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The Possibilities of Brazil as a Competitor of the United States in Cotton Growing



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FIG. 150.—Relief map of Brazil. From model by Howell. Copyright 1896 by the Macmillan Co. (Reprinted by Permission.)

(Photographed from page 305 of "Economic Geography of South America", by R. H. Whitbeck, published in 1926 by the McGraw-Hill Book Co., Inc., New York City. Reprinted by permission of the Macmillan Company and the McGraw-Hill Book Co., Inc.)

Figure 1.

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THE POSSIBILITIES OF BRAZIL AS A COMPETITOR OF THE UNITED STATES IN COTTON GROWING

By

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INTRODUCTION

The invention of the cotton gin in 1793 put the United States of North America in the lead of all other countries in cotton production. This position she continues to hold, and with diligence may hold indefinitely. The object of this paper, therefore, is not to view with alarm the possibilities of foreign competition in the near future, but rather to caution the cotton growers of the United States against the presumption that the bulk of the world's supply of cotton will always come from their own country.

Though competition is not impending, the cotton growers of the United States of North America cannot afford to ignore the fact that there are influences at work which may ultimately bring competition to their industry. It is not unbelievable that in the not far distant future other countries having soils and climate fully as well adapted to cotton growing as our own, cheaper lands, and cheaper labor, may develop cotton growing, and this may be accomplished by peoples similar in origin to those of the United States of North America. It may be done by the British, either in their own possessions or elsewhere; it may be done by the Brazilians; or it may be done by enterprise from the United States of North America.

It appears well worth while, therefore, for the cotton growers of the United States of North America to give careful consideration to the potential forces which may eventually bring them serious competition. It is a well known fact that European spinners, particularly those of Great Britain, have become greatly alarmed over the cotton situation in the United States of North America. The short crops of the past few years, coupled with an ever-increasing consumption of American cotton by American spinners, have given impetus to a movement to develop the cotton growing possibilities of the British possessions and of other cotton growing countries, notably Brazil.

In 1920 there was published a report entitled, "A Report to the Board of Trade by the Empire Cotton Growing Committee,"¹ on

¹London, 1920.

page 4 of which it was stated that the object of this committee was “* * * to investigate the best means of developing the growing of cotton within the British Empire, and to advise the government as to the necessary measures to be taken for this purpose.” The report states that the British cotton industry is in a most dangerous condition as to its supply of cotton and that this condition necessitates the strongest of efforts on the part of the government to obviate, so far as possible, its dependence upon the United States of North America for its supply. It then discusses the possibilities of cotton growing in the different parts of the British Empire, among others, Egypt, the Sudan, New Guinea, and the West Indies.

Not sure, however, that their efforts to grow cotton within the British Empire will provide an adequate supply of raw cotton for English spindles in the near future, the International Federation of Master Cotton Spinners' and Manufacturers' Associations¹ has done everything within its power to encourage cotton growing in the United States of Brazil. It is a well known fact that European spinners, including those of Great Britain, have bought cotton in Brazil whenever they could for more than 100 years.

The efforts of the spinners to encourage cotton growing in Brazil took definite form in 1920, following the visit of the Brazilian Commercial Mission to Europe in 1919, the object of which was to interest the European cotton spinning industry in Brazilian cotton. On this visit to Europe, one of the members of the Brazilian Mission, Mr. Roberto Cochrane Simonsen, read a paper before the International Cotton Committee at Paris, telling of the possibilities of Brazil as a cotton growing country, and in conclusion inviting the Federation to send a mission to Brazil with a view to studying the conditions there and offering suggestions as to the improvement of cotton culture. This invitation was accepted at the Zurich meeting of the Federation, and the mission reached Brazil in March of 1921. This mission visited various cotton growing sections of Brazil and subsequently published the results of its findings in a report entitled, “Brazilian Cotton.”²

Again, an International Cotton Conference was held in the city of Rio de Janeiro, Brazil, October 15-20, 1922, in connection with the Brazilian Centennial Exposition.³ The report of the “First Section”⁴ of this conference calls attention to “the world's shortage of cotton,” and predicts that it will become more pronounced as time goes on, and, therefore, urges all countries possessing proper conditions for cotton growing, to employ all means within their power to develop

¹Hereinafter referred to, for brevity, as “The Federation.”

²Published in 1921 at Manchester, by the International Federation of Master Cotton Spinners' and Manufacturers' Associations, Arno S. Pearse, General Secretary.

³The delegates from the United States of North America were W. Irving Bullard of Boston; President Andrew M. Soule of the University of Georgia; and the author, who also visited some of the leading livestock-, sugar-, coffee-, and cotton-growing districts of South Central Brazil.

⁴Resolutions of the International Cotton Conference, 1922, pp. 4, 9.

the cotton growing industry, and holds out rather flattering prospects for profits. This report suggests also that Brazil improve her cotton growing industry through research, demonstration, development of seed breeding farms, and special concessions to growers. The report also emphasizes the importance of Brazil's growing the American upland type of cotton, having a staple from 1 to 1½ inches long. More specific recommendations were made also as to breeding, cultivation, fertilizers, picking, ginning, combating insect pests and diseases, and marketing.

Following the International Cotton Conference in Rio de Janeiro, another mission of the Federation, under the leadership of its General Secretary, Mr. Arno S. Pearse of Manchester, made a trip to the cotton growing states of North Brazil, and thereafter issued a report entitled, "Cotton in North Brazil,"¹ as a continuation of the first report, entitled, "Brazilian Cotton." This report again calls attention to "Brazil as a cotton supplier to the world," and to the decline of the cotton crop of the United States, due, as the commission believed, to the depletion of soil fertility, the infestation of the boll weevil, the spread of the pink boll worm, the high costs of production, and the increasing standards of living among American cotton growers. The report then elaborates upon the particular cotton growing possibilities of the several states of North Brazil.

More recently (on July 18, 1923), the English Cotton Industry Bill became a law. This law provides that contributions at the rate of six pence per bale of raw cotton imported into and spun in the United Kingdom must be paid to the British Empire Cotton Growing Corporation. The object of this corporation, as previously suggested, is to increase the production of cotton in the British Empire, by the study of the physical and economic conditions under which cotton must be produced, and the actual development of cotton growing districts.

In this connection, it is interesting to observe the following news item which appeared in a Washington, D. C., newspaper on February 2, 1926:

"Britain to Grow Cotton, Fearing U. S. 'Squeeze'"

"London, Feb. 2.—As the United States is striving to produce rubber to free itself of British domination of the rubber market, so Great Britain will undertake legislation for the development of cotton growing within the British Empire to free the British cotton industry of its dependence upon the United States for cotton, it was announced today in the House of Commons.

"We are dependent entirely on the United States for our cotton," said Lloyd George, discussing the project. "We will not be safe in regards to our greatest manufacturing interest until we are able to grow sufficient cotton supplies for ourselves."

¹Published at Manchester by the International Federation of Master Cotton Spinners' and Manufacturers' Associations, Arno S. Pearse, General Secretary.

"Other speakers declared that the amount of American cotton available for England is becoming less each year and that the prices are increasing rapidly."

Because of the interest in cotton growing in Brazil, the President of that Republic, on February 27, 1924, issued a decree "* * * regulating the concession of favours to Establishments and Companies legally constituted in Brazil for the development of cotton growing, ginning, and the manufacture of cotton by-products."¹ Under this decree, cotton growers who agree to maintain a yearly production of at least 1000 hectares (2471.04 acres) of cotton and to maintain a demonstration farm of 100 hectares, may, under certain restrictions and the supervision of the cotton service of the Federal Government, receive certain advantages, including exemption from import duties for fifteen years on such machinery, equipments, apparatus, and supplies as may be necessary for either practical cotton production or technological work; free transportation upon government-owned railroads and steamship lines for such machinery, equipments, apparatus, and supplies; reduced freight rates on cotton pressed to a density of 350 kilos per cubic meter; and other advantages.

This activity is nothing more or less than the result of the very commendable ambition of progressive Brazilians to develop their very great interior. As cotton growers, they have much in common with the cotton growers of the United States of North America. In fact, during the author's visit to Brazil in 1922, many prominent Brazilians interested in cotton growing manifested to him a desire to become a part of an association of the cotton growers of North and South America with a view to perfecting the industry and making it more profitable to all concerned.

Obviously, all this interest on the part of European spinners in cotton growing in countries other than the United States of North America is with a definite view to relieving their cotton spinning industry of its dependence upon the United States as the chief source of cotton most commonly used in spinning.

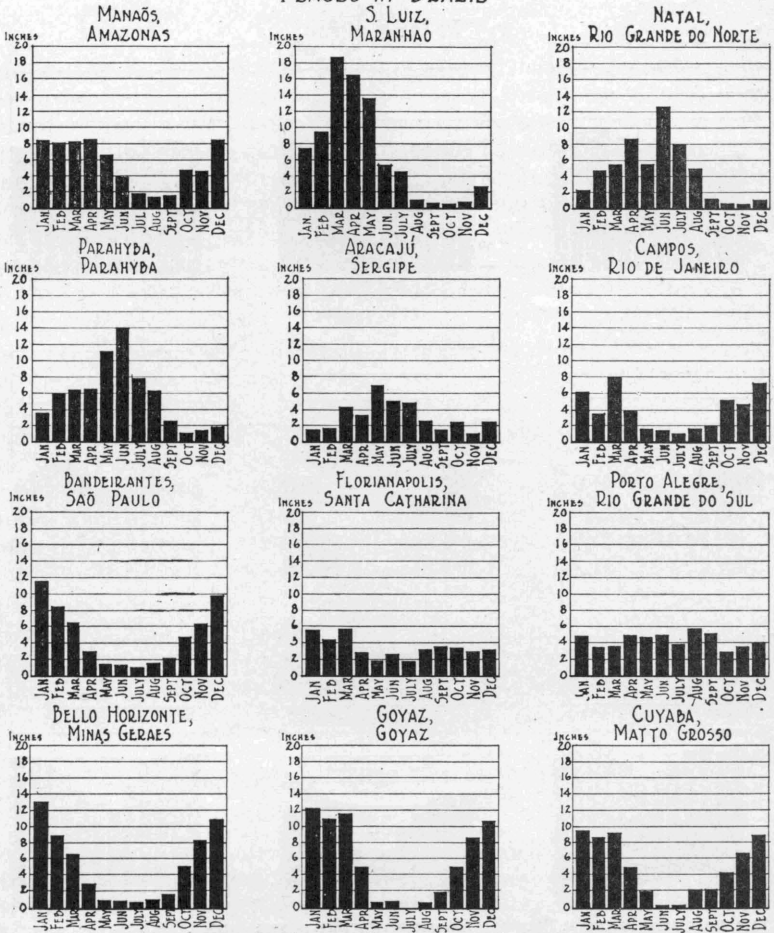
SOME FACTS ABOUT BRAZIL

Area

In area, Brazil is one of the four or five largest countries of the world. It is exceeded in size only by Canada, Russia, China, and the United States of North America, including Alaska. Leaving Alaska out, Brazil is said to be a little larger than the continental United States, having an area of about 3,300,000 square miles, or more than 12½ times the size of the State of Texas.

¹Diario Official, Rio de Janeiro, March 6, 1924.

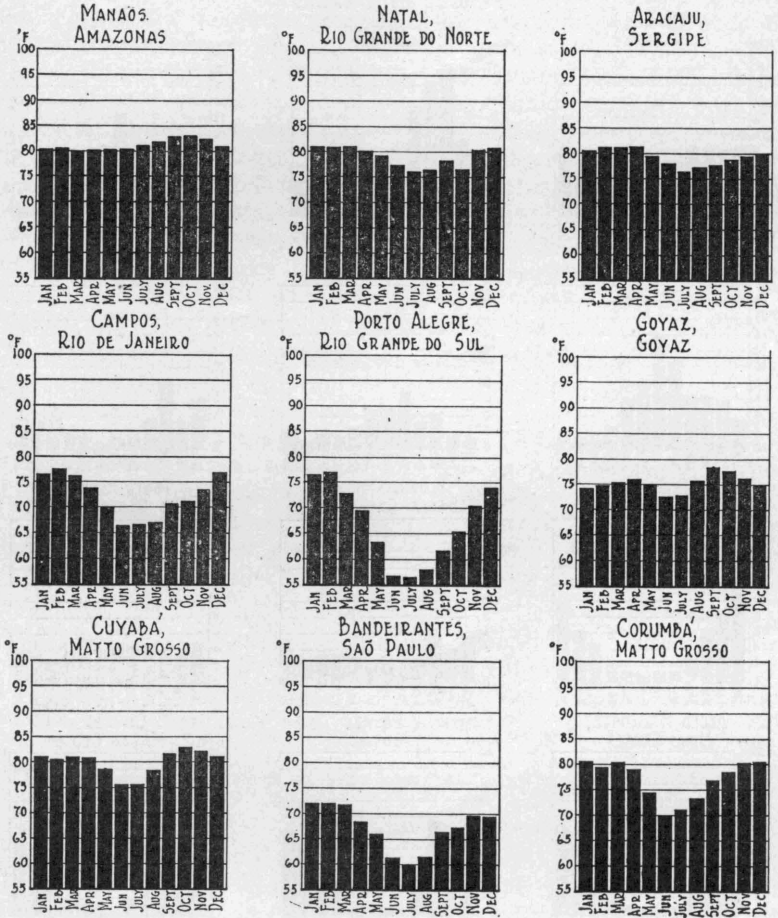
MONTHLY DISTRIBUTION OF RAINFALL, SELECTED PLACES IN BRAZIL



DATA TAKEN FROM DOLETIM DE NORMAES. NORMAES DAS ESTACOES DAREDE NACIONAL 1922

Figure 2.

AVERAGE TEMPERATURES BY MONTHS, SELECTED PLACES IN BRAZIL



DATA TAKEN FROM BOLETIM DE NORMAES. NORMAES DAS ESTACOES DA REDE NACIONAL 1922

Figure 3.

Geographical Position

The extreme northern point of Brazil is north latitude 5 degrees 10 minutes; the extreme southern point is south latitude 33 degrees 45 minutes; the extreme eastern point is in longitude 34 degrees 45 minutes; and the extreme western point is in longitude 74 degrees 8 minutes 59 seconds west from Greenwich.

Physical Features

Brazil may be divided into four physical divisions, depending upon altitude, as follows: (1) the lowlands, lying below the 500-foot contour; (2) the slopes, lying between the lowlands proper and the plateaus, with elevations of 500 to 1000 feet; (3) the plateaus of Brazil, with elevations of 1000 to 2000 feet or more; and (4) the Brazilian, or Eastern, Highlands, having elevations of 2000 to 5000 feet or more.

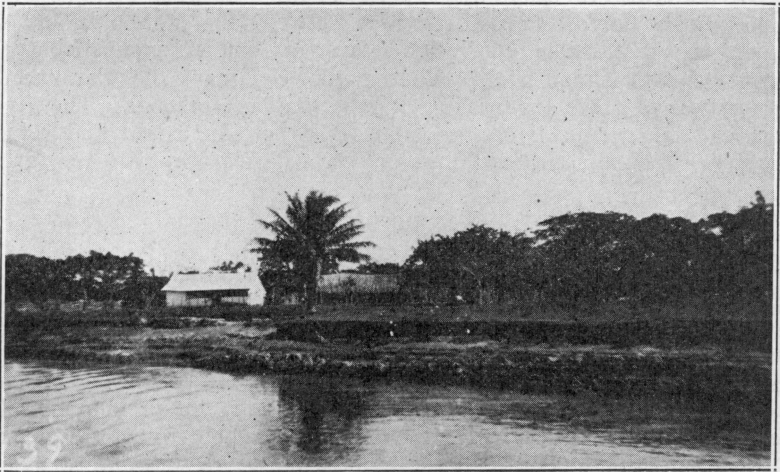


Figure 4. Lowlands of the Paraguay River System, Western Brazil.
(Photo, courtesy of Professor T. R. Day, 1922.)

The lowlands include the Amazon Valley proper, a narrow strip of Atlantic coastal plain, and the valley of the Paraguay River in South-western Brazil.

The second division includes parts of the Amazon Basin, back from the valley proper up to the plateaus; the coastal plain above the 500-foot contour; the valley of the Parana; and the basin of the Paraguay River, back of the valley proper.

The Plateau of Brazil, with its elevations of 1000 to 2000 feet or more, is of great economic significance because it comprises more than

half of the total area of Brazil and is undoubtedly the world's largest area of potential agricultural land.

The still more elevated Brazilian Highlands extend from North-eastern to Southern Brazil, beginning back of the rather narrow coastal plains facing the Atlantic, but in places extending their gigantic bases right out into the ocean. These, too, are of vast economic and aesthetic value, since they provide Brazil with some of the finest harbors in the world, impress the visitor with their beauty, and provide a delightful refuge from the often oppressive warmth of the lowlands.

River Systems

Brazil is a well watered country. Not only is the rainfall relatively abundant, but she has two of the greatest river systems in the world. The Amazon, together with its tributaries; the Tocantines and its tributaries; the Parahyba, and other streams drain Northern Brazil. The River Sao Francisco, and numerous other smaller streams drain the relatively narrow strip of country between the highlands and the sea on the east. The Platé River system, extending up from the Argentine into Brazil and including the Uruguay, the Parana, the Paraguay, and their tributaries, drains Southwest Brazil. The rivers of Brazil, taken collectively, are unexcelled both in extent and volume of water. The possibilities for water power development are very great.

Temperatures

Omitting for the moment those influences which modify climate, including proximity to the sea, elevations, and prevailing winds, Brazil may be divided into three zones, depending upon prevailing temperatures, as follows: (1) a tropical zone, including the states of Pernambuco, Parahyba, Rio Grande do Norte, Ceara, Piauhy, Maranhao, Para, Amazonas, and the Acre Territory; (2) a warm zone, embracing the middle states of Brazil, including parts of Matto Grosso, Goyaz, Rio de Janeiro, Espirito Santo, Bahia, and Minas Geraes; and (3) a temperate zone in the south, including Parana, Rio Grande do Sul, Santa Catharina, and a part of the state of Sao Paulo.

Notwithstanding the fact that Brazil lies chiefly in the tropics, there are tempering influences, including more than 3600 miles of seacoast, altitudes ranging from 1000 to 3000 feet or more above sea level, and sufficient vegetation for shelter. One contemplating a visit to Brazil, therefore, is likely to expect the climate there to be more severe than what he finds. The author was surprised indeed to find that an overcoat was necessary to comfort in the evenings during the spring months in Rio, and was delighted with the climate of the highlands, a short distance from Rio, where the mean annual temperature is only 62 degrees Fahrenheit, and the winter temperatures below freezing. Visitors are often surprised to learn that in 1918 the coffee growers in Sao

Paulo suffered heavy losses due to frost. In the southern states of Brazil freezing weather and snows are not uncommon.

Rainfall

Brazil may be divided into three rainfall regions,¹ as follows: (1) a wet equatorial region, including the Valley of the Amazon; (2) an intermediate, southern and coastal region; and (3) a local Brazilian dry region. The first region is under the influence of the doldrums. The warm moisture-laden air rises to great heights, from which it precipitates its moisture. These currents being vertical and the surface temperatures rather high, the evaporation and precipitation, resulting in heavy rainfall for the Amazon Valley, is a rather continuous process. In the southeastern interior and the coastal region, the rainfall is influenced by the southeast trade winds, with the result that there is a wet and a dry season. The dry period occurs when the southeast trade winds are farthest to the south, and the wet period when they are farthest north.

The northeastern part of Brazil, the highland dry region, is well known for its drouths. Here the rainfall varies from 20 to 40 inches, but its occurrence is very irregular from the standpoint of both monthly and annual distribution. It should be understood, of course, that 30 to 40 inches of rainfall in Northeast Brazil is not as effective in crop production as a similar amount of rainfall similarly distributed in the temperate zones, because of the great amount of evaporation. Farming in this region is generally conducted on the sandy, alluvial, natural levees along the streams. Irrigation projects have been planned and work begun with a view to increasing the tillable area of this section, but in most cases financial conditions have made it necessary for these projects to be discontinued for the time being.

It will be interesting to observe the rainfall data presented in Tables 1 and 2, and the accompanying illustrations.

¹Monthly Weather Review, October, 1921; Weather Bureau, United States Department of Agriculture; p. 538.

Table 1. Weather Data for Brazilian Stations.¹

Stations	Period	Average Temperatures						Average Rainfall						Relative Humidity		
		January		July		Annual		January		July		Annual		Jan.	July	Annual
		C.	F.	C.	F.	C.	F.	Mm.	Inch	Mm.	Inch	Mm.	Inch	%	%	%
Manaos, Amazonas.....	1911-19	26.7	80.1	27.2	81.0	27.2	81.0	210.9	8.3	46.2	1.8	1654.1	65.1	80.5	77.1	78.5
S. Luiz, Maranhao.....	1912-18	26.4	79.5	25.9	78.6	26.3	79.3	190.5	7.5	114.9	4.5	2048.8	80.7	82.2	82.8	82.0
Quixada, Ceara.....	1913-19	27.1	80.8	26.9	80.4	27.1	80.8	125.6	4.9	15.4	.6	873.4	34.4	72.7	68.6	69.0
Natal Rio Grande Do Norte.....	1904-17	27.2	81.0	24.4	75.9	26.1	79.0	59.6	2.3	199.8	7.9	1417.0	55.8	76.2	80.8	77.6
Parahyba, Parahyba.....	1912-19	25.9	78.6	23.8	74.8	25.0	77.0	91.8	3.6	224.5	8.8	1763.5	69.4	81.3	87.4	84.0
Fernando Noronha, Pernambuco.....	1911-19	27.8	82.0	25.1	77.2	26.8	80.2	46.6	1.8	155.6	6.1	1192.8	47.0	72.4	76.8	73.5
Aracaju, Sergipe.....	1911-19	26.9	80.4	24.6	76.3	26.1	79.0	38.9	1.5	119.2	4.7	947.3	37.3	80.1	81.8	79.6
Ondina, Bahia.....	1909-19	25.6	78.1	23.5	74.3	24.8	76.6	82.2	3.2	187.4	7.4	1876.2	73.9	82.8	83.4	83.2
Caetite, Bahia.....	1909-19	23.2	73.8	19.7	67.5	22.0	71.6	139.1	5.5	9.4	.4	786.9	31.0	74.8	68.8	71.3
Campos, Rio de Janeiro.....	1912-19	24.8	76.6	19.3	66.7	22.3	72.1	155.7	6.1	22.5	.9	1153.9	45.4	82.4	80.6	81.8
Bandeirantes, S. Paulo.....	1914-19	22.2	72.0	15.5	59.9	19.5	67.1	291.5	11.5	26.4	1.0	1520.3	59.9	82.1	81.0	81.0
Paranagua, Parana.....	1910-19	23.1	73.6	15.6	60.1	19.3	66.7	269.8	10.6	57.7	2.3	1538.0	60.6	88.5	91.6	90.3
Florianopolis, Santa Catharina.....	1912-19	24.6	76.3	16.6	61.9	20.7	69.3	142.0	5.6	39.7	1.6	1025.4	40.4	78.9	80.9	80.2
Porto Alegre, Rio Grande do Sul.....	1910-19	24.7	76.5	13.6	56.5	19.3	66.7	121.1	4.8	99.8	3.9	1299.7	51.2	70.3	80.3	74.9
Bello Horizonte, Minas Geraes.....	1910-19	21.8	71.2	16.4	61.5	20.0	68.0	329.9	13.0	10.3	.4	1500.5	59.1	77.0	70.4	72.6
Goyaz, Goyaz.....	1912-19	23.4	74.1	22.6	72.7	24.0	75.2	307.7	12.1	.2	Trace	1687.4	66.4	81.5	56.5	69.2
Cuyaba, Matto Grosso.....	1911-19	27.2	81.0	24.3	75.7	26.6	79.9	240.7	9.5	6.2	.2	1460.2	57.5	78.7	62.4	71.7
Corumba, Matto Grosso.....	1912-19	27.0	80.6	21.8	71.2	25.0	77.0	166.1	6.5	7.1	.3	1245.1	49.0	84.1	75.3	80.0

¹Sampaio Ferraz, Boletim de Normaes, Normaes das Estacoes da rede Nacional. 1922.

Humidity

Brazil has a relatively high percentage of humidity, due to a high average rainfall. This varies, however, with the wind velocities, wet and dry seasons, and the altitudes.

Altitudes

The mean altitude of Brazil is considerably greater than that of continental United States. The altitudes cited in Table 2 vary from about 9 feet at Natal and Florianopolis, to 2952.7 feet at Caetite. The altitude of the business section of the city of Rio de Janeiro is only a few feet above the sea level, whereas a few miles back in the mountains, Petropolis, an aristocratic suburb of Rio, has an altitude of 2667.3 feet, while Alto Itatiaya, also in the state of Rio de Janeiro, has an altitude of 7480.3 feet.

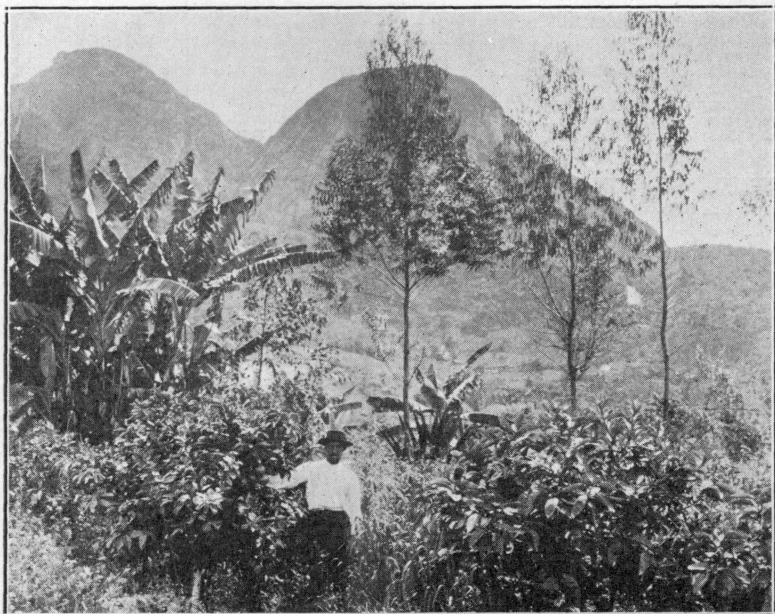


Figure 5. Nova Friburgo, Brazilian Highlands; Elevation 2775 Feet.
(Photo, courtesy Professor T. R. Day, 1919.)

Owing to the tropical and semi-tropical climate of Brazil, there are few elevations too great for cotton culture. There are, of course, limited areas in the mountainous districts of Southern Brazil which are exceptions.

Unfortunately, the only two stations reported in the state of Sao

Paulo, in the literature cited, are well up in the highlands. The elevation of Bandeirantes, for example, is about 1750 feet, while the only other station reported, Mariestella, has an elevation of 1968.5 feet.

It is well for one studying the weather data given in Table 2 to consider, at the same time, the position with reference to the equator and the elevation.

Table 2. Brazil: Latitude, Longitude, and Elevation in Meters and Feet of the Weather Stations Included in Table 1.¹

Station	South Latitude	West Longitude	Elevation	
			In Meters	In Feet
Manaos, Amazonas.....	3-08-1	60-01-5	44.9	147.6
Sao Luiz, Maranhao.....	2-31-5	44-16-8	20.0	65.6
Quixada, Ceara.....	4-55-4	39-08-3	180.0	590.5
Natal, Rio Grande do Norte.....	5-46-7	35-18-4	3.0	9.8
Parahyba, Parahyba.....	7-06-6	34-56-1	30.0	98.4
Fernando Noronha, Pernambuco.....	3-50-0	32-55-5	95.0	311.7
Aracaju, Sergipe.....	10-54-9	37-03-5	4.0	13.1
Ondina, Bahia.....	13-00-0	38-30-0	47.0	154.2
Caetite, Bahia.....	14-02-0	42-38-6	900.0	2952.7
Campos, Rio de Janeiro.....	21-45-4	41-19-9	10.2	33.0
Bandeirantes, Sao Paulo.....	22-36-0	44-28-0	533.2	1748.7
Paranagua, Parana.....	25-34-0	48-30-0	4.0	13.1
Florianopolis, Santa Catharina.....	27-36-0	48-30-3	3.0	9.8
Porto Alegre, Rio Grande do Sul.....	30-01-9	51-13-2	11.2	36.1
Bello Horizonte, Minas Geraes.....	19-54-9	43-55-9	857.0	2811.7
Goyaz, Goyaz.....	15-55-4	50-07-9	520.0	1706.0
Cuyaba, Matto Grosso.....	15-35-9	56-06-0	165.0	541.3
Corumba, Matto Grosso.....	20-28-1	57-39-2	116.0	380.6

¹Sampaio Ferraz, Boletim de Normaes, Normaes das Estacoes da rede Nacional, 1922; special table following page 24.



Figure 6. Native Indians; Interior of Brazil.
(Photo, courtesy Professor T. R. Day, 1920.)

POPULATION

In considering the factors affecting the possibilities of cotton production in Brazil, none is more important than the people themselves. Attention should be given to their numbers, habits, customs, state of development, and in general their progressiveness. Were Brazilians of a single type, it would be a simpler matter to describe and evaluate them, but, like practically all other nationalities, they are a mixed people. While the basic type is clearly Portuguese, this is only one of the many stocks which comprise the present-day population of Brazil.

When discovered in 1500, Brazil was peopled by savages, many of whom were extremely low in the scale of human development. It would be futile indeed even to venture a guess as to the number of Indians in Brazil at the time of discovery. It is certain, however, that the population was sparse. Possibly the first estimate of the population of Brazil was made in 1583 by Father Anchieta, who placed the number of Europeans at that time at 25,000, the number of civilized Indians at 18,500, and the number of African slaves at 14,000. These figures, of course, refer to the colonies on the coast of Brazil, rather than the vast interior, which, even at the present time, is relatively unknown.

Negro slaves were introduced from the time of the first settlements on down to 1850. Beginning with Father Anchieta's estimate of 14,000 slaves in 1583, we find another in 1830 by Malte-Brun, listing 1,347,000 whites and 2,000,000 negroes.

Table 3. Brazil: Percentages of Whites, Negroes, Indians, and Mestizos in the Year 1890.1

Races	Percentage
Total.....	100
Whites.....	43
Negroes.....	19
Indians.....	6
Mestizos.....	32

¹See James, Herman G., "Brazil After a Century of Independence," 1925, pp. 262-263.

Since 1890, some three million white immigrants have entered Brazil, thus increasing the proportion of pure whites to more than 60 per cent and reducing the percentage of negroes to about 12 per cent.

In 1808, the emperor ordered the taking of a census, which, imperfect as it necessarily was, resulted in an estimate of 4,000,000 people in Brazil at that time. An ecclesiastical census by Oliveira gave for the year 1819 a population of 4,396,132. Of this total, 2,488,743 were classed as whites, 1,187,389 as slaves, and 800,000 (purely a guess) as savages. In the census of 1854, the population was placed at

7,677,800; in that of 1872 at 10,112,061, including 1,500,000 slaves; in that of 1890 at 14,333,915; and in that of 1900 at 17,318,556.

There was no census in 1910, but an estimate places the population at that time at 23,414,177; while the census of 1920, possibly the most reliable of all, places the total population at 30,635,605, or about that of the United States of North America in 1860. The population of the United States of North America in 1920 was 105,710,620.

James¹ is of the opinion that the percentage of the negro element in Brazil is gradually decreasing and that the white element is increasing, both relatively and absolutely.

Immigration

During the 100 years ending in 1920, the number of immigrants of which there is record was 3,648,382. Of this number, more than one-third were Italian, a little less than one-third were Portuguese, and more than one-seventh were Spanish.

It is interesting to observe that both the early settlers and later immigrants were of southern European or Latin stocks. Peoples of Teutonic, Slavic, and Celtic origins, though represented in small numbers, form but a negligible percentage of the whole population. Most of the English, German, and Slavic peoples have settled in the southern states of Brazil, rather than the northern and more tropical states. These peoples have blended but slightly with the other races.

People of northern Europe and of the United States of North America who have not been to Brazil, usually think of the climate there as being unbearably hot and unhealthful. That people of Celtic and Teutonic origins can live and thrive in Brazil has been sufficiently demonstrated to leave little room for doubt. It is possibly true, however, that peoples of Slavic, Celtic, Teutonic, and so-called Anglo-Saxon stock might not thrive in Brazil were it necessary for them to do hard work out in the sun. It is apparent to anyone who visits Southern Brazil, however, that people of these stocks may live and thrive as business men and owners or managers of agricultural enterprises.

Density

Obviously, Brazil has not yet developed anything like the population which the country could well maintain. Were the entire country as thickly populated as, for example, the state of Rio de Janeiro and the Federal District, the population would be between four hundred and five hundred millions. The great bulk of the population is still along the Atlantic seaboard, and the great interior is very sparsely settled.

¹James, Herman G., "Brazil After a Century of Independence," 1925; p. 261 .

Table 4. Brazil: Number of People Per Square Mile in 1920.¹

State	Number of Persons Per Square Mile
Amazonas.....	0.5
Para.....	2.2
Maranhao.....	5.0
Piauhy.....	5.0
Ceara.....	33.0
Rio Grande do Norte.....	24.0
Parahyba.....	33.0
Alagoas.....	43.0
Sergipe.....	32.0
Bahia.....	20.0
Minas Geraes.....	27.0
Espirito Santo.....	26.0
Rio de Janeiro.....	60.0
Federal District.....	2687.0
Sao Paulo.....	42.0
Santa Catharina.....	32.0
Parana.....	7.0
Rio Grande do Sul.....	24.0
Goyaz.....	2.0
Matto Grosso.....	0.4
Acre Territory.....	1.5

¹Federal Census of Brazil, 1920.

The average density of population in Brazil in 1920 was about 9.3 persons per square mile, which corresponds approximately with the density of population in the United States of America in 1860. At that time we had 10.6 persons per square mile. In 1922, the density of population in the United States of North America was 36.09 persons per square mile.²

Though Brazil was first colonized 100 years before our settlements at Jamestown and Plymouth, she has had a much slower development and increase in population than the United States of North America. This, in years gone by, may have been due in part to the relative isolation of Brazil, and in part to other causes which need not be developed here.

With the impetus given the increase in world population by the development of industry since 1776, and considering the fact that few countries have potential agricultural lands as yet unoccupied, one must conclude that the population of Brazil will, in future, increase by immigration at a faster rate than heretofore. Whether the people of Brazil—native or immigrants—grow cotton or do something else will depend upon many factors; among them, their inclinations and abilities, their credit, capital, and transportation facilities, and the grower's price of cotton as compared with what he receives for other products.

PUBLIC DEBT

The public debt of Brazil on December 31, 1923, amounted to about \$881,000,000. With an appropriate development of her natural re-

²Statistical Abstracts of the United States, 1922, Department of Commerce, Washington, D. C., p. 40.

sources and a more progressive system of revenue and taxation, her public debt will be a matter of small concern. It is difficult, however, to adjust the operating expenses of the government to the income, which is derived very largely from import duties. The states further complicate the situation by charging export duties.

Table 5. Public Debt of Brazil and the States of the Federal Union; Also the Value of the Milreis in United States Currency.

Federal Indebtedness as of December 31, 1923.

(1) Foreign debt. Total in circulation:		
L102,729,434. (at \$4.3233)	.....	\$ 444,130,162.01
Francs 322,249,500. (at \$0.051)	.....	16,434,724.50
\$68,996,500.	.....	68,996,500.00
(2) Internal Funded Debt:		
Rs. 1,778,201:300\$ (milreis at \$0.0993)	.....	176,575,389.09
(3) Floating Debt:		
Rs. 1,286,497:296\$ (milreis at \$0.0993)	.....	127,749,181.49
(4) Annual Debt Charges (estimated for 1924):		
Foreign—Gold (L7,673,545)	.....	33,175,037.10
Internal—Currency at 6d. exchange = (L3,226,454)	.....	13,948,928.58
		\$ 881,009,922.77

Public Debt of the States of the Federal Union (May 3, 1924).

(1) Foreign Debt:		
L23,950,390 (at \$4.3851)	.....	\$ 105,024,855.19
Francs 381,355,338 (at \$0.0645)	.....	24,597,419.30
\$51,091,000	.....	51,091,000.00
Florins (Dutch) 17,800,000 (at \$0.3742)	.....	6,660,760.00
(2) Internal Debt:		
Milreis 861,177:975 (at \$0.1141)	.....	98,260,406.95
		\$ 285,634,441.44

(Compiled and rearranged from Report on the Economic and Financial conditions in Brazil, by Mr. Ernest Hambloch, Commercial Secretary to His Majesty's Embassy, Rio de Janeiro. Published by His Majesty's Office, 1925, pp. 66-67. Refer to Bureau of Agricultural Economics Library copy—255 3, G 79.)

For many years the value of the gold milreis stated in terms of the United States gold dollar has been quoted in the report of the Treasury of the United States under value of foreign money at about \$0.546. The value of government paper currency, however, has fluctuated greatly. The normal value of a milreis should be about 25 cents of United States currency; however, it was quoted at \$0.0993 on December 31, 1923, and at \$0.1141 on May 3, 1924. These exchange rates are given merely as indicative of the fluctuation in the value of the milreis in terms of United States money.

TRANSPORTATION FACILITIES

Waterways

Brazil is relatively well supplied with natural transportation facilities. In addition to her more than 3600 miles of coast line, she has thousands of miles of navigable streams, including the great Amazon River system; the upper reaches of the Plate River system, including the Uruguay, the Paraguay, the Parana, and others, with their tributaries.

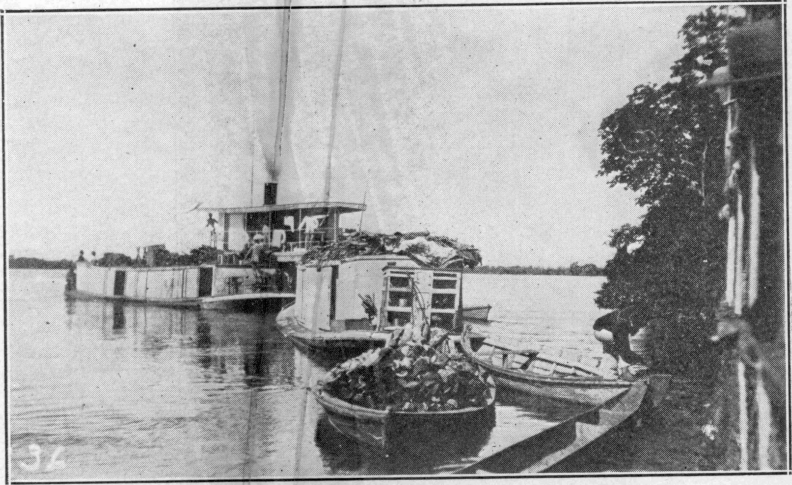


Figure 7. River Transportation, Western Brazil, 1922.
(Photo, courtesy Professor T. R. Day.)

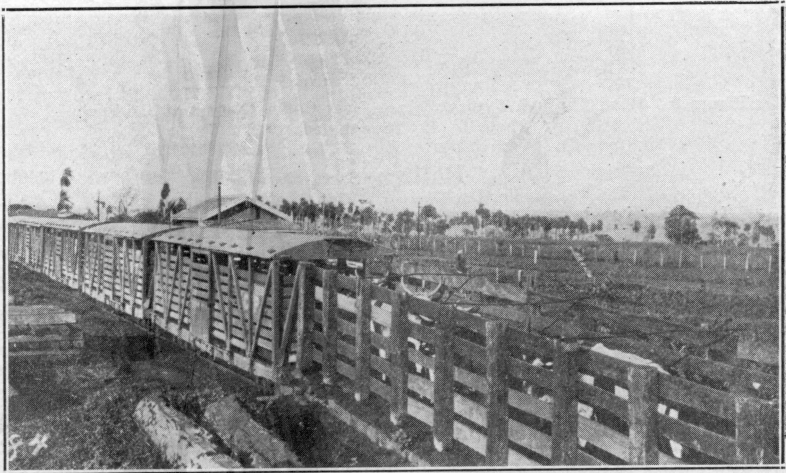


Figure 8. Cattle Train Near Barretos, 1922.
(Photo by B. Youngblood.)

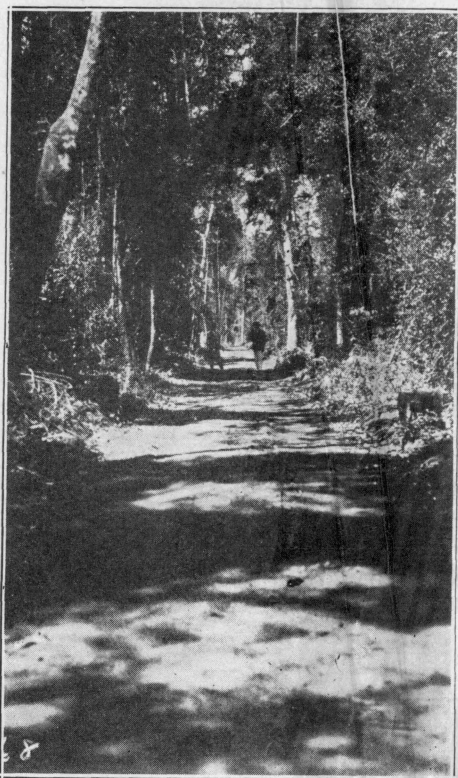


Figure 9. Road Through Typical Forest, Near Coffee District of Sao Paulo.
(Photo by B. Youngblood, 1922.)

Railways

Realizing the inadequacy of waterways for transportation in her program of national development, however, Brazil early saw the importance of railway development. Beginning in the 50's, she has drawn heavily upon her resources in order to finance railway building, including both government and privately owned lines.

In 1920, Brazil had more than 18,000 miles of track, the greater part of which, however, was of two different widths of narrow gauge. As yet, this mileage doesn't constitute a national system of railways, more than half of it being centered in the states of Rio de Janeiro, Sao Paulo, and Minas Geras. There are no transcontinental lines, as in the United States of North America. One wishing to go from South to North Brazil finds it necessary to make the trip by sea. Owing to the three different gauges used, the rolling stock is not always transferable from one line to another.

Not only are the freight rates too high to promote agricultural and industrial developments in the interior, but the rolling stock is inadequate. The shipper never knows with any degree of certainty whether or not he can deliver his products at the central markets or the seaboard with promptness. The railways of Brazil have not prospered as they should, and have given the government serious financial responsibilities. Possibly it was illogical to attempt to build railways in advance of other economic developments as was done so extensively in the United States of North America. In the future, it is probable that railroad building in Brazil will be co-extensive with the more general development of agriculture and industry.

Brazil will hardly become a serious competitor of the United States of North America in cotton growing until such time as she may develop a more perfect system of waterways, railways, and highways, so manned, equipped, and maintained that cotton may be shipped both promptly and cheaply from points in the interior.

AGRICULTURE AND STOCK RAISING

Land Utilization

According to the Federal census of 1920, the landed area of Brazil comprises 851,118,900 hectares, or the equivalent of 2,103,148,847 acres,¹ of which 79.4 per cent or 1,670,458,191 acres was not included in "Rural Establishments," or farms as we designate them. The remaining 20.6 per cent or 432,690,656 acres was included in "Rural Establishments," or farms, but of this acreage 5.8 per cent or 120,875,006 acres was classed as "Occupied by forests," leaving only 14.8 per cent of the total area of the republic, or 311,815,650 acres, in farms and classed as "Cultivated and uncultivated" land.

Just how much of the land in farms is really cultivated, is not known. James² concludes that not more than 3 per cent of the total area of Brazil is actually in cultivation. Whitbeck³ thinks about 3½ per cent is cultivated. The areas which both he and James attribute to the principal crops, including corn, coffee, beans, sugar, cotton, rice, tobacco, and wheat, amount to about 21,500,900 acres, or about 1 per cent of the total area of Brazil. These crops occupy about 7 per cent of the land classed as "Cultivated and uncultivated" in the rural establishments reported in the Federal census of 1920. This, however, is far from being all the land in cultivation in Brazil. In the aggregate, an enormous area is devoted to the production of minor crops, including cacao, mandioca, vegetables, and fruits of many kinds. Practically every rural home in Brazil, including those of share-tenants on the larger estates, has a few acres upon which to grow products

¹One hectare equals 2.47104 acres.

²James, Herman G., "Brazil After a Century of Independence," 1925.

³Whitbeck, R. H., "Economic Geography of South America," 1926, pp. 308-9.

for the household. Then, as in the United States of North America, the grazing ranches, such as those in the region of Barretos, Sao Paulo, are included in rural establishments.

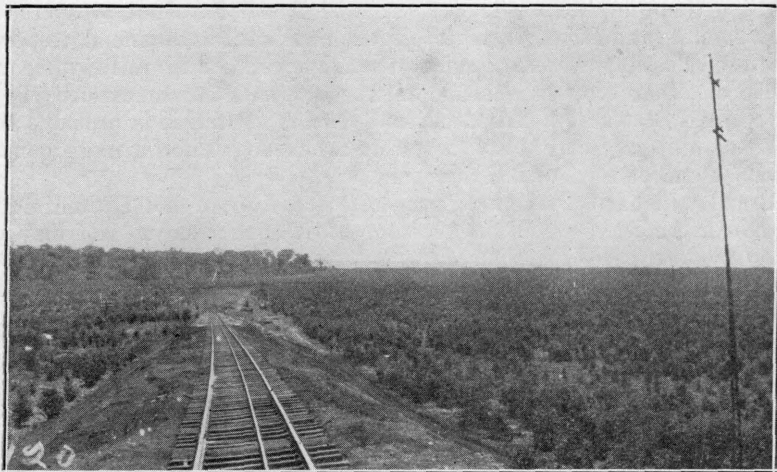


Figure 10. Young coffee *fazenda* along the route from Sao Paulo to Barretos, Estado do Sao Paulo. Note the two different widths of the narrow-gauge track. This land is well adapted to cotton growing.

(Photo by B. Youngblood, 1922.)

Table 6 is a classification, showing the total area of Brazil, the area of the rural establishments included in the 1920 Federal census, the land in these establishments occupied by forests, the "Cultivated and uncultivated" land, and the area not included in the census and, therefore, not included in rural establishments.

Table 6. Area of Brazil.¹

Classification	Acres	Per Cent of Total
Total area.....	2,103,148,847	100
Area of the Rural establishments included in the census:		
Occupied by forests ²	120,875,006	5.8
Cultivated and uncultivated.....	311,815,650	14.8
Total.....	432,690,656	20.6
Area not included in the census and, of course, not included in Rural establishments.....	1,670,458,191	79.4

¹Census of Brazil, 1920, Vol. III, Part 1.

²It will be noted that about 28 per cent of the land in rural establishments is in forests. According to Dr. Gonzaga de Campos, the area occupied by forests in 1910-1911, amounted to 58.6 per cent of the total area of Brazil.

There were 648,153 rural establishments,¹ averaging 270 hectares or 667.17 acres, of which 72.1 per cent or 481 acres was classed as "Cultivated and uncultivated" and 27.9 per cent or 186.18 acres was classified as "Occupied by forests."

Under the land classified as "Cultivated and uncultivated" is included the area devoted to the principal crops enumerated above, and, in addition, all the land devoted to fruits and vegetables for home consumption and for sale, and all the grazing land.

 Table 7. Brazil: Rural Establishments; Extent and Value.²

Extent	Number	Area, Hectares	Value Including Machinery, Etc., Contos of Reis
Total.....	648,153	175,104,675	10,568,009
Up to 40 hectares.....	317,785	6,115,158	1,391,851
Over 40 to 100 hectares.....	146,094	9,593,156	1,340,389
Over 100 to 200 hectares.....	71,377	10,454,242	1,160,273
Over 200 to 400 hectares.....	48,877	14,079,761	1,396,499
Over 400 to 1,000 hectares.....	37,705	23,881,734	1,917,414
Over 1,000 to 2,000 hectares.....	13,186	18,891,552	1,231,901
Over 2,000 to 5,000 hectares.....	8,963	28,667,844	1,085,250
Over 5,000 to 10,000 hectares.....	2,498	17,928,532	484,614
Over 10,000 to 25,000 hectares.....	1,207	18,256,042	525,132
Over 25,000 upwards.....	461	27,236,654	234,686

²Federal Census of Brazil, 1920.

 Table 8. Brazil: Rural Establishments in the Various States.³

State	Number	Area Hectares	Value Contos of Reis	Percentage of Area Cultivated
Total.....	648,153	175,104,675	10,568,009	.....
Alagoas.....	8,840	1,348,241	127,950	47.2
Amazonas.....	4,946	7,515,307	96,346	4.1
Bahia.....	65,181	8,451,440	556,954	16.0
Ceara.....	16,223	5,649,677	155,073	38.0
Espirito Santo.....	20,941	1,279,699	180,921	28.6
Federal District.....	2,088	51,419	37,839	44.1
Goyaz.....	16,634	24,828,210	244,188	37.6
Maranhao.....	6,674	2,999,565	47,442	8.7
Matto Grosso.....	3,484	19,600,893	240,239	13.3
Minas Geraes.....	115,655	27,390,536	1,961,000	46.1
Para.....	26,907	9,830,280	193,329	7.2
Parahyba.....	18,378	3,751,628	174,233	67.1
Parana.....	30,951	5,302,709	308,526	26.5
Pernambuco.....	23,336	5,156,332	392,318	52.0
Piauhy.....	9,511	5,551,212	85,619	22.6
Rio de Janeiro.....	23,699	3,053,004	456,282	72.0
Rio Grande do Norte.....	5,678	2,412,905	87,773	46.0
Rio Grande do Sul.....	124,990	18,578,923	2,010,999	65.1
Santa Catharina.....	33,744	3,567,757	191,166	37.6
Sao Paulo.....	80,921	13,883,269	2,887,244	56.2
Sergipe.....	8,202	754,086	99,042	35.0
Acre Territory.....	1,170	4,147,583	33,526	28.0

³Federal Census of Brazil, 1920.

¹Hereinafter referred to as "Farms."

Table 9. Brazil: Classification of Ownership of Farms.¹

Owners	Number	Area Hectares	Value Contos of Reis	Percentage of Total Value
Total	648,153	175,104,675	10,568,009	100.00
(Country of Birth.)				
Germany.....	6,887	545,413	69,187	0.65
Austria.....	4,292	214,892	30,526	0.29
Belgium.....	82	12,306	2,956	0.03
Denmark.....	51	16,064	4,245	0.04
France.....	335	163,973	14,654	0.14
Spain.....	4,725	449,024	77,526	0.73
Holland.....	91	9,349	2,272	0.02
Hungary.....	138	4,915	720	0.01
England.....	110	120,861	11,067	0.11
Italy.....	35,894	2,743,178	466,083	4.41
Norway.....	9	4,070	347	.....
Portugal.....	9,552	3,629,383	259,144	2.45
Russia.....	4,471	179,508	20,266	0.19
Sweden.....	129	5,917	1,182	0.01
Switzerland.....	386	57,591	7,769	0.07
Turkey.....	429	83,501	8,601	0.08
Other countries in Europe.....	7,764	297,435	35,817	0.34
Argentina.....	197	125,401	9,353	0.09
Bolivia.....	7	2,161	80	.....
United States of America.....	87	361,348	8,346	0.08
Paraguay.....	156	323,712	5,539	0.05
Peru.....	34	286,245	859	0.01
Uruguay.....	1,365	763,883	72,865	0.69
Venezuela.....	9	265	112	.....
Other countries in America.....	23	15,928	1,921	0.02
Japan.....	1,167	43,239	5,045	0.05
China.....	8	1,498	144	.....
Other countries.....	771	269,897	18,499	0.18
Subtotal, foreign.....	79,169	10,748,987	1,135,125	10.74
Unknown.....	2,774	584,276	28,039	0.27
Joint ownership.....	19,396	16,468,843	1,084,506	10.26
Government-owned.....	948	2,300,177	56,861	0.54
Brazil.....	545,866	145,002,392	8,263,478	78.19

¹Federal Census of Brazil, 1920.

Table 10. Brazil: Nativity of Farm Owners in 1920.²

	Number
Total number of farm-owners.....	67,239
Latin Countries	
Total.....	50,506
Italy.....	35,894
Portugal.....	9,552
Spain.....	4,725
France.....	335

²Federal Census of Brazil, 1920.

Table 10. Brazil: Nativity of Farm Owners in 1920—Continued.

	Number
Non-Latin Countries	
Total	16,733
Germany	6,887
Russia	4,471
Austria	4,292
Switzerland	386
Hungary	138
Sweden	129
England	110
Holland	91
United States	87
Belgium	82
Denmark	51
Norway	9

From Table 10 it will be noted that in 1920, according to the Federal census, there were in Brazil a total of 16,733 farmers who were born in non-Latin countries. Leaving out Germany, Austria, and Russia, and presuming that conditions in those countries have stimulated emigration to Brazil, say, during the past twelve years, one gets some indication of the relative tendencies of northern and southern Europeans to go to Brazil to farm.

Taking all the Brazilian farmers who were born in Slavic, Teutonic, Celtic, and Anglo-Saxon countries, one finds that they form a negligible percentage of the total number of farmers in Brazil. This may be explained in part by their tendency to emigrate from these countries to the United States during the past hundred years, and in part to the fear of Celtic, Teutonic, Slavic, and allied peoples of the tropics. This, however, is not to be taken as indicative that this will continue to be the case in the future, as it is very probable that as time goes on the tropics will become more and more attractive to the peoples of northern Europe, by the elimination of fallacies concerning the tropics on the one hand, and the pressure for unoccupied territory on the other.

 Table 11. Brazil: Number of Rural Establishments, Less and Greater than 101 Hectares, and Percentages.¹

Region	Number of Establishments			Percentage of Establishments	
	Total	Less Than 101 Hectares	More Than 101 Hectares	Less Than 101 Hectares	More Than 101 Hectares
Total	648,153	463,879	183,274	71.6	28.4
Maritime States of the North	188,930	127,355	60,575	67.4	32.6
Maritime States of the South and the Federal District	317,334	257,015	60,319	81.0	19.0
Central States and Acre Territory	141,889	79,509	62,380	56.0	44.0

¹Federal Census of Brazil, 1920, Vol. III, Part 1.

It will be interesting to note from Table 11 that in the maritime states of Northern Brazil, 67.4 per cent of the farms are of 101 hectares (250 acres) or less in size, while the remaining 32.6 per cent are larger.

In the maritime states of the south, and in the Federal district, 81 per cent of the farms are smaller than 101 hectares, while 19 per cent are larger.

In the central states of Brazil, including the Acre Territory, 56 per cent of the farms are smaller than 101 hectares, while 44 per cent are larger.

It will be noted further that, as in the United States of North America, the large land holdings are in the forest and grazing states—Matto Grosso, Acre Territory, Amazonas, Goyaz, and Sao Paulo—and probably represent a relatively small amount of farming.

Land Utilization in the United States of North America

With the foregoing, it may be well to compare the facts presented in Table 12. According to Baker's figures therein quoted; of the total area of the United States of North America, 26.4 per cent is classed as "Improved land"; 24.4 per cent as "Forest, cut-over, and burnt-over land"; 45.4 per cent as "Unimproved pasture or range land"; and 3.8 per cent as "Non-agricultural land." This authority has estimated that ultimately we may have 42 per cent of improved land, 18.7 per cent of forest land, 34.6 per cent of unimproved pasture and range land, and 4.7 per cent of non-agricultural land, in the United States of North America.

Table 12. Land Utilization in the United States of North America, by Acres and Percentages.¹

Present			Potential		
Class	Acres	Per-centage	Class	Acres	Per-centage
Improved land.....	503,000,000	26.4	Improved land.....	800,000,000	42.0
Forest, cut-over, and burnt-over land.....	465,000,000	24.4	Forest land.....	355,000,000	18.7
Unimproved pasture and range land.....	863,000,000	45.4	Unimproved pasture and range land.....	658,000,000	34.6
Non-agricultural land..	72,000,000	3.8	Non-agricultural land..	90,000,000	4.7

¹Figures taken from Figure 17, "A Graphic Summary of American Agriculture, Based Largely on the Census of 1920," by O. E. Baker; Separate from the Yearbook of the United States Department of Agriculture, 1921; p. 24.

No attempt is made to project a potential classification of Brazilian lands, as the facts are too meager for that purpose.

Brazil is frequently compared with the United States of North

America by different authorities. This is difficult to do, because comparisons sometimes hold true and sometimes they do not. In passing, however, it may not be amiss to note that Brazil has a much smaller semi-arid or desert area than the United States of North America.



Figure 11. Coffee trees on *fazenda* of J. Abreu Cardosa, Campos, Rio de Janeiro. (Photo, courtesy Professor T. R. Day, 1919.)

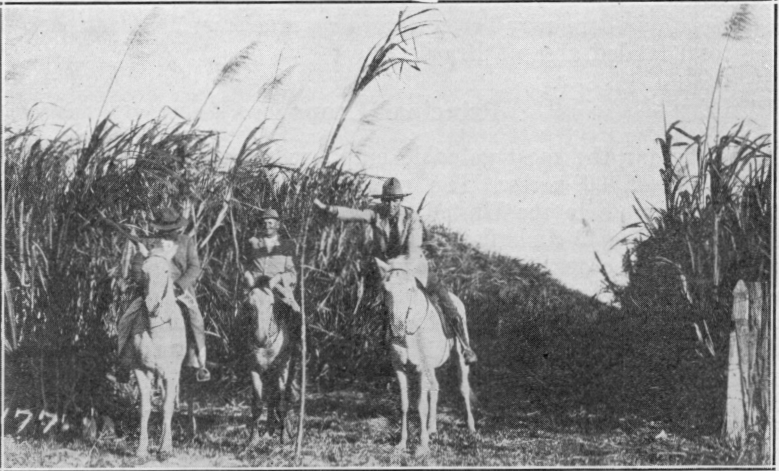


Figure 12. Sugar Cane Ready for Harvest, Barra Secca *fazenda*, on Parahyba River, near Campos, Estado do Rio de Janeiro. (Photo by B. Youngblood, 1922.)



Figure 13. Hauling in Sugar Cane, Barra Secca fazenda, on the Parahyba River, near Campos, Estado do Rio de Janeiro.
(Photo by R. A. Oliveira, 1922.)

Only the northeast corner of Brazil may be classed as semi-arid, while almost the entire western half of the United States may be so classed. As to lands which are too rough or otherwise unsuited for agricultural use, there is probably as much of this kind of land in Brazil as in the United States of North America. The author's guess would be that ultimately there may be cultivated as much as 50 to 60 per cent of the total landed area of Brazil.

Principal Crops

Coffee, by far the most valuable crop produced in Brazil, is grown on about 5,562,500 acres. The greater part of the coffee exported from Brazil comes to the United States of North America.

It is surprising to find that Indian corn occupies the largest acreage of all Brazilian crops. It is grown on about 8,500,000 acres and is consumed very largely at home. The yield appears to be about the same as in the South of the United States of North America.

Beans are grown on about 4,125,000 acres and form a part of the diet of many Brazilians.

Sugar was the first crop grown in Brazil for export. Slaves were early introduced to perform the labor in its production. It is grown on more than a million acres. In the fertile valleys of such streams as the Parahyba River, in the state of Rio de Janeiro, the yield is very heavy. The sugar-growing area will probably be considerably expanded in the fertile valleys of Western Brazil with the development of that region.

Rice is grown both in the uplands and under irrigation, on about 775,000 acres.

Tobacco is grown on about 312,500 acres.

Wheat is best adapted to Southern Brazil. It is grown on about 262,500 acres, but not in sufficient quantities to supply the home demand.

Cotton (1920) was grown on more than 800,000 acres, but the acreage has been increased since that time to considerably more than a million and a half acres.



Figure 14. A part of Wilson & Company's *fazenda* north of Barretos, in Sao Paulo, showing the appearance of pastures in Brazil after most of the timber is removed and the land is sodded (naturally) to jaragua and gordura. This range is over-grazed, because the scene is immediately in front of the *fazenda* headquarters. This land is well suited to cotton growing.

(Photo by B. Youngblood, 1922.)

There are numerous minor crops grown in Brazil, characteristic of the country, but of unknown acreages. Among these are cacao, mandioca or farinha, potatoes, and fruits and vegetables in great variety. All of these minor crops occupy acreages in addition to the live stock grazing land and that occupied by the more important crops of corn, coffee, beans, sugar, rice, tobacco, wheat, and cotton.

Stock Raising

In the great interior of Brazil, stock raising precedes agriculture, the same as in the United States of North America. The forests are felled and later burned. Then there is developed an excellent stand of Brazilian grasses, notably *Capim jaragua*, (*Andropogon rufus*), *Capim gordura* (*Melinis minutiflora*), and others in the uplands, and Angola grass in the lowlands.

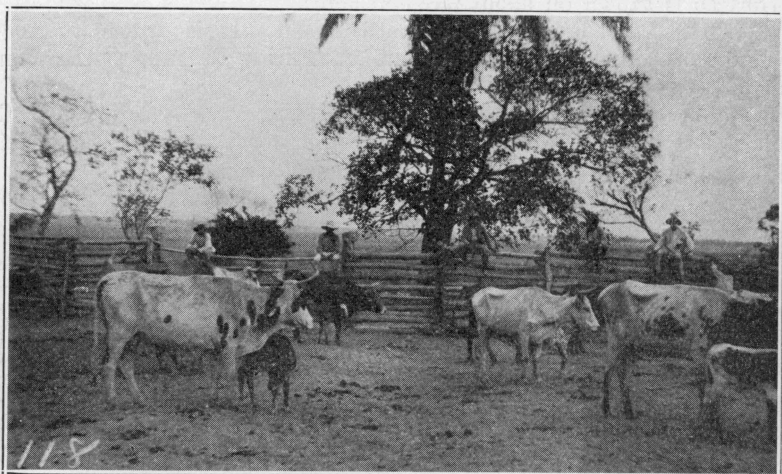


Figure 15. Native Brazilian Cattle, State of Matto Grosso. These animals are probably descended from the early stock introduced from the Cape Verde Islands.
(Photo, courtesy Professor T. R. Day, 1920.)

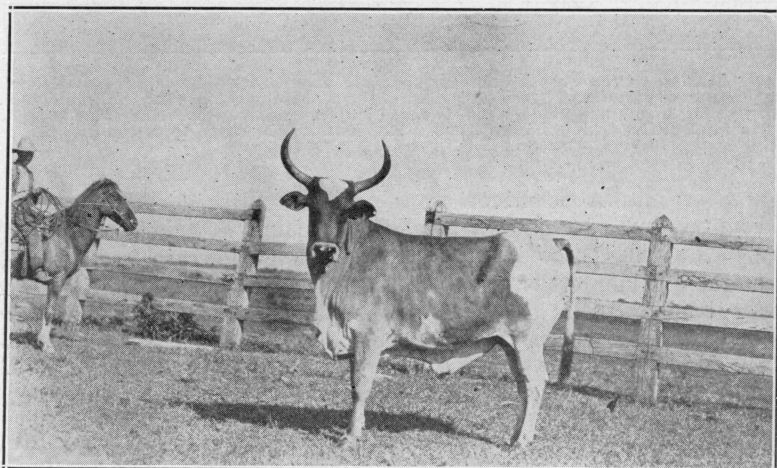


Figure 16. A Typical Grade Brahma Steer—a cross between a native scrub cow and a Brahma bull.
(Photo, courtesy Mr. R. A. Oliveira, 1922.)



Figure 17. Trailing Steers Down to Barretos, 1922.
(Photo by B. Youngblood.)

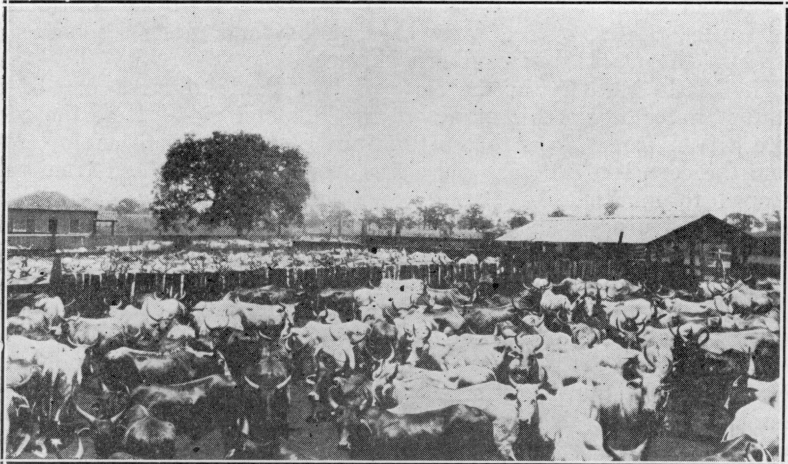


Figure 18. Steers at the Headquarters of Wilson & Company's *invernada*,
about 25 miles north of Barretos, Sao Paulo.
(Photo by B. Youngblood, 1922.)

In October of 1922, the author visited the fattening district in the vicinity of Barretos, Sao Paulo, where this process was going on upon *invernadas*, or fattening ranches, and saw an excellent stand of *gordura* and *jaragua* after what Brazilians termed a four or five months' drouth. It was surprising to find the grass fresh and green and not a sign of dry grass or dead weeds anywhere to indicate dry weather. These ranches are in units of about 9000 acres each and are stocked at the rate of one aged steer to two acres. After remaining on the grass for about nine months, the steers come out grass-fattened and ready for the packing house.

The lands occupied by the *invernadas* are excellently suited to the growing of crops, such as upland rice, coffee, and cotton, and with the development of the country, they will obviously be converted into farms. As the country is opened up, one of the best opportunities in the western and northwestern parts of Sao Paulo and Matto Grosso, it seems to the author, will be to engage in a combination of cattle and cotton growing.

The original cattle of Brazil were introduced in early days, by the colonists. These cattle, as indicated in the accompanying illustration, very much resemble the scrub cattle which were found in South Texas a generation or more ago. The Brazilians have introduced Brahma cattle from India in great numbers and crossed them on to these native scrub animals with good results. A native cow bred to a Brahma bull will raise a cross-bred calf which, at five or six years old, will finish out on the *invernada* weighing 1000 pounds or better. Though the beef is not equal to that produced in the feed lots of the corn belt of the United States, it is of very good quality and meets a popular demand in the markets of southern Europe.

The cattle industry in the state of Sao Paulo reminds one of the United States of North America in the 70's and 80's. Here the cattle were driven from Texas to the terminus of the railroad coming down from the corn belt, at some place like Abilene, Kansas, and from there shipped to market. In Brazil, steer buyers, known as "*boadeiros*," take long journeys up into Matto Grosso and return after several months on the trail with large droves of aged lean steers. These steers are driven down long trails, to the fattening district around Barretos, where they are sold and put on the grass, and when fattened out are shipped to Sao Paulo for slaughter.

Though sheep are not as well adapted to Brazil as to the more temperate climates, quite a number of them are grown. Hogs are numerous, and pork, like beef, is cheaply produced. Horses, mules, and goats thrive in the uplands. There is considerable interest in live stock improvement and in the control of diseases in Brazil but there is as yet much room for improvement.

Table 13 shows the numbers of live stock of the various types in Brazil in 1920.



Figure 19. Brazilian "Camaradas," or Cowboys, on Oliveira's "Pedra" *Fazenda*.
(Photo by B. Youngblood, 1922.)

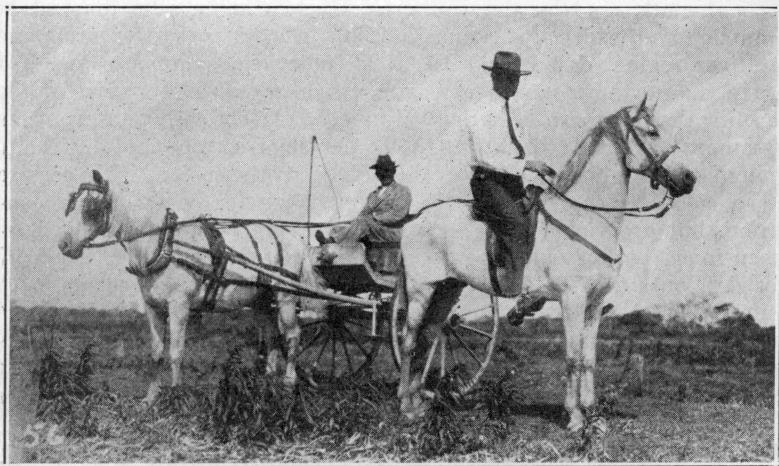


Figure 20. Left: Type of Driving Horse on Barra Secco *Fazenda*.
Right: Arabian Type of Stallion Belonging to a Neighbor *Fazendeiro*.
(Photo by R. A. Oliveira, 1922.)

Table 13. Brazil: Numbers of Heads of Livestock in 1920, by Types.¹

Type	Number of Heads
Beef cattle.....	34,271,324
Swine.....	16,168,549
Sheep.....	7,933,437
Horses.....	5,253,699
Goats.....	5,086,655
Mules and asses.....	1,865,259

¹Federal Census of Brazil, 1920.

COTTON GROWING IN BRAZIL

Historical

Cotton is undoubtedly indigenous to Brazil. There is no evidence to indicate that cotton was cultivated prior to the coming of the Europeans. The chances are it was growing wild. In fact, there is not a great amount of inclination on the part of the native Indians of Brazil, even today, to grow cotton or otherwise exert themselves more than is absolutely necessary. That cotton was picked and spun and made into cloth, hammocks, cord, and other goods by them, however, there is little doubt. Numerous adventurers and explorers make mention of cotton and cotton goods from 1500 on.²

Pero Vaz de Caminha,³ who landed at Porto Seguro with Cabral, in a letter to the King of Portugal, dated May 1, 1500, mentions hammocks and cloth used by the Indians. Diego Garcia, who touched at Pernambuco and Santa Catharina in 1526, in a letter written from the Plate River region, dated July 10, 1528, mentions hammocks made of cotton in the northern part, and comments on cotton cloth worn by the women in the southern. Father Manuel de Nobrega, who went as a missionary to the Indians, in 1549, mentions cotton used by them.

Though the Indians evidently did not cultivate cotton, it is certain that the colonists early began its culture, principally for home consumption, but eventually for export. Father Nobrega is cited as having mentioned cotton culture in his letters as early as 1549. Gabriel Soares de Sousa (1570-1587) mentions the cultivation of cotton with hoes in Bahia. Dr. Cezar Augusto Marquis is also cited by Branner⁴ as authority for the statement that 20,832 pounds of cotton were exported from Maranhao in 1760, and Camara for the statement that some cotton was exported from Pernambuco in 1771. Lyman⁵ is

²For early historical notes on cotton in Brazil, see John C. Branner's "Cotton in the Empire of Brazil," United States Department of Agriculture, Special Report No. 8, 1885, and various official documents of the Government of Brazil.

³For ethnological data on Brazilian Indians, see the Reports of the Rondon Commission, published by the Government of Brazil.

⁴Branner, John C., "Cotton in the Empire of Brazil," United States Department of Agriculture, Special Report No. 8, 1885.

⁵Ibid.

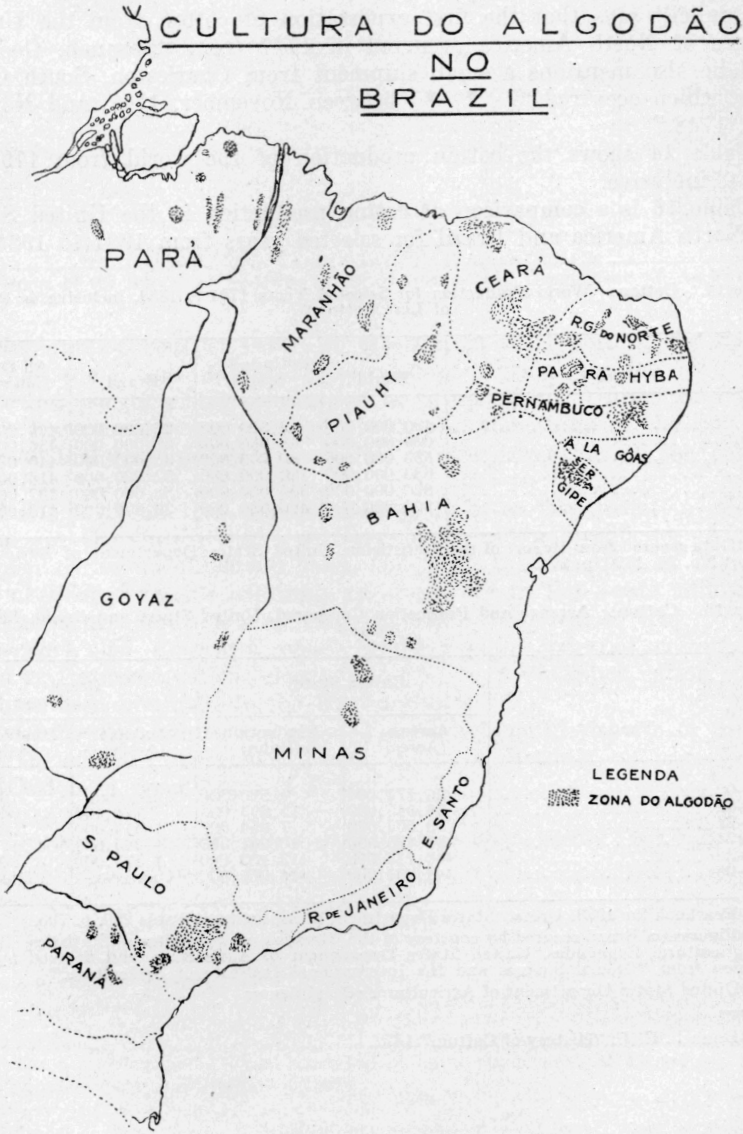


Figure 211.

¹Photographed from "Cotton Growing in Brazil" insert following page 233, Annaes da Primera Conferencia Algodoeira, Vol. I (no date) (about 1922).

authority for the statement that cotton was first exported from Brazil to England in 1781.

Donnell¹ says that the first exportation of cotton from the United States of North America occurred in 1747 from Savannah, Georgia, and he also mentions a small shipment from Charleston, South Carolina, which occurred "* * *" between November, 1747, and November, 1748."

Table 14 shows the cotton production of the world from 1791 to 1834, inclusive.

Table 15 is a comparison of cotton production in the United States of North America and Brazil for selected years from 1901 to 1925.

Table 14. Cotton: World Production for Selected Years 1791 to 1834, inclusive, in Pounds of Lint Cotton.²

Year	World	United States	Brazil	All Other Countries
1791.....	490,000,000	2,000,000	22,000,000	468,000,000
1801.....	520,000,000	48,000,000	36,000,000	436,000,000
1811.....	555,000,000	80,000,000	35,000,000	440,000,000
1821.....	630,000,000	180,000,000	32,000,000	418,000,000
1831.....	820,000,000	385,000,000	38,000,000	397,000,000
1834.....	900,000,000	460,000,000	30,000,000	410,000,000

²Data secured from Report of the Statistician, United States Department of Agriculture, Report No. 70, 1890, p. 274.

Table 15. Cotton: Acreage and Production Compared, United States and Brazil, Selected Years.³

Year	United States		Brazil ⁴	
	Acreage (Acres)	Production (Bales)	Acreage (Acres)	Production (Bales)
1901-02.....	26,774,000	9,510,000	Unknown	197,000
1911-12.....	36,045,000	15,693,000	778,400	360,000
1921-22.....	30,509,000	7,954,000	1,419,000	504,000
1923-24.....	37,420,000	10,281,000	1,965,800	576,000
1924-25.....	⁵ 40,115,000	⁵ 13,153,000	1,573,000	605,000
1925-26.....	⁵ 44,231,000	⁵ 16,085,000	Unknown	Unknown

³Yearbook for 1923, United States Department of Agriculture, Table 290, p. 796.

⁴Figures on Brazil secured by courtesy of the Division of Agricultural Statistics, Bureau of Agricultural Economics, United States Department of Agriculture, and derived by that Division from "Official Sources and the International Institute of Agriculture."

⁵United States Department of Agriculture, official figures.

¹Donnell, E. J., "History of Cotton," 1872.

Table 16. Cotton: Production in the United States, Selected Years, 1791 to 1888, Inclusive in Lint Cotton.¹

Year	Pounds
1791.....	2,000,000
1801.....	48,000,000
1811.....	80,000,000
1821.....	180,000,000
1831.....	444,364,650
1841.....	759,903,750
1851.....	1,421,413,340
1860.....	1,934,000,000
1871.....	1,384,084,494
1881.....	2,588,236,636
1888.....	3,437,408,499

¹Report of the Bureau of Statistics of the United States Department of Agriculture, 1890, p. 275.

The figures shown in Table 16, taken from the report of the statistician of the United States Department of Agriculture for 1890, indicate the growth of the production of cotton in the United States of North America between 1791 and 1888, and something of the impetus given cotton growing in this country by the invention of the cotton gin in 1793.

It will be noted that within eight years after the invention of the cotton gin, the United States of North America was producing 48,000,000 pounds, or about 96,000 bales, and, with the exception of the setback occasioned by the breaking up of slavery in the South following the Civil War, there was a continual increase from year to year.

In 1784,² an American vessel carrying eight bales of cotton was seized at Liverpool, on the charge that “* * * so much cotton could not have been produced in the United States.”

The following figures are selected from a table of exports of cotton from the state of Maranhao, Brazil, given by Branner on page 20 of his “Cotton in the Empire of Brazil”:

Table 17. Cotton: Exports from the State of Maranhao, Brazil, Selected Years, in Pounds of Lint.³

Year	Pounds
1760.....	24,960
1770.....	598,080
1780.....	1,423,488
1790.....	2,173,632 (Two years before Whitney's invention) ⁴
1800.....	5,529,408 (Seven years after Whitney's invention)

³Branner, John C., Special Report No. 8, United States Department of Agriculture, 1885.

⁴Parenthetical statements are the author's.

²Editorial in The Country Gentleman, Philadelphia, Pennsylvania, issue of February 27, 1857; p. 147.

Maranhao, however, was only second to Pernambuco in cotton production in those days, and several other states, collectively, were producing as much cotton as Pernambuco. It is evident, therefore, that there was a growing interest in cotton culture in Brazil as early as the last quarter of the eighteenth century.

To the report of the statistician of the United States Department of Agriculture for 1890, we are indebted for the figures presented in Table 18, following, representing the contribution of Brazil to the world's supply of cotton, presumably export.

Table 18. Brazil: Exports of Cotton, Selected Periods, 1841 to 1889, Inclusive.¹

Year	Pounds of Lint
1841-45.....	18,900,000
1851-55.....	27,100,000
1861-65.....	32,600,000
1871-75.....	108,800,000
1881-85.....	54,100,000
1886-89.....	55,500,000

¹Report of the Statistician, United States Department of Agriculture, for 1890, p. 282.

The foregoing figures, though probably estimates, are of interest, in that they indicate the emphasis given to cotton growing in Brazil because of high prices due to the effect of the American Civil War. They also indicate that Brazil responds quite readily to variations in prices, increasing her output when prices are high, and decreasing rather promptly following a decline in prices.

Average Acre-Yield Compared

Notwithstanding the fact that the culture of cotton in Brazil is very primitive, her adaptation to this crop is such that she easily outstrips the United States of North America in acre-production, as the following table will indicate.

Table 19. Cotton: Comparison of Average Acre-Yield, Brazil and the United States of North America, in Pounds of Lint Cotton.²

Year	United States of North America	Brazil
Average.....	150.5	188.0
1920-21.....	179	219
1921-22.....	124	170
1922-23.....	141	175
1923-24.....	157	175

²Yearbook for 1923, United States Department of Agriculture, Washington, D. C., p. 801.

The average acre-yield for the United States of North America for the period 1909 to 1913, inclusive, was 181.1 pounds of lint cotton, and for the period 1914 to 1920, inclusive, it was 170.8 pounds. The average for Brazil for the period 1920 to 1923, inclusive, of 188 pounds, is less than the average claimed for American upland varieties in the south of Brazil by Brazilian authorities and by Professor T. R. Day, a Texan who has spent ten years as agriculturist for the Leopoldina Lines, and for the state of Sergipe. Professor Day states that with the same effort, yields in Brazil may practically double those of the United States of North America. This, however, may be too optimistic a view.

The following data are taken from the annual report of Professor Day, concerning yields of lint cotton at the Campos Experiment Station¹ for the season of 1918-19. This is located in the sugar district, on the Parahyba River, in the state of Rio de Janeiro, where the soils are alluvial and very fertile:

Day's Pedigreed Big Boll, a variety developed by Professor Day, yielded 893 pounds; Cleveland Big Boll, 783 pounds; and Dixie, 551 pounds of lint per acre. Another variety, Express, the seed of which Professor Day imported from the United States, was almost a complete failure, yielding only 617 pounds of seed cotton on two acres planted, or a little better than 100 pounds of lint per acre.

Foreign Crops and Markets² says that the average acre-yield for all Brazil is about 226 pounds according to the figures used, but that yields are known to be higher in many places.

If Brazil were to perfect her cotton growing as the United States of North America is now in process of doing, the difference between our average acre-yields and those of Brazil would probably be considerably greater than the figures quoted.

Cotton Growing Districts

In considering the cotton growing possibilities of Brazil, it is well to visualize, roughly at least, the principal cotton growing districts and species and varieties grown. It is presumed, of course, that there has been a great deal of inadvertent mixing of seeds and consequent cross-fertilization, resulting in new types with fibers of varying length and quality.

Brazil may be divided into two major cotton growing divisions, north and south. North Brazil is noted for its tree cotton, and South Brazil for its American upland or "herbaceo" type of cotton.

North Brazil. In North Brazil there are three outstanding cotton growing districts, each well known for its outstanding variety or varieties of cotton. The leading varieties, however, are not necessarily

¹Operated by the Leopoldina Railway Co., Ltd.

²United States Department of Agriculture, Washington, D. C., issue of January 22, 1925.

restricted to their typical districts, but may be found elsewhere if conditions are favorable to their growth. Notable cotton growing districts are the "Serido," the "Matta," and the "Sertao."

The *Serido* consists of the high, dry plateaus of the state of Rio Grande do Norte. The outstanding variety for this section is the "Moco," though other varieties are grown there.

The *Matta* is the coastal plain, and extends back to the hills and plateaus of Sergipe, Alagoas, Pernambuco, Parahyba, and Rio Grande do Norte, following the hills away from the coast to the southward. This belt is characterized by broad and fertile valleys, excessive rainfall, and humid atmosphere. Varieties of the "herbaceo" type do best in this region, although the "quebradinho" variety of tree cotton is grown back toward the hills in the drier sections.

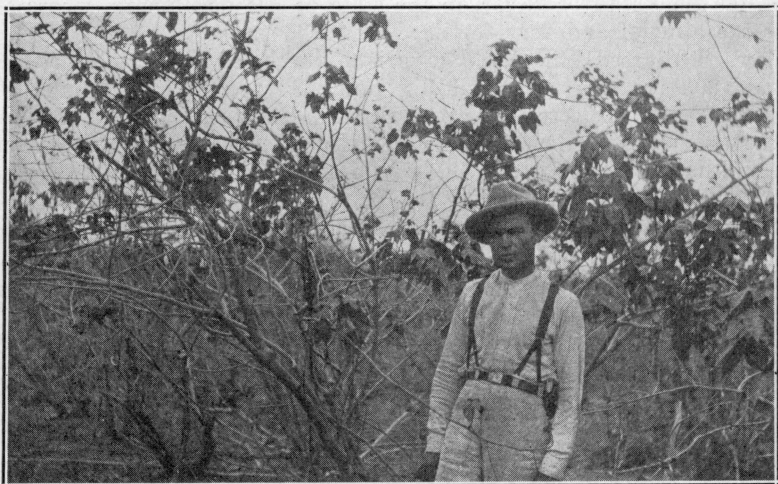


Figure 22. Tree Cotton in the Serido, Six Miles South of Jardim de Serido, Estado do Parahyba. (Photo, courtesy Dr. C. F. Marbut.)

The *Sertao* district is a high, dry plateau beginning far back from the coast and is characterized by a yellow grass, known as *Capim panasco*, shrubs of different kinds, and the fact that it is practically surrounded by mountain peaks. Some of the different types of Sertao cottons are the "moco," the "quebradinho," the "inteiro," and the "verdao," all of which are tree cottons.

South Brazil. As one goes southward from North and Northeast Brazil, the tree cottons gradually give way to the "herbaceo," or American upland type of cotton. In the state of Bahia and Minas Geraes, both types are grown, but in South Brazil the dominant varieties grown are of the "herbaceo" type. This is the prevailing type in the state of Sao Paulo, the greatest cotton growing state of Brazil.

Tree Cottons of North Brazil

There is some confusion as to the proper names for the different varieties of the tree cottons. A given variety evidently goes by several names in different places. The following, however, may serve to indicate the principal varieties of tree cotton:

Creolo (Creole), Rim de Boi, Ox Kidney, Inteiro, Maranhao. This type of cotton has smooth black seeds which cling together. The lint slips off easily. It does not protrude from the boll when ripe, as does the American type. The fiber varies from 1 to 1.4 inches in length. This variety yields about 20 per cent of lint, but because the fibers are long and strong, it is preferred by the natives for handspinning and hammock making.



Figure 23. Vegetation: Sertao Plateau Basin, near Parahyba River; 1500-2000 feet elevation. (Photo, courtesy Dr. C. F. Marbut.)

Quebradinho. The seed of the "quebradinho" type separate from each other; otherwise it is similar to "creolo," but the seeds and bolls are somewhat smaller. In Maranhao, this variety and the Crioula are known as "Arboreo," or tree cotton. This variety is said to be drouth-resistant, and, therefore, well adapted to the dry sections of Northeast Brazil. The length of its staple is .9 to 1.4 inches.

Verdao. The seed of this cotton is described as verdigris green. Its fiber is especially strong, long and silky in appearance. It is one of the best types for Northeast Brazil. The fibers are .9 to 1.5 inches in length.

Moco. This is undoubtedly the best long staple cotton in Brazil. It does best in the Serido district. Like "quebradinho," the seed of

this cotton is naked, black or brown in color, and characterized by a two-pronged fork. The fiber is long, strong, and creamy in color. It is grown elsewhere than in the Serido, but not with as good results. The fiber is 1.4 to 1.8 inches in length.

Northeast Brazil is well adapted to these long-staple tree cottons and, while some medium-staple varieties of American cotton one inch or better in length are grown in this region, the tree cotton will probably continue as the dominant type. The long staple cottons have their own special markets, and, therefore, do not compete in any material way with American upland, medium staples in the markets of the world.

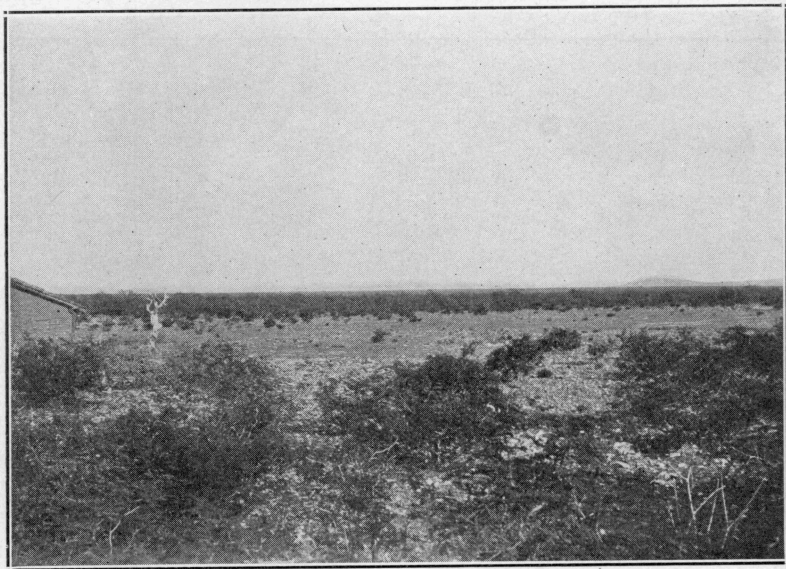


Figure 24. View of the Sertao on the Rio Sao Francisco in the State of Bahia, Elevation About 1500 Feet.

(Photo, courtesy Dr. C. F. Marbut.)

Herbaceo. This was originally an American upland, medium-staple cotton, ranging around one inch or better in length. It is grown to a limited extent in North Brazil, somewhat more in the central coastal states, and almost exclusively in the state of Sao Paulo, which grows the greater part of all the cotton of Southern Brazil. It yields better than the tree cottons, but as a rule sells for less than the long staples.

This type, when exported from Brazil, comes directly into competition with the American upland cottons ranging around one inch in length. It was noted in the introduction that this is the type of cotton which European spinners are urging Brazil and the British

Empire to grow in competition with the United States of North America. According to the best authorities on Brazil, this type of cotton is adapted to practically every part of the republic, except some of the drier sections of the northeast. It is certain that as the cotton growing industry expands in Brazil, that country will grow an ever-increasing volume of the American upland 1 to 1½-inch type of cotton, and if ever it produces large surpluses its exports will go into the channels of trade in direct competition with the growers of the United States of North America.

Hybrid Types. There are some hybrid crosses between "Arboreo" and "Herbaceo," notably "Herbaceo" X "verdao," a quickly maturing cotton, which makes it well adapted to rainy regions with a limited dry period. Cotton breeding has hardly begun in Brazil, but it is rather sure that there will be much breeding and improvement from now on.

In South Brazil, one frequently hears mention of such varieties as Day's Pedigreed Big Boll, Russell Big Boll, Cleveland Big Boll, Webber, Herbaceo, Durango, Sunbeam, and Carioba. The fibers of these varieties are .8 to 1.2 inches in length.

Planting and Picking

The dates of planting, and in the case of tree cottons, pruning, depend upon the advent of the rainy seasons, which are so varied in the different districts that planting, pruning, or picking, is going on in one part or the other of North Brazil practically the year round. The main picking season, however, may be designated as from June to January, inclusive.

The tree cottons are allowed to stand, as a rule, from three to ten years, and in their case, the pruning of the plants occurs at what would be planting-time, that is, at the beginning of the rainy season. The crop is grown as nearly as possible during the rainy season, and the picking is done during the dry period. Owing to the irregularity of the wet and dry seasons, however, losses from too much or too little rain either at planting or picking time are not infrequent.

In South Brazil, cotton is planted in the Brazilian springtime, that is, September, October, and November, and the picking is done during the Brazilian fall and winter—April to August.

Methods of Cultivation

Primitive methods of cultivation have been followed almost exclusively, down to recent years. The custom has been to clear the land, plant the cotton in hills here and there, and to do all the cultivating with a rather heavy type of hoe, such as is used to cut sprouts in the South of the United States of North America. These primitive methods are still followed almost exclusively in North Brazil, but the use of simple horse- and mule-drawn implements such as are commonly

used in the South of the United States has been begun in South Brazil, notably in the state of Sao Paulo. On a visit to Brazil in 1922, however, the writer saw very little of plows and farm implements, but *did* see quite a lot of hand-hoe work going on.

Sao Paulo is the most progressive state of Brazil, and undoubtedly much headway will be made in the use of modern farm implements there in the next few years. The older, more primitive methods of hoe husbandry, however, will be abandoned rather slowly in the remoter districts, especially in Central and Northern Brazil.



Figure 25. Tenant House in Interior of Central Brazil. Brick with Tile Roof. (Photo, courtesy Professor T. R. Day, 1922.)

Land Values

Owing to the fluctuating value of the milreis, land values in terms of United States currency are almost meaningless. Land, of course, is cheaper throughout the Republic of Brazil than in the United States of North America. It can be had, under certain conditions, for practically nothing in the remoter districts, and at possibly \$10 to \$20 per acre in the better situations. In 1922, land was quoted at about \$8 to \$10 in the better sugar districts; 25 cents to \$10 in the grazing districts of Sao Paulo; and \$10 to \$20 per acre in the coffee growing regions, but without coffee trees planted on it.

Tenure

Cotton is grown on rather small units in North Brazil, but there is a tendency toward larger holdings in the state of Sao Paulo. The most common form of tenure is the share system, in which the owner directs

the cultivation of the crop and takes a share for his rent. There are some tenants who pay cash rent, and some owners who work their crops by hired labor. Under the share system, a number of families will live on one holding and each will have a small acreage on which to grow truck and fowls for home use.

There is more shiftlessness on the part of tenants than in the South of the United States of North America and less businesslike supervision of cotton farming. One of the difficulties is that it is not the custom for a gentleman to do manual labor in Brazil. This is due to a form of the caste system in which there is hardly any middle class. One is either a gentleman or a "piao" in Brazil. Yet there is a tendency to develop a middle class, notably in the state of Sao Paulo. Until a middle class is developed, there is little hope of a substantial development of the great interior of Brazil, and North Americans need have little fear of competition from cotton growing in that country.



Figure 26. Hauling Cotton to Market in South Central Brazil, 1919.

(Photo, courtesy Professor T. R. Day.)

As will be noted from the weather charts, there is an abundance of rainfall except in the northeastern part of Brazil, where, however, cotton is produced in the better-suited localities. There is evidently too much rainfall in the Amazon Valley for cotton production on an extensive scale, and a large part of the area of Northeast Brazil is too dry and cannot be irrigated. There will undoubtedly be a material increase in cotton production in that section with the development of irrigation projects which have been begun but which have been impeded by financial conditions.

Cotton Marketing

Owing to the crudity of transportation facilities, high carriage charges, and export duties on commodities from one state to another, much Brazilian cotton is isolated from the central markets and is grown for home consumption only. Except in the more favorable locations near the coast or a cotton mill, much of what would otherwise be profits is dissipated in getting the cotton to market. Under the existing imperfect marketing conditions, it is said that it is more advantageous to be a cotton merchant than a cotton farmer. Such difficulties are being overcome in the United States of North America, however, and it is not unreasonable to presume that they will be overcome in Brazil, though the process may be a long and tedious one. The cotton is often sold in a dirty, trashy condition, and unless it is hopelessly inferior the same price is paid for all the different qualities. No inducements, therefore, are held out to growers to produce cotton of superior grade and quality. The Federal Cotton Service, however, has recently established a system of cotton grading which, in time, will undoubtedly prove of value to the growers. The cotton is divided into short, medium, and long fibers, and each of these classes is subdivided, according to quality, into the following types: Superior, good, common, passable, and ordinary.

Ginning

The long staple cottons are ginned on roller-gins, because the saw-gins materially damage the long staple fibers. The medium and short staple cottons are ginned primarily on the saw-gins.

Export Taxes

One of the greatest obstacles in growing cotton in Brazil has been the export duties assessed by the states. Since these are fixed by the legislature, they cannot be regulated by the national government, as Brazil is an outstanding "states' rights" country. The federal government, however, under its new concessions to cotton growers, promises to use its good influences to modify, if not eliminate, these export duties.

Table 19. Brazil: Export Taxes on Ginned Cotton from the Principal Cotton States.¹

State	Tax
Alagoas.....	6 per cent Ad Valorem
Bahia.....	2 per cent Ad Valorem
Ceara.....	10 per cent Ad Valorem
Espirito Santo.....	5 per cent Ad Valorem
Maranhao.....	10 per cent Ad Valorem
Matto Grosso.....	7 per cent Ad Valorem
Minas Geraes.....	4 per cent Ad Valorem
Parahyba.....	10 per cent Ad Valorem
Pernambuco.....	5 per cent Ad Valorem
Rio de Janeiro.....	5 per cent Ad Valorem
Sergipe.....	8 per cent Ad Valorem
Para.....	.046 cents per pound
Sao Paulo.....	.023 cents per pound

¹Foreign Crops and Markets, United States Department of Agriculture, Washington, D. C., issue of June 22, 1925, p. 761.

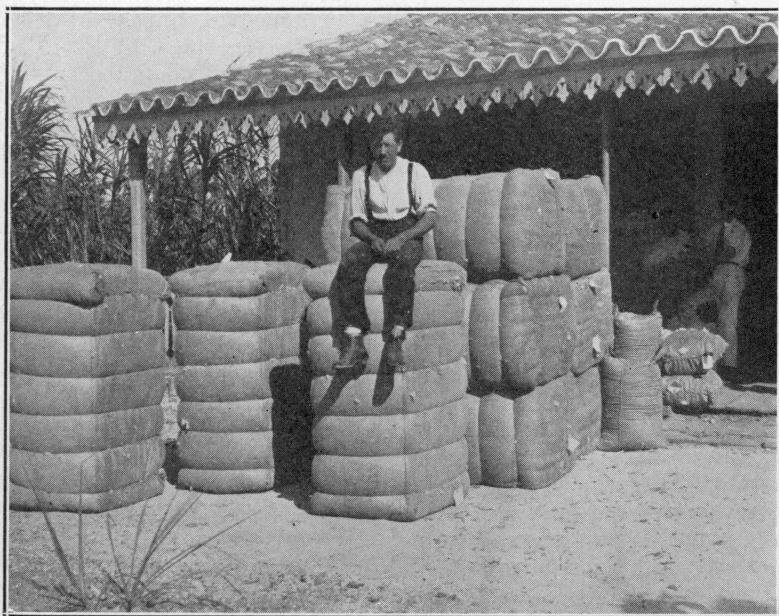


Figure 27. Cotton grown on the demonstration farm of the Leopoldina Railway Lines of Brazil, season of 1918-1919, under the direction of Professor T. R. Day, a native Texan, Chief of the Industrial Department. These bales are made on a hand press and weigh about 250 pounds each. Wires are used for ties.

(Photo, courtesy Professor T. R. Day.)

Exports

The average consumption of cotton cloth per person is considerably lower in Brazil than in the United States of North America; yet that country consumes about 80 per cent and exports about 20 per cent

of its annual production of cotton. With the economic development of the lower classes, they will undoubtedly consume an increasing volume of cotton goods.

There is quite a textile industry in Brazil, of 248 factories, comprising 1,621,300 spindles and 59,208 looms, and employing 108,960 operatives, according to report made by American Consul Hickerson of Rio de Janeiro.¹ Brazil, however, imports rather than manufactures her finer cotton goods, and this will continue until more perfect machinery and greater skill are employed in the Brazilian cotton mills.

Cotton Seed

Owing in part to the lack of transportation facilities, and in part to a lack of development of the live stock feeding and the fertilizer business in Brazil, there is not much of a market for cotton seed in that country. There is considerable export demand for the seed, however, from the more accessible districts. In the states of Sao Paulo, Pernambuco, and Ceara, there are thirty-six cotton oil mills, but from the best information obtainable they are not as efficiently operated as those of the United States of North America. Considerable outcome may be expected, therefore, in the manufacture of cottonseed products in Brazil.

Cotton Insects

Brazil has an advantage over the southern part of the United States of North America, to the extent that the boll weevil has not as yet invaded that country. Offsetting this advantage, however, the pink boll worm is thoroughly distributed over the cotton growing areas of Brazil. Its damage to the cotton crop of Brazil is possibly as great as that of the boll weevil in the United States of North America. This pest, however, is not the occasion of great alarm among the Brazilians. Mr. Edward C. Green, an American who has worked with cotton in North Brazil for many years, states that very little is done to check the ravages of the pink boll worm. Mr. Green states that the annual loss due to this pest amounts to possibly 15 per cent, though it has been known to cause a loss as high as 85 per cent in certain districts. Owing to the absence of freezing weather in winter and the quite general distribution of the pest, it is very likely that the pink boll worm will remain in Brazil indefinitely. The chances of successfully combating the pink boll worm are best in South Brazil, where the annual American upland type of cotton is grown.

There are numerous other minor insects affecting cotton production in Brazil, but none of such importance as the pink boll worm.

¹Foreign Crops and Markets, United States Department of Agriculture, Washington, D. C., issue of June 22, 1925.

Climatic Conditions Favorable to Cotton

The mean summer temperatures of the north line of cotton production in the United States of North America is around 77 degrees Fahrenheit. The rainfall varies from 23 to 50 inches. It is doubtful if cotton growing is a success where the rainfall is greater than 60 inches. The Amazon Valley is thus eliminated as a great cotton producing region; and likewise the higher, drier sections of Northeast Brazil are also eliminated. In this connection, it must be remembered that along with rainfall, evaporation must also be considered. Evaporation is so great, for example, in the Panhandle of Texas that, according to Briggs and Belz, about seven inches more rainfall are required to produce a given result with short grass in that region than in Montana.¹ Under the hot, tropical sun of Northeast Brazil, it is obvious that from 20 to 40 inches of rainfall, by virtue of its poor distribution and the high rate of evaporation, is of no practical utility in cotton production except upon certain soils well suited to the retention of moisture.

Growing conditions requisite to cotton production are to be found almost everywhere in Brazil. In the United States of North America, cotton is planted after the normal daily temperature reaches 62 degrees Fahrenheit or higher. It takes about 200 days to mature those varieties which require the longest growing period. With the exception of limited areas, there is no question as to temperatures or length of growing season in Brazil. In the Amazon Basin, large areas are too wet; others in the northeast are too dry. But in the greater part of Brazil, the rainfall varies from 40 to 60 inches per annum, which, with the tropical and semi-tropical temperatures, produces conditions quite favorable to cotton culture.

In most parts of Brazil, conditions are really more favorable to cotton production than, for example, at Lubbock, Texas, which is near the northern line of cotton production. At Lubbock the elevation is 3240 feet. The average temperature for the growing season—May to October, inclusive—is 71 degrees Fahrenheit; for the three summer months—June, July, and August—the average temperature is 76.62 degrees. The April-May temperatures average 61.6 degrees. The September-October temperatures average 65 degrees; the September temperature averaging 70, and the October temperature averaging 59 degrees. Table 20 shows the number of days required from planting to the first open boll and to the peak of picking. The average number of days of frost-free season for a ten-year period was 203; the shortest frost-free season during this ten-year period was 166 days; and the longest was 246 days.

¹"Dry Farming in Relation to Rainfall and Evaporation," Bureau of Plant Industry Bulletin No. 188, United States Department of Agriculture, by Lyman J. Briggs and J. O. Belz; 1910.

Table 20. United States: Cotton and Growing Season Data secured at the Lubbock Substation of the Texas Agricultural Experiment Station System.¹

Staple—Inches	Variety	Number of Days; Average for 1923-24, Inclusive	
		Date Up to First Open Boll	Date Up to Peak of Picking
Average ²		111	147.5
3-4 to 1	Burnett	107	138
1 to 1 1-16	Mebane 804	110	147
1 1-8 to 1 5-16	Durango	110	148
1 1-16 to 1 1-8	Lone Star	117	157

¹Data furnished by R. E. Karper, Assistant Director, Texas Agricultural Experiment Station, formerly Superintendent Lubbock Substation.

²Average number of days frost-free period for 10-year period was 203. The shortest period during this ten years was 166 days, and the longest was 246 days.

Needless to say, the areas in Brazil having sufficient rainfall with such limitations as exist at Lubbock, Texas, are limited.

Cotton Labor

Thus far, cotton is grown in Brazil principally upon small units, either owned or rented. In some cases, cash rents are paid, but more commonly the share system of tenant farming is followed.

Cotton growing on an extensive scale will have its labor problems, much the same as those encountered in the cotton belt of the United States. It will be conducted either by hired labor or the share system. The share system will likely prove to be the safest plan if native labor does the work. With the introduction of modern machinery, such as the "farm-all" tractor, skilled labor will be employed to handle the implements and machinery, and the hoeing will be done by unskilled labor.

Should there be a general development of cotton growing on an extensive scale, cotton picking will become a problem, the same as here. Brazilian coffee growers employ day laborers, both local and migratory, and this may be necessary in the case of a big cotton crop. The problem of cotton picking on this basis, however, will have its further complications in that cotton picking will compete with coffee picking for the day laborers in the state of Sao Paulo. Moreover, if the same type of day laborer is depended upon for cotton picking that is employed in coffee picking, some difficulty may be encountered in attracting the laborers to cotton picking. In addition, there will be the problem of securing enough laborers for both coffee and cotton picking.

At the present time, wages in Brazil vary from about 50 cents to \$1.00 per day for regular laborers, and from \$1.50 to \$2.00 for the day laborers employed at the height of the picking season. These wages will, of course, fluctuate with the demand for labor.

Shiploads of migratory laborers are brought over from Italy for the coffee picking season, and returned in time for the Italian harvest. Heretofore the laborers on the cotton, sugar, and coffee plantations have been paid less than farm laborers in the United States, but with the development of Brazilian agriculture this situation will not necessarily continue. Considering the relative inefficiency of farm labor in Brazil, however, the wages paid are not as low as would appear to one unfamiliar with the labor situation there. There is, of course, the prospect of improving the condition of Brazilian labor and developing its efficiency.

Cotton Soils

Some interesting viewpoints were obtained through a conference with Professor C. F. Marbut, head of the Soil Survey in the United States of North America. Professor Marbut made an extensive trip through both North and South Brazil a few years ago, for the purpose of observing soil conditions and agricultural possibilities.

Professor Marbut's opinion is that Brazil will probably never develop its agricultural industry on so highly an extensive and intensive scale as the United States, and he gives the following reasons: (1) That period in the world's history which gave the United States its opportunity for great and rather quick development has passed. Brazil, therefore, does not have the same world opportunity for agricultural development as the United States of North America has had from the beginning of the nineteenth century to the present time. (2) Brazil has no great expanses of black fertile prairies like the corn belt, the black lands of the South and the Southwest, and the broad river valleys of the Mississippi Basin. (3) The soils of Brazil, in general, compare in fertility with the lighter upland soils of the humid sections of the South of the United States, excepting the black lands of Mississippi, Alabama, and Texas. (4) The future of Brazilian agriculture on a large commercial scale is limited primarily to the production of cattle, cotton, and coffee. All other Brazilian products, though numerous and valuable, are for one reason or another of minor importance.

Professor Marbut believes that the soils of Brazil, with the exception of some of the more fertile river valleys, will rather quickly lose their virgin fertility, and to maintain satisfactory yields, Brazilian farmers will find it necessary to resort to the extensive use of fertilizers, as has been the case in the southern part of the United States of North America.

Owing to the heavy rainfall of Brazil, the soils are often low in their original soluble materials, particularly lime, phosphoric acid, and nitrogen. Organic matter is soon lost, due to excessive oxidation and leaching. Professor Marbut states that many of the soils of Northeast Brazil are underlaid by very impervious clays which make them undesirable for agricultural utilization.

According to Professor Marbut, the soils of the Amazon Valley are comparable with our Gulf Coastal Plains, but they run higher in clays and silts. Organic matter is rather limited in Brazilian soils and will rather quickly be dissipated under cultivation. Generally speaking, Professor Marbut is of the opinion that Brazilian soils are rather poor as compared with European and North American soils.¹

Cotton Services

The federal government and several of the states of Brazil maintain "Cotton Services," which, by the operation of experimental, demonstration and seed-breeding farms and otherwise promoting cotton culture, are tending to bring about improvement in the industry. Two notable Texans, Mr. Edward C. Green of Natal, Rio Grande do Norte, and Professor Thomas R. Day, have been employed in various federal, state, and private capacities for the purpose of studying the cotton problems of Brazil and of breeding and introducing better varieties and methods of cultivation, ginning, and marketing.

Foreign capital is beginning to flow into Brazil for the purpose of developing cotton growing corporations on a rather extensive scale, notably in the states of Sao Paulo, Bahia, Espirito Santo, and Parana. Observations in Brazil convince the author that, though Brazilians themselves may be slow to develop their cotton growing industry, the Brazilian Government may make great headway in this direction by encouraging ability and capital to come to Brazil and engage in cotton growing. This movement has just begun, however, and it is not possible at this time to predict final results.

CONCLUSION

The total area of Brazil is about the same as that of the United States of North America. Brazil probably has more agricultural lands than the United States. Here, cotton growing is restricted to the Southern States; there, it is grown in practically every state. Even under primitive conditions, Brazil secures better average yields per acre than the United States of North America. Her soils and climate seem to be favorable to both quality and quantity production.

There are powerful influences at work encouraging the expansion of cotton growing in Brazil, notably the International Federation of Master Cotton Spinners' and Manufacturers' Associations, and the very commendable efforts of the Brazilians themselves to develop the agriculture of their country.

Brazil, though practically as old a country as the United States of

¹Marbut, C. F., and Manifold, C. B., Bureau of Soils, United States Department of Agriculture, Washington, D. C., in "The Soils of the Amazon Basin in Relation to Agricultural Possibilities," July, 1926. Thanks are due Professor Marbut for the privilege of reading this manuscript in advance of publication in the Geographical Review of the American Geographical Society of New York City.

North America, has been much slower in her development. In fact, Brazil was colonized by the Portuguese long before the United States of North America was settled by the English. The United States became independent in 1776; Brazil in 1822. The United States of North America became a republic at once; Brazil in 1889. The United States abolished slavery in 1865; Brazil, gradually, from 1871 to 1888. Brazil's lack of material development may be attributed to a number of causes, some climatic, some geographical, some ethnological, and some political. It may be that Professor Marbut is correct in the view that Brazil has missed the historic opportunity which made possible the rapid development of the United States of North America.

It may be, however, that Brazil's great economic opportunity lies just ahead. There are too many powerful influences favoring human advancement at work throughout the world today for one to believe that world population will cease to increase for many decades to come. The increasing pressure of population upon the strictly limited areas of agricultural land will undoubtedly become greater rather than less.

Science is being called into service to subdue the varied problems of the tropics, and, if it is as effective there as in other fields, Brazil will one day support a large population, both native and introduced. Included therein may be found ability and capital from the more prosperous countries. Peoples from northern Europe have been the leaders of progress in its westward movement around the world. There being no other frontiers to develop in the North Temperate Zone, business enterprise from the United States of North America, Great Britain, and other countries, will in the near future seek new economic opportunities wherever they may be found.

The increasing pressure of population, and the scientific control of tropical diseases, coupled with the fact that Brazil possesses in her great interior the world's largest area of potential agricultural lands, constitute her great opportunity for progressive development.

Brazil will grow increasing crops of cotton of the American upland, medium staple type, and much of it will be of superior quality. She will consume greater quantities of her production, however, due to an increasing per capita consumption, as well as to increases in population. She now exports about 20 per cent of her crop.

Just how soon Brazil may increase her exports to the extent that she becomes a serious competitor of the United States of North America is problematical; in fact, she may never become a serious competitor. Possibly both countries will grow all the cotton that they should, without the one ever interfering seriously with the interests of the other. It depends upon whether, as the cotton growing possibilities of Brazil are developed, the world supply materially exceeds the world demand.

There is much more land suited to cotton growing in the world than is at all necessary to supply the world demand. Not all of this, however, will ever be planted to cotton. Much of it will be needed for

other crops, and, in the long run, the world will hardly produce more cotton than it really needs.

It will be the part of wisdom, therefore, for each and every cotton growing country to consider well the question of how much cotton it may grow to advantage. While there is little danger of long time over-production, there may be occasional slumps in prices, due to increased acreages and favorable yields, which would bring much misery to cotton growers throughout the world. This danger may be minimized by the cotton growers of every country keeping abreast with the world cotton situation and co-operating to that end.

Yet, if for any reason, American cotton growers should curtail production, and American spindles increase until they consume the American cotton crop, then foreign spindles will not stop, but will create their own supply in other lands and their finished products will compete with those of the United States of North America in the markets of the world. Such a situation may come about more naturally than one would imagine. It is estimated that by 1950—twenty-four years from now—the population of the United States of North America will range around 150 million, and that by the year 2000, it will probably reach the 200 million mark. Presuming a reasonable growth of American spinning and manufacturing enterprises, they should be manufacturing the greater part, if not all, of the American raw cotton and selling the surplus as finished goods by 1950 or 1975.

The surplus of cotton, whether it be the raw or finished product, will decline with the increase in population in the United States of North America and there will come a time when consumption in the United States will equal production. In the meantime, American cotton interests will meet some rather keen competition either in the form of raw cotton or finished goods, and the salesman with the best commodity at the lowest price, other things being equal, will get the business.

At the present time, competition, though observable in the offing, is not impending, and American growers of cotton have yet time to put their house in order. They will profit most by producing a more perfect product as regards length, strength, and character of fiber; by scientifically reducing the costs of production; by endeavoring to grow only so much of a crop as will bring a fair return for their efforts, and reserving ample acreages for such other crops as are consistent, with the maintenance of soil fertility and good farm husbandry.

Though there is no need for alarm over foreign competition in cotton growing at this time, certainly the activity of foreign spinners should prove fruitful of suggestions to the entire cotton industry of the United States of North America, including, of course, not only the growers, but also the merchants, spinners, financiers, and the consuming public.

Certainly the cotton farmers of the United States will agree that they should produce neither so little cotton as to induce increased

acres in foreign countries, nor so much as to impoverish not only themselves, but the growers of every land.

How American cotton growers may fare in the future will depend in part upon the scientific knowledge which they put into service in the details of cotton production and marketing; in part upon the soundness of the principles upon which their government is maintained; and in part upon the greatness displayed by the people of the United States of North America in harmonizing their interests with those of other countries.