome the ill-effects of disease. Finally, success was achieved, and by 1955 both production and exports showed strong upward trends. Since that time São Paulo has become the nation's foremost citrus

producing area, with more land devoted to citriculture than the rest of Brazil combined.

The physical environment of the state of São Paulo possesses many characteristics that are ideal for the cultivation of citrus. A large portion of the state is gently undulating to hilly and is well suited to mechanized farming. Only a few areas have excessive local relief.

Climatic conditions throughout much of the interior are especially good for citriculture. Frosts and freezes are rare, except on higher portions of the plateau, and even in these areas freezing temperatures are normally restricted to low lying terrain. Precipitation averages are above 1,000 mm per annum throughout the entire state, but annual variations are pronounced, and the single most important climatic problem is occasional drought.

São Paulo possesses a wide variety of pedalferic, or iron and aluminum accumulating soils. Leaching has reduced much of the organic and inorganic material, but there are large portions of the state with sandy to loamy soils that are well suited to citriculture. They are known locally as glacial, new terra roxa, and Botucatú and Baurú sandstone soils. They are deep, well drained, and with adequate aeration. Under careful and enlightened management these soils can produce abundant supplies of citrus.

The cultural landscape of São Paulo has changed considerably during the last seventy years. Both the state and city of São Paulo have grown rapidly, and at the present time constitute the

nation's largest and most prosperous market. The standard of living and earning power in São Paulo are greater than in any other state. Transportation, manufacturing, power, communications, urbanization and education are more developed here than elsewhere in Brazil. The state's citrus industry has benefited greatly from this milieu of progress and development and is, in reality, a product of it.

There are two major citrus producing regions, both of which are located to the northwest of the city of São Paulo. The city of Bebedouro constitutes the center of the Northern Citrus Region, whereas Limeira is the focal point of the Southern Citrus Region. The former is the principal center for export fruit and the latter is the main supplier for the domestic market. The most common citrus variety produced is the orange, but some tangerines, lemons, limes and grapefruit are also grown.

Cultural practices in the citrus groves vary greatly. The larger, commercial fazendas are usually highly mechanized and employ modern practices and techniques. On the other hand, numerous farms, particularly the smaller ones, have limited mechanization and a relatively low level of technology. At present, Paulista fazendeiros use limited amounts of commercial fertilizer and the value of irrigation is just beginning to be realized. Labor within the citrus regions is cheap and plentiful. The major problem confronting citriculturists is disease; however, the São Paulo Department of Agriculture assists the farmers in an endeavor to control tristeza, citrus canker, and other diseases.

One of the most significant developments within the state's citrus industry has been the recent establishment of several modern processing plants. These plants are located within the main citrus growing areas and all are served by good transportation facilities. Frozen concentrated orange juice is the main product, but small quantities of other juices are also produced.

The marketing of fresh fruit for export is handled by several large companies. They process and package the fruit using modern methods and techniques. They also handle its shipping and eventual sale on the overseas markets, most of which are located in Western Europe. Urban centers within São Paulo and other Brazilian states constitute the major domestic markets for Paulista citrus. The export of frozen orange juice commenced in 1963. Since that time the state has become one of the world's largest orange juice exporters. The United States and Canada were the first major buyers of Paulista juice, but the present trend is away from North America to Western Europe. The consumption of frozen orange juice in Brazil is limited at present, but small amounts are now sold in the larger urban centers.

Conclusions.--The significant growth that has occurred during the last seventeen years is an indication of the resilience and potential of the Paulista citrus industry. Expansion will probably continue in the foreseeable future. Production in the Northern Citrus Region will spread gradually to the northwest forming a continuous citrus belt between Araraquara and São José do Rio Preto. The

Southern Citrus Region will develop more slowly and may eventually decrease in importance as urbanization and rising land values force growers to move or seek other sources of income. Scattered centers of production will develop on the Western Plateau.

Paulista citriculture will experience significant changes during the 1970's. Tree quality will improve as greater reliance is placed on improved rootstocks and uncontaminated budwood. Yields will increase as a result of greater dependence on irrigation and a more widespread consumption of fertilizer. Tangerine and lemon production will become relatively more important. Marginal producers will find it more difficult to compete with scientifically operated farms. This should lessen the quantity of non-commercial citrus that is presently produced and raise the quality of the state's fruit.

The processing plants will continue to provide an important market for Paulista citrus growers. The quantity of juice produced will gradually increase but occasional freezes in Florida and other citrus regions will result in larger exports from São Paulo. Rising costs within the industry will force processors to diversify. Other fruits such as passion fruit, guavas, and papayas could be juiced during the summer when the plants are normally idle.

The present prosperity of the Paulista citrus industry is based to a large degree on the export of fresh fruit and frozen orange juice. Any disruption of trade between Brazil and the principal overseas market areas (Western Europe and North America) would result in hardship for the industry. The occurrence of a major war would appear to be the only significant threat, but increased competition

from other countries and citrus diseases within São Paulo would also limit exports. In order to compete more effectively on the international market, the Paulista citrus industry needs greater cooperation and organization among the exporting companies. Much could be gained by a unified promotional program in the world's potential citrus markets, and more emphasis should be placed on establishing new markets.

One of the greatest needs of the Paulista citrus industry is the strengthening of the domestic market. The ubiquitous nature of citrus production in Brazil and the low buying power of many Brazilians has retarded the development of commercial citriculture. However, the rapid rate of urbanization, along with an increase in the standard of living, have resulted in a growing potential market for commercial citrus within the country. Much could be done to promote the consumption of citrus and citrus products in Brazil. A greater variety of non-frozen products could be prepared. Also, the dietary advantages of citrus juices could be stressed. A national advertizing campaign would create a greater awareness of the values of citrus and lead to larger consumption within the country.

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A P P E N D I X

TABLE XXVI
WORLD'S MAJOR ORANGE AND TANGERINE
PRODUCING COUNTRIES, 1967-1970

Country	1967 Boxes (000) ^a	1968 Boxes (000)	1969 Boxes (000)	1970 ^b Boxes (000)
United States	165,732	237,042	241,193	249,651
Japan	61,688	89,213	76,328	95,837
Spain	65,382	54,529	67,248	63,618
Brazil ^c	49,799	51,096	63,140	65,130
Italy	45,308	52,778	53,427	51,629
Argentina ^d	25,699	32,697	34,382	38,266
Mexico	27,778	28,313	29,501	32,124

^a32 kilo boxes.

^bPreliminary statistics (Countries ranked according to 1969 data).

^cStatistics refer only to the state of São Paulo. Data provided by the Food and Agriculture Organization have been used in the text because they represent the entire country.

^dExcludes bitter oranges.

Source: World Agricultural Production and Trade Statistical Report, July 1971 (Washington, D.C.: Foreign Agricultural Service, U.S.D.A.).

TABLE XXVII
AVERAGE ANNUAL VALUE OF BRAZILIAN
CRUZEIRO PER U.S. DOLLAR

Year	Cruzeiros	Year	Cruzeiros
1912	3.09	1941	19.72
1913	3.11	1942	19.64
1914	3.42	1943	19.63
1915	4.09	1944	19.58
1916	4.26	1945	19.50
1917	4.01	1946	19.35
1918	3.95	1947	18.73
1919	3.82	1948	18.72
1920	4.78	1949	18.72
1921	7.78	1950	18.72
1922	7.74	1951	18.72
1923	9.84	1952	18.72
1924	9.21	1953	43.32
1925	8.33	1954	62.18
1926	7.00	1955	73.54
1927	8.46	1956	73.59
1928	8.37	1957	75.63
1929	8.48	1958	130.06
1930	9.24	1959	159.83
1931	14.27	1960	189.90
1932	14.13	1961	252.43
1933	12.70	1962	390.52
1934	14.69	1963	577.65
1935	17.40	1964	978.91
1936	17.23	1965	1,900.00
1937	16.03	1966	2,218.00
1938	17.62	1967	2,686.00
1939	19.22	1968	3,470.00
1940	19.80	1969	4,114.00

Source: Anuário Estatística do Brasil. Statistics obtained from the following volumes:

1912-1953 from Vol. XV, 1954, p. 222.
 1954-1956 from Vol. XVIII, 1957, p. 190.
 1957 from Vol. XX, 1959, p. 199.
 1958-1961 from Vol. XXII, 1961, p. 180.
 1962-1964 from Vol. XXVI, 1965, p. 268.
 1965-1967 from Vol. XXIX, 1968, p. 366.
 1968-1969 from Vol. XXXI, 1970, p. 435.

TABLE XXVIII

LEADING ORANGE PRODUCING MUNICIPIOS
IN THE STATE OF SÃO PAULO, 1969

Município	Boxes
1. Bebedouro	3,600,000
2. Limeira	3,580,000
3. Araraquara	2,720,000
4. Monte Azul Paulista	1,600,000
5. Santa Ernestina	1,050,000
6. Arthur Nogueira	900,000
7. Olímpia	780,000
8. Araras	760,000
9. Taquaritinga	750,000
10. Tabatinga	550,000
11. Cajobí	500,000
12. Mogi Mirim	500,000
13. Severinia	500,000
14. Pitangueiras	472,000
15. Amparo	450,000
16. Pirassununga	440,000
17. Colina	420,000
18. Jaguariúna	420,000
19. Fernando Prestes	300,000
20. Mogi Guaçu	300,000
21. Piracicaba	300,000
22. Santa Rita do Passa Quatro	292,500
23. Matão	280,000
24. Cravinhos	250,000
25. Boa Esperança do Sul	240,000
26. São José do Rio Preto	240,000
27. Itapira	230,000
28. Porto Ferreira	215,040
29. Viradouro	210,000
30. Nova Granada	200,000
31. Pirangi	200,000
32. Santa Cruz das Palmeiras	200,000
33. Votuporanga	200,000
34. Jardinópolis	180,000
35. Cândida Moto	170,000
36. Paraguaçu Paulista	160,000
37. Santo Antonio de Posse	160,000
38. Tabapuã	160,000
39. Capeta do Alto	150,000
40. Jaboticabal	150,000

Source: Files of the Secretaria da Agricultura de São Paulo.

TABLE XXIX
 AGRICULTURAL LAND USE IN THE MUNICIPIO
 OF BEBEDOURO*, 1969

Item	Hectares
Cotton	315
Onion	5
Rice	3,686
Corn	2,889
Soya Beans	50
Beans (Fresh)	187
Beans (Dry)	113
Peanuts (Fresh)	690
Peanuts (Dry)	39
Castor Beans	400
Sugar Cane (Forage)	192
Cassava	200
Tomatoes	100
Eucalyptus	1,120
Coffee	1,927
Oranges	17,142
Lemons	30
Ponkan	23
Cravo Orange	95
Avocado	30
Papaya	83
Mango	234
Pineapple	15
Banana	27
Natural Pasture	13,000
Planted Pasture	10,000
Total	52,592*

*The total area of the município is 72,300 hectares.

Source: Files of the Secretaria da Agricultura de São Paulo.

TABLE XXX

MAIN CITRUS VARIETIES GROWN IN BRAZIL

Early Ripening Oranges

Lima orange (Sweet orange)
Barão orange
Sabará orange
Bahia or Bahiana orange (Washington Navel orange)
Bahianinha (Small Bahia Navel orange)
Seléta Vermelha orange (Red Select orange)
Hamlin

Oranges Ripening During the Midseason

Abacaxi orange (Pineapple orange)
Péle de Moca orange
Caipira orange ("wild" orange)
Imperial
Côco orange

Late Ripening Oranges

Seléta Branca orange (White Select orange)
Serra d'Agua orange
Pêra orange
Valencia
Natal

Other Citrus Varieties

Laranja Cravo (Type of Mandarin orange)
Mexerica (Type of Mandarin orange)
Ponkan (Type of Mandarin orange)
Limão (Lemon)
Limão doce (Sweet Lemon)
Limão galego (Similar to Mexican Lime)
Lima da Persia (Sweet Lime)

Source: Fred A. Motz, The Fruit Industry of Brazil, Foreign Agricultural Report No. 2 (Washington: U.S. Government Printing Office, 1942).

TABLE XXXI

CITRUS CONSUMED BY PROCESSING PLANTS IN SÃO PAULO

Year	Boxes ^a
1963	2,120,000
1964	1,610,000
1965	2,530,000
1966	4,240,000
1967	4,290,000
1968	10,106,000
1969	6,000,000 ^b
1970	9,200,000
Total	40,096,000

^a40 kilo boxes.

^bAn approximation of the Secretaria da Agricultura de São Paulo.

Source: Statistics for the period 1963 to 1969; Antonio A. Amaro, "Laranja com sinal amarelo," Correio Agro-Pecuário, X (February, 1970), p. 17. The 1970 total; Antonio A. Amaro, "Laranja está virando o suco," Correio Agro-Pecuário, XI (March, 1971), p. 15.

TABLE XXXII

SÃO PAULO ROAD STATISTICS, 1968

Classification	Kilometers Paved	Per cent Paved	Kilometers Unpaved	Per cent Unpaved	Total
Federal	4,245	89	539	11	4,784
State	9,058	64	5,024	36	14,082
<u>Município</u>	3,000	2	147,000	98	150,000
Totals	16,303	9	152,563	91	168,866

Source: Anuário Estatístico do Brasil, 1969, p. 373.

TABLE XXXIII
URBAN POPULATION IN BRAZIL, 1940-1975

Year	Urban ^a	Per cent Urban	Total Population
1940	12,880,182	31	41,236,315
1950	18,782,891	36	51,944,397
1960	32,471,000	46	70,967,185
1970	50,950,000	54	95,073,000
1975 ^b	62,895,000	57	110,861,000

^aUrban areas are defined by the Brazilian census as concentrations with more than 2,000 people. According to a study made by the United Nations in 1961 even communities with 20,000 should be classified as rural since they frequently lack the amenities that are commonly associated with urban life in much of the western world. Nevertheless urbanization has been expanding rapidly in Brazil during the last three decades. Survey of the Brazilian Economy (Washington, D.C.: The Brazilian Embassy, 1966), p. 9.

^bData projected by Getulio Vargas Foundation.

Source: Statistics for 1940 and 1950 were published in Anuário Estatístico do Brasil, Vol. XIV, 1953, p. 33. Statistics for 1960, 1970 and 1975 were published in Projections of Supply and Demand for Agricultural Products of Brazil Through 1975, Getulio Vargas Foundation, Brazilian Institute of Economics, Center for Agricultural Studies (Published for the U.S. Department of Agriculture, Economic Research Service by the Israel Program for Scientific Translations, Printed in Jerusalem by S. Monson, July 1968), pp. 18-20.

TABLE XXXIV
PERCENTAGE OF PAULISTA CITRUS EXPORTED^a

Year	Per cent	Year	Per cent
1931	9	1951	6
1932	6	1952	5
1933	8	1953	3
1934	7	1954	6
1935	7	1955	8
1936	10	1956	12
1937	21	1957	13
1938	20	1958	16
1939	23	1959	22
1940	7	1960	18
1941	2	1961	14
1942	1	1962	13
1943	2	1963	23
1944	4	1964	22
1945	2	1965	25
1946	8	1966	22
1947	8	1967	18
1948	10	1968	31
1949	12	1969	26
1950	9	1970	24 ^b

^aCalculations are based on the total annual citrus crops. Percentages would be higher if based only on commercial production statistics. Unfortunately these were not available.

^bIn 1970, 44 per cent of the commercial citrus crop was exported.

Source: Production statistics for the period 1931 to 1947 were taken from the Anuário Estatística do Brasil; 1948 to 1969 taken from the files of The Secretaria da Agricultura de São Paulo; 1970 taken from the Correio Agro-Pecuário, Vol. XI (February, 1971), p. 6.

Export statistics for the period 1931 to 1970 were taken from the files of the Secretaria da Agricultura de São Paulo. Juice export statistics for 1963 to 1969 were published in Coopercotia, Vol. XXVII (April, 1970), p. 29; statistics for 1970 were published in Correio Agro-Pecuário, Vol. XI (March, 1971), p. 15.

TABLE XXXV

BRAZILIAN CITRUS EXPORTS, 1955-1966

Year	Boxes of Fruit exported from Santos ^a	Boxes of Fruit exported from Rio de Janeiro	Total
1955	520,000	797,000	1,317,000
1956	918,000	315,000	1,233,000
1957	1,246,000	76,000	1,322,000
1958	2,000,000	144,000	2,114,000
1959	3,184,000 ^b	58,000	3,242,000
1960	3,227,000	40,000	3,267,000
1961	3,256,000	41,000	3,297,000
1962	3,109,000	--	3,109,000
1963	4,143,000	--	4,143,000
1964	2,882,000	--	2,882,000
1965	4,732,000 ^b	--	4,732,000
1966	2,328,000	--	2,328,000

^a40 kilo boxes.

^bThese figures differ slightly from those listed in Table XVI.

Source: Files of the Secretaria da Agricultura de São Paulo.

VITA

Robert George Pierson was born in Surat, India, on April 3, 1937. He attended elementary schools in Mandeville, Jamaica, and Collegedale, Tennessee, and completed his secondary studies at Vincent Hill School in Mussoorie, India, in 1953. In 1954 he commenced studies toward a Bachelor of Arts degree in Theology, the first year of which was undertaken at Madison College, Madison, Tennessee, and the remaining year at Southern Missionary College, Collegedale, Tennessee. Upon receiving his degree in the spring of 1958 he moved to Washington, D.C. where he began study toward a Master's degree in Systematic Theology at Andrews University (now located in Berrien Springs, Michigan). After completing his Master's degree in 1959 he engaged in pastoral and teaching activities in Madison and in Memphis, Tennessee. While in Memphis he commenced graduate studies in geography at Memphis State University but interrupted this program in 1961 to accept an appointment to teach geography at Solusi College near Bulawayo, Rhodesia. Shortly after returning from Africa, he entered the Graduate School of the University of Tennessee at Knoxville in June, 1967, and received the Doctor of Philosophy degree with a major in geography, August, 1972.

He is married to the former Barbara Phyllis Short of Takoma Park, Maryland and has three children.



THE CHANGING CLASSROOM

