

UNITED NATIONS

ECONOMIC  
AND  
SOCIAL COUNCIL



GENERAL

E/CN.12/578  
8 March 1961

ENGLISH  
ORIGINAL: SPANISH

ECONOMIC COMMISSION FOR LATIN AMERICA

Ninth Session  
Caracas, May 1961

THE COFFEE INDUSTRY IN SAO PAULO

Note by the secretariat

The secretariat has pleasure in submitting herewith to the Governments members of the Commission the article entitled "The coffee industry in Sao Paulo", which is an offprint of the Economic Bulletin for Latin America, Vol. V, No. 2, (Santiago, Chile, October 1960). It contains a summary of the survey made by the Joint ECLA/FAO Agriculture Division in the State of Sao Paulo, Brazil, which is presented in extenso in documents E/CN.12/545 and E/CN.12/545/Add.1 (United Nations Publications, Sales No. : 60.II.G.6), and will be considered by the Commission under item 12 (d) of the provisional agenda for its ninth session.



THE COFFEE INDUSTRY  
IN SÃO PAULO



UNITED NATIONS



## TABLE OF CONTENTS

	<i>Page</i>
I. Principal conclusions . . . . .	3
II. Physical structure of coffee growing . . . . .	5
1. Plantings and their present distribution in the State . . . . .	6
2. Age composition of trees . . . . .	7
3. Shift towards new varieties . . . . .	8
4. Present size distribution of coffee farms . . . . .	9
5. Diversification of activities on coffee farms . . . . .	10
6. Variations in coffee yield . . . . .	12
III. Main economic factors affecting production . . . . .	14
1. Use of fixed capital . . . . .	14
2. Use of manpower . . . . .	15
3. Use of fertilizers. . . . .	17
4. Coffee processing on farms . . . . .	19
5. Cost structure and productivity levels . . . . .	19
IV. Basic technical and economic problems . . . . .	20
1. Defects in present plantings . . . . .	20
2. Defects in present exploitation methods . . . . .	22
3. Defects in the farm structure as a whole: excessive specialization . . . . .	24
4. Interrelations of existing problems . . . . .	24
V. Evaluation of prospects . . . . .	25
1. The case of no special action . . . . .	25
2. Present plans. . . . .	26
3. Prospects for diversifying the coffee farm . . . . .	27
4. Summary of prospects . . . . .	28



## THE COFFEE INDUSTRY IN SÃO PAULO

The following pages contain a synthesis of the findings of the coffee survey conducted in the State of São Paulo in 1958. The survey was sponsored jointly by the Food and Agriculture Organization of the United Nations (FAO), the Economic Commission for Latin America (ECLA), the Brazilian Coffee Institute (*Instituto Brasileiro do Café*) (IBC) and the Department of Agriculture (*Secretaria da Agricultura* (DA) of the State of São Paulo.<sup>1</sup>

The purpose of the survey was to supply information on a variety of characteristics of coffee growing in the State of São Paulo, which were hitherto insufficiently known. For this purpose it was necessary to collect original data in the field by means of a large-scale and statistically representative sample of all coffee farms in the State.

Quantitative estimates, of, for instance, the number of trees, area and production, are based on the careful on-the-spot investigation of 1 991 coffee farms in all parts of the State. Economic information, such as the number of man-days employed in coffee growing, the use of capital, etc., are derived from an even more detailed study of 486 farms, included in the 1 991 already mentioned.

All data have been rigorously inspected and sifted by technicians fully acquainted with coffee-growing methods in the State of São Paulo. In addition, the results of the survey have been checked with those obtained on 33 farms which independently kept daily records of activities during the survey period.

Though original farm data, obtained through a field survey, cannot be expected to yield mathematically accurate results, it is considered that the data presented in the following pages are reasonably reliable and adequately reflect the average conditions under which coffee is produced in São Paulo.

Although many features of coffee growing are, of course, similar irrespective of the place where it is cultivated, it is stressed that the detailed results obtained and the analysis made are valid only for the State of São Paulo and that they do not apply to Brazil as a whole. Many of the characteristics and problems of coffee growing in São Paulo, as well as many of the possible solutions, are

<sup>1</sup> The complete report, in its different aspects and phases, has already gone to press, and will form part of the series *Coffee in Latin America*, published jointly by ECLA and FAO, the first volume of which was devoted to Colombia and El Salvador (see E/CN.12/490, United Nations publication, Sales No. 58.II.G.4). The São Paulo survey will appear in the following two volumes (II and III) in the same series: the first is entitled *The state and prospects of production* (E/CN.12/545/Vol.1); the second (E/CN.12/545/Vol.2) is divided into two main sections: *Case study of 33 farms* and *Analysis of the functions of production*.

peculiar to that State. The situation in other States is often very different.

This study does not enter into the present problem of world supply and prices, although the conditions in São Paulo are directly related to the world coffee situation owing to the importance of the State in total production. Many of the internal problems of the industry are of a long-term nature and their solution calls for independent measures, to a certain extent regardless of the present world market situation.

But for the splendid co-operation of the Brazilian Coffee Institute and of the Department of Agriculture of São Paulo it would have been impossible to undertake an extensive and important survey such as the one outlined here. The Institute financed local costs and also supplied technicians to supervise the various field operations and plan the statistical services. The Department, through its Division of Rural Economy, headed by Mr. Ruy Miller Paiva, provided regional technical personnel for the field enumeration as well as central personnel for the planning, execution and evaluation of the multiple phases involved. These phases included the planning of the samples and of the questionnaires, the checking of the data collected, the mechanical tabulation of results, and permanent consultations with FAO and ECLA staff members assigned to the project. Special recognition is therefore due to all who worked so assiduously to complete the survey, often under difficult conditions.

As the results of the survey will be given in greater detail in the volumes mentioned previously, they are commended to the attention of the reader who wishes to delve more deeply into the subject. This article presents the most important data obtained, as concisely and clearly as possible. It has been divided into five sections: the first contains the principal conclusions deriving from the survey, and is followed by a consideration of the structure of coffee cultivation, of the main economic factors bearing on production and of basic technical and economic problems. The final section contains an evaluation of the industry's prospects.

The São Paulo coffee industry is facing serious problems at present owing to greatly expanded output in many production areas, prices notably below those of the past decade, and certain inherent weaknesses in the State's coffee production structure, which are analysed in these pages. It is hoped that the result of this joint study will contribute towards a better understanding of the present difficulties and that it will also help to suggest adequate long-term solutions.

### I. PRINCIPAL CONCLUSIONS

1. The São Paulo coffee industry has entered upon a critical phase of its development owing to the world situation as well as to factors peculiar to the State. The steep rise in output in other areas of Brazil, particularly in Paraná, as well as in other regions of the world (Africa),

is creating much stronger competition on the world market. These are a challenge to the position of São Paulo as an efficient coffee producer. At the same time the incorporation of new lands has practically come to an end in State, and no further expansion can take place in this

way. Existing plantings are faced with serious problems of soil exhaustion, excessive age, poor yields and correspondingly low productivity.

2. World market prospects are unlikely to improve in the short run, and internal coffee prices seem more likely to fall further in real terms than to rise. The present price situation is illustrated in figures XVIII and XIX.<sup>2</sup> In these circumstances the position of the São Paulo industry may well deteriorate further, unless determined efforts are made to adjust to the new situation. While it is not possible to separate coffee prospects in São Paulo from the world picture, special measures may nevertheless be adopted to deal with the problems which are largely peculiar to that State. Corrective action should, of course, take the world coffee situation fully into account, especially as regards its effect on the total level of production.

3. Six hundred million trees, half of the adult plantings in São Paulo, produce yields below 400 kg per 1 000 trees (see figure XVII). It is doubtful whether coffee production is profitable at such low levels of yield with the existing price and cost structure, and if the cost of capital is duly accounted for. The large majority of these plantings must therefore be considered as sub-marginal. They do not provide the State with net economic profits and this situation could be radically changed only through large-scale new investments aiming at their replacement by more productive plantings or by other profitable agricultural activities. While the causes of this extremely low productivity are manifold, the magnitude of the State's internal production problem can be judged from the preceding estimate.

4. The existing situation characterized by poor yields and productivity is the outcome of the migratory development of coffee cultivation for more than a century. Growing techniques seem to have varied little over this period and they are generally still at a low level. A cycle of developments has therefore taken place which has resulted in the loss of the original soil fertility, the abandonment of former coffee areas, the continued existence of over-aged plantings and the steady westward movement of the centre of gravity of production. Though these trends have been known to exist for a considerable time, this survey presents the problem on a quantitative basis.

5. The following are among the main factors contributing to current technical defects in coffee growing:

(a) Only 13 per cent of the existing plantings receive any chemical fertilizer no fertilizer of any kind is used on about 60 per cent (see figure XV). This indicates a widespread failure to rectify low yields and soil depletion. As a result, coffee yields are far lower in São Paulo than in competing areas, even with relatively young plantings and improved varieties.

(b) About one third of all plantings are over 30 years old (see figure III). This indicates that farmers do not replace their trees in order to maintain productivity at the highest possible level. Neither are they interested, generally speaking, in introducing new practices which require new planting systems. The present proportion of old trees would even be greater but for the exceptionally high rates of abandonment and elimination prevailing in the abnormal 1930's and during the Second World War.

(c) Eighty-five per cent of the State's coffee trees are of

the traditional varieties. Considerably improved strains have been available for more than a decade (see figure IV), but the introduction of new ones in São Paulo is limited to a rather marginal volume of new planting, and the position of the industry as a whole has been hardly affected so far. This means, in effect, that average productivity is at least a fourth lower than what it would be if all plantings consisted of improved trees, other conditions being identical. Furthermore, the high frequency of new varieties in recent plantings is not an indication of new cultivation techniques, as it is not always accompanied by any other structural improvements in coffee growing.

(d) Less than 20 per cent of the labour employed in coffee production is used on tree improvement or soil maintenance (see figure XII). This means not only that inadequate attention is paid to the future of coffee growing, but also that the technological pattern is excessively rigid. This is especially serious, as labour is the predominant variable input in coffee production.

6. Large amounts of additional capital investment would be required to solve the present problems. On the basis of the elimination of about one half of the existing trees, of their partial replacement by new coffee plantings, and of related farm adjustments, it may be estimated that total new investment needed to complete such a programme would be of the order of Cr. 30 000-40 000 million at 1958 prices. A large part of the investment would begin to pay only three to four years after it was made.

Furthermore, farmers would not harvest an estimated 10 million bags of coffee, normally obtained from the low-yielding trees in three years. If this loss is valued at about Cr. 20 000 million, it will be seen that the total amount involved would be of the magnitude of Cr. 50 000 million to 60 000 million, i.e. equivalent to the value of about three coffee crops for the entire State. These figures show the magnitude of the problem as a whole. Naturally replacement would always be gradual and call for a smaller but steady financial investment.

7. It is unrealistic to suppose that farmers would be willing to make such large financial sacrifices on their own initiative, particularly in view of the present uncertain prospects of the coffee market. The new investment would involve a considerable risk because of fluctuating coffee prices. Again, anticipated profits, though substantial, might not equal those obtainable over an equal period from alternative investments. They would also involve a widespread shift to modern production technology, with all the accompanying difficulties and structural adjustments and the heavy demands for agricultural extension services. Hence, spontaneous action by farmers is expected to be strictly limited despite the presence of favourable factors in the economic development of São Paulo and of many technical improvement possibilities.

8. The "three-to-one programme" of the Brazilian Coffee Institute, under which the elimination of three low-yielding trees and the establishment of one new tree by modern methods is to be financed, constitute a constructive effort to break the vicious circle of stagnation affecting coffee cultivation in many parts of São Paulo. They would encourage higher coffee-growing standards and greater diversification in farm production. Though important, the programmes so far approved are only a first step and can satisfy only a small part of present requirements as regards capital and technology. It might be possible to use available funds in ways which would attract further pri-

<sup>2</sup> The figures quoted in this section appear in their appropriate places in sections II and V, *quod vide*.



vate capital for use along the same lines, but this would require special approaches. The effectiveness of the existing programmes would also be enhanced if they included specific plans to utilize the resources freed by the elimination of old trees, for different enterprises could be associated with coffee in many zones of the State. One difficulty of the present programme is that it contributes little towards balancing total coffee supplies with prospective demand. In three years the production of one new tree might well equal that of the three old trees which it replaced. The general increase in production which may be expected on the basis of other factors would more than offset even the modest temporary reduction caused by the three-to-one programme. Thus the emphasis is mainly on raising the productivity of coffee growing within given volumes of output.

9. Present indications are that, up to the mid-sixties, much of the low productivity problem will remain as an outstanding handicap to the São Paulo industry. On the other hand, it is likely that the rising post-war trend in total production will continue until then. An analysis of the existing structure of plantings and of reasonable assumptions for the industry's evolution up to 1965 leads to the conclusion that total output might increase by 30-35 per cent in the six years 1958/59-1964/65, reaching a level of 15 million to 16 million bags by 1964/65. These figures provide, of course, only a very general picture which may be considerably modified by weather conditions, new Government programmes affecting coffee, or unforeseen events, but they indicate the general production trend calculated from rather complete observations in 1958 and in large measure already determined by the present structure of the industry.

## II. PHYSICAL STRUCTURE OF COFFEE GROWING

It is common knowledge that the State of São Paulo has led the world in coffee production for at least the past 60 years. After the introduction of coffee growing in São Paulo at the beginning of the nineteenth century, the basis for the great expansion in production was laid in the second half of that century and the main upsurge took place in the first 40 years of the present century. During the latter period, the volume of production in the State of São Paulo alone exceeded that of all other areas in Brazil plus that of the rest of the entire world.

The spectacular growth of coffee cultivation in São Paulo in the past 100 years has been made possible by the existence of especially favourable internal physical and economic factors, which operated in conjunction with the rapidly expanding world coffee market. The most important internal physical factors include rather homogeneously favourable climatic and edaphological conditions and a relatively even topography. Furthermore, important railways gradually penetrated into the extensive territory of the State, consolidating the opening-up of virgin lands to coffee the production of which could reach the port of Santos easily. At about the same time large-scale immigration from Europe helped to provide manpower for the coffee plantings, which require a relatively high labour import.

The entire period of rapid growth of the São Paulo coffee industry was characterized by the clearing of virgin forests and by the opening up of new lands, which prod-

10. Although serious problems are now facing the São Paulo coffee industry and are likely to continue in the near future, it is also true that favourable opportunities exist for successful corrective action. The economy of the State is becoming gradually less dependent on coffee growing, owing to the significant progress of industrialization in recent years. Internal demand for agricultural commodities other than coffee is at record levels and is certain to increase still further, with rising income levels, strong urbanization trends and rapid population growth. A favourable internal environment therefore exists in which the modernization of coffee cultivation might take place, and any resources shifting away from coffee production can be profitably employed in a host of other agricultural and livestock activities, which will find favourable market outlets in the State. The recent discovery that high-yielding plantings may be re-established on old coffee lands, which was formerly considered impossible, is also an important contributing factor. There is no intrinsic reason for stagnation in the coffee sector, other than the unavoidable rigidities of coffee production itself and the traditional immobility of the State's rural economy in general. On other occasions it has already been shown, however, that São Paulo's agriculture can face up to the requirements of basic shifts in demand and of important technological innovations. All possible efforts should therefore be directed towards eliminating specific impediments in the way of change, and towards stimulating the establishment of a permanent and modern coffee industry, profitably associated with other important branches of farm production. Only under these conditions can the State's economy be expected to continue to prosper in the long run, as the experience of other industrial nations has proved.

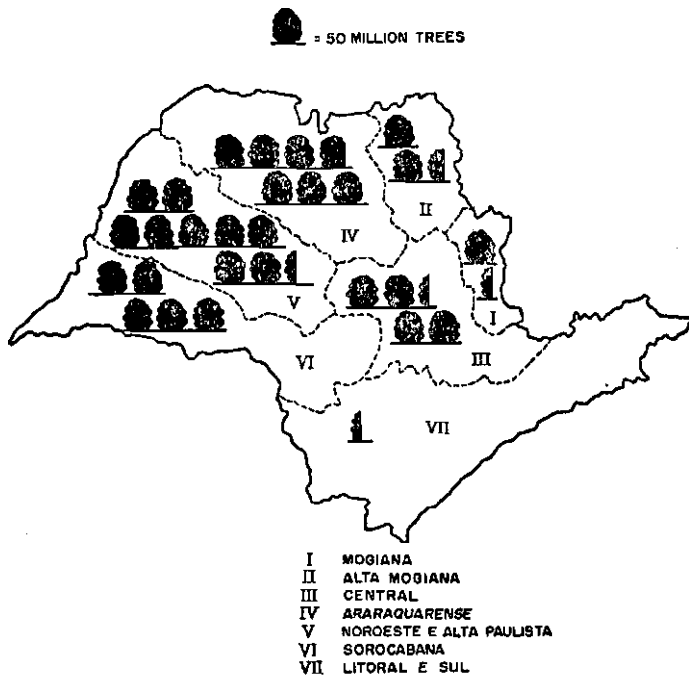
uced high yields for at least one generation of coffee trees. Subsequent declines in yield, as well as periods of unfavourable coffee prices, resulted in the abandonment of large areas, especially in the eastern and north-eastern parts of the State, and in a general east-west shift of the centre of gravity of production. However, the volume of new planting exceeded the abandonment of old trees at least up to about 1930, and total production continued to expand.

In the period 1930-45, the abandonment and elimination of trees greatly exceeded new planting, and São Paulo's production fell off sharply. This occurred when the maximum cyclical volume of coffee output coincided with the world-wide economic depression, and when the important European market was closed by the war after 1939. The east-west shift of cultivation, however, continued in this period, with the limited new planting taking place primarily in the Araraquarense, Noroeste e Alta Paulista and Sorocabana regions, and much of the abandonment occurring in the Mogiana, Alta Mogiana and Central regions (see map 1).

The post-war period of expansion, once more involving the westward penetration of coffee growing, culminated in the recent large crops of 1958 and 1959, but also coincided with the final incorporation of the last western reserves of São Paulo's virgin lands. Between the 1948-52 average and 1959, and additional 400 000 hectares were planted to coffee (an increase of 31.5 per cent). The traditional

MAP 1

REGIONAL DISTRIBUTION OF ALL EXISTING COFFEE PLANTINGS, 1958



evolution of coffee growing in São Paulo can therefore no longer continue, and the industry has reached a decisive juncture in the history of the State.

As the limit of western expansion was reached in São Paulo, surplus production again began to bedevil the world coffee market. Real prices and farmers' profits fell sharply after 1954 and helped to bring the structural problems of the São Paulo industry into perspective.

It is no exaggeration to say that, under these circumstances, the future of coffee growing in São Paulo will be strongly affected by the events of the next few years, when the world production cycle is expected to raise output further.

During 1958, when the present survey was made, coffee and of Brazil as a whole as well as in the world coffee picture. São Paulo accounted for about 40 per cent of Brazil's total production and one fifth of world output. It also provided one fourth of the total value of Brazil's exports, a crucial dynamic contribution to the country's economic development efforts. Within the State's agriculture, coffee still remained the principal commodity, providing nearly a fourth of the total gross value of farm production. While the recent growth of industry and of agricultural activities other than coffee cultivation has relatively diminished the role of coffee in the economy of São Paulo as a whole, coffee still absorbs a massive volume of human and other resources and continues to be the mainstay of nearly all rural areas.

1. PLANTINGS AND THEIR PRESENT DISTRIBUTION IN THE STATE

The total area occupied by coffee farms comprises about one half of the State's total land area of some 247 000 square kilometres.

Within this area, the 104 800 coffee farms in the State of São Paulo are estimated to have occupied, in 1958, some 1.7 million hectares for growing purposes, which constitutes 14 per cent of the total area of the farms. The total number of trees in 1958 is estimated at 1 500 million.<sup>3</sup> Total coffee production, including all types and qualities, amounted to 11.7 million bags clean equivalent, or 700 900 metric tons, in 1958 (see figure I). These figures indicate the magnitude of the physical structure within which the industry is operating.

The resident population on coffee farms, which is one measure of the direct human dependence on coffee growing, is estimated at nearly 2.2 million in 1958, composed as follows:

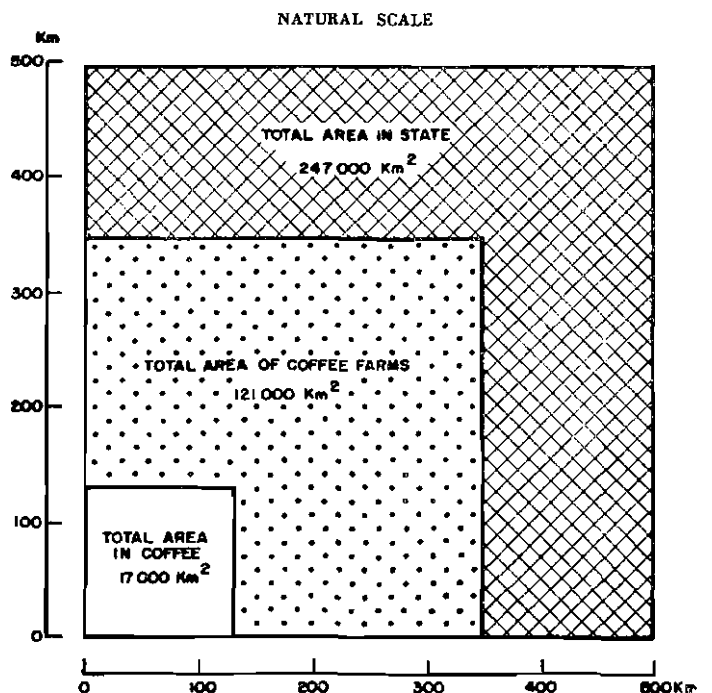
	Thousands
Farm owners and their families . . . . .	570.0
Hired labourers ( <i>colonos</i> ) and their families . . . . .	640.0
Sharecroppers ( <i>parceiros</i> ) and their families . . . . .	810.0
Other workers and their families . . . . .	130.0
Resident population on coffee farms . . . . .	2 150.0

This total is only a partial estimate of the number of people actually dependent on coffee in São Paulo. To it should be added those engaged in transporting, storing and marketing coffee in all rural communities, in the State capital and in Santos, as well as the large number of people servicing the requirements of coffee farms and their resident population. The figure of 2.2 million is therefore a very conservative one, but even so it corresponds to about 20 per cent of the entire population of the State.

Estimates of the total investment represented by coffee

<sup>3</sup> Throughout this report the term "trees" refers to the Brazilian *cova* or *pé*, which consists of four to eight individual coffee plants growing closely together and constituting one bush for operational purposes.

FIGURE I  
THE FRAME OF COFFEE GROWING IN SÃO PAULO, 1958



farms are rather difficult to make, because land values are frequently influenced by factors which may not adequately reflect agricultural productivity. However, on the basis of the 1958 commercial farm value, it is estimated that coffee growing represented a total asset value of between 120 000 million and 140 000 million cruzeiros at 1958 prices.<sup>4</sup>

Map 1 shows that more than 70 per cent of the trees are now concentrated in the three western regions, whereas only 28 per cent are found in the Central, Mogiana and Alta Mogiana regions, which several decades earlier were the main producing zones. The greatest concentration of production is now found in the Noroeste e Alta Paulista area, which accounts for nearly one-third of the entire output of the State.

An analysis of existing plantings by age of establishment clearly reveals the geographical shift of the industry during the past 60 years. The bulk of the oldest coffee plantings, as of 1958, is still found in the north-east, the centre of coffee growing during the early part of the century. Similarly, the current heavy concentration of young plantings in the west points to the displacement of coffee growing in that direction. An intermediate situation is revealed with respect to the remaining share of plantings, as reflected in the following data (see also map 2):

Area	Percentage of trees		
	Over 50 years	4-50 years	All trees less than 4 years
Mogiana . . . . .	14.0	3.3	4.9
Alta Mogiana . . . . .	21.5	8.0	5.5
Central . . . . .	43.9	12.7	9.3
Araraquarense . . . . .	11.2	22.4	34.8
Noroeste e Alta Paulista . . . . .	2.8	34.7	30.4
Sorocabana . . . . .	6.6	18.3	13.3
Litoral e Sul . . . . .	—	0.6	1.8
Total . . . . .	100.0	100.0	100.0

## 2. AGE COMPOSITION OF TREES

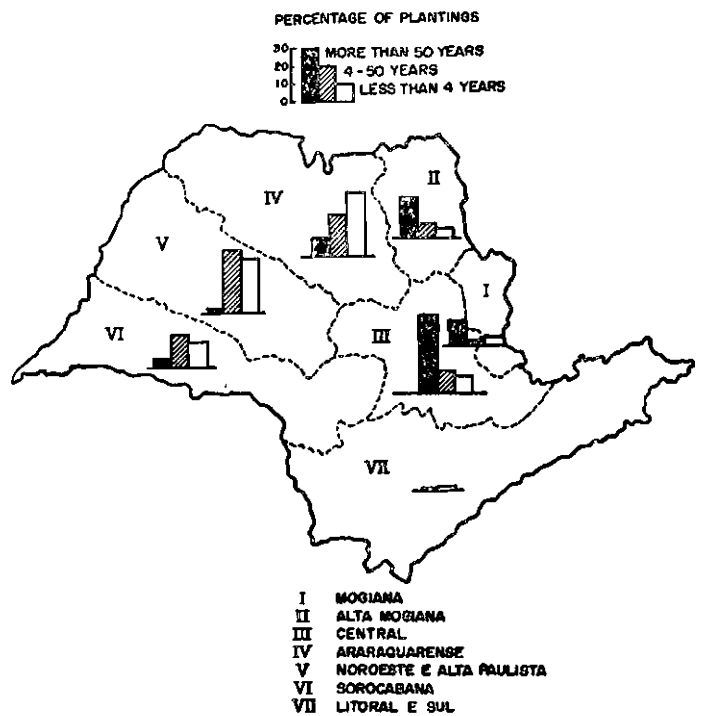
Special attention was paid to a full investigation of the distribution by ages of the coffee plantings in existence in 1958. The proportion of trees by major age groups and by significant historical periods are given below (see also figure II).

Age of planting (years)	Period of establishment	Percentage of trees existing in 1958	Percentage of production in 1958
0-3 . . . . .	1956-1958	13.3	0.9
4-12 . . . . .	1946-1955	25.4	30.9
13-28 . . . . .	1930-1945	22.0	26.5
29-40 . . . . .	1918-1929	25.0	26.8
41-50 . . . . .	1908-1917	7.2	7.1
more than 50 . . . . .	before 1908	7.1	7.8
		100.0	100.0

These results, tabulated from farmers' reports on the specific age of each of their plantings, show a highly significant pattern. The post-war period of variable, but generally high, planting rates has by now led to the predominance of new plantings in São Paulo. On the other hand, about one third of the post-war plantings, i.e. 13.3 per cent of all existing plantings consisted, in 1958, of trees up to three years old, which had not yet entered full

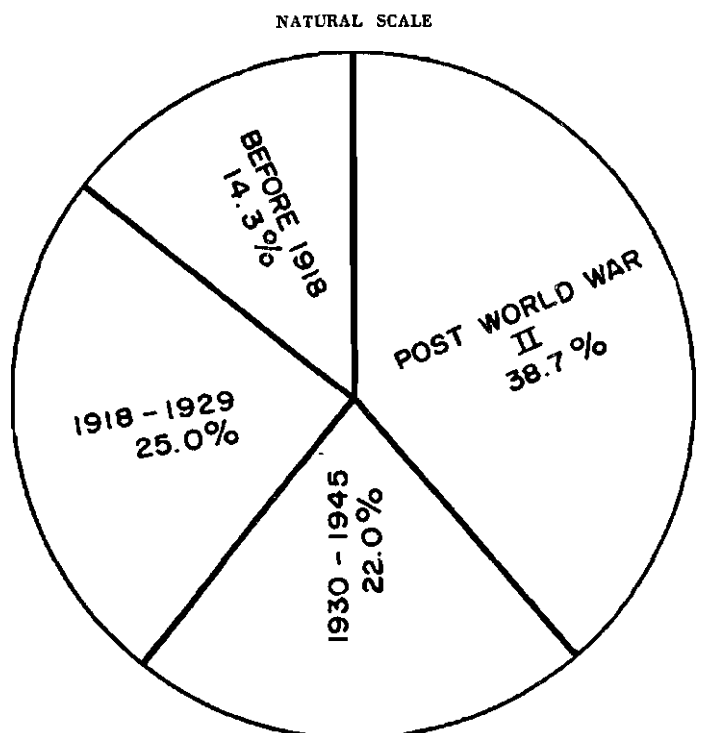
<sup>4</sup> This would represent an equivalent of about 1 000 million dollars at the average free-exchange rate prevailing in 1958.

MAP 2  
PERCENTAGE DISTRIBUTION OF OLD AND NEW COFFEE PLANTINGS BY REGIONS, 1958



production. The proportion of output represented by this group was therefore notably less than the share of trees. But the production of post-war plantings will probably exceed the proportion of 40 per cent of total output in 1960, as trees planted in the period 1956-58, reach full production.

FIGURE II  
PROPORTION OF EXISTING COFFEE TREES PLANTED IN SIGNIFICANT HISTORICAL PERIODS, 1958



In 1958, only 22.0 per cent of existing trees and 26.5 per cent of production corresponded to plantings established in the disturbed period 1930-45 covering the great depression and the Second World War. This relatively small proportion seems to be the direct result of low planting rates in the unfavourable period mentioned rather than the result of abandonment, for the corresponding plantings are still relatively young at present, falling within the age group 15-30 years.

The estimates for the period 1918-1929 show that the coffee boom of the 1920's is reflected even today in the high proportion of trees belonging to that period. One fourth of the plantings in 1958 was established between the end of the First World War and the beginning of the depression, i.e. after 1929. This figure is especially significant, since the abandonment and elimination of the 1930's and 1940's have probably really reduced the frequency of this age group.

Finally, about 14 per cent of existing trees was planted before 1918, equally divided between the age groups 40-50 and more than 50 years. It would appear, however, that only the best plantings originating in those periods have survived the economic upsets of later years and that a large proportion of the trees planted that long ago no longer exist.

The age composition of coffee trees is particularly important in São Paulo in view of current efforts to modernize the industry and to increase its competitive strength. The following are detailed estimates prepared on the basis of the survey (see also figure III).

Age of plantings in 1958 (years)	Millions of trees	Percentage
1-3	195.8	13.3
4-6	132.0	8.9
7-9	113.4	7.7
10-12	129.2	8.8
13-15	68.5	4.6
16-20	108.4	7.4
21-25	98.4	6.7
26-30	169.8	11.5
31-35	146.7	9.9
36-40	102.1	6.9
41-50	106.2	7.2
51-60	49.7	3.4
61-70	29.8	2.0
71-80	18.7	1.3
more than 80	5.9	0.4
Total	1 474.6	100.0

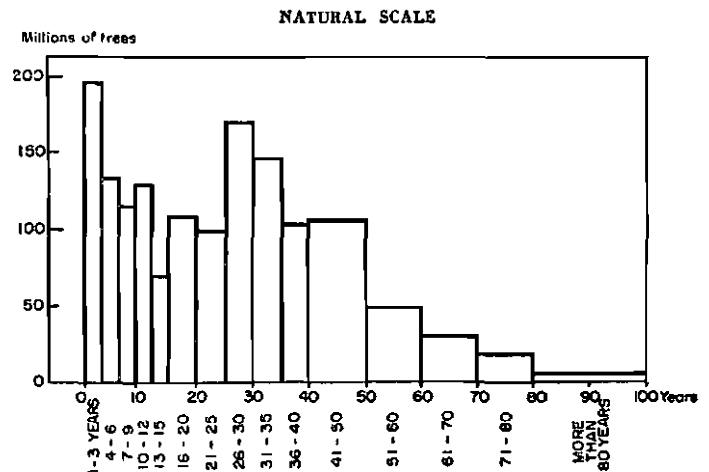
These estimates also throw light on rates of planting. If it is assumed that no significant proportion of the originally established plantings up to 25 years old were eliminated or abandoned by 1958, the following planting rates would result for the last quarter century:

Years	Number of trees planted per year (millions)
1934-38	19.7
1939-43	21.7
1944-46	22.8
1947-49	43.1
1950-52	37.8
1953-55	44.0
1956-58	65.3

The very low rates up to 1946 and the sharp increases in plantings as soon as market prospects improved after

FIGURE III

AGE COMPOSITION OF EXISTING COFFEE PLANTINGS, 1958



the war stand out clearly. But the surprising thing is that the largest volume of new plantings over the period—some 65 million trees—were planted in the most recent triennium 1956-58. In that period the world market situation changed profoundly, but planting rates showed no reaction. This is probably largely explained by the fact that cruzeiro prices did not begin to decline up to the middle of 1958, though dollar prices had already fallen sharply in 1957 and early 1958. The effects of this rising trend in new planting, up to 1958, is likely to be felt until the mid-1960's when the 1956-58 plantings reach maximum production.

3. SHIFT TOWARDS NEW VARIETIES

One of the most dynamic changes in coffee growing in São Paulo in recent years is certainly the rapid shift towards improved varieties. The introduction of the *Mundo Novo* has proceeded at a striking pace since about 1950, but improved strains of *Bourbon* and the new *Caturra* variety also of commercial importance. The trend towards better types of tree is a direct result of the well-known research carried out by the Agronomic Institute of Campinas, which began during the 1930's.

*Mundo Novo*, which became available for distribution only after 1950 accounts for 14.7 million trees in the age group originating in 1950-53 (7 to 9 years), or 13.0 per cent of all coffee trees of this age. During the next three years (1953-55), 48.2 million trees of *Mundo Novo* were planted, constituting 36.5 per cent of total planting. During the last three-year period for which data are available through the present survey, it is estimated that 111.3 million trees of *Mundo Novo* were planted, representing 57.0 per cent of all new planting, and this proportion appears to be increasing further, as the 1958 percentage was 63.7 (see figure IV).

The *Caturra* variety was introduced somewhat earlier than *Mundo Novo* and shows up in the survey estimates in the age group 7-9 years, with 2.4 per cent of all trees of this age. Since that time the proportion of *Caturra* on new plantings has increased somewhat, but it has never reached as much as 5 per cent in any one year. It was not possible to make a distinction between the different strains of *Bourbon* plants used.

Altogether it may be estimated that about 70 per cent of all trees planted in the last few years have been of various improved types. Yet, a classification of all trees existing in 1958 by variety shows that the traditional types still predominate strongly, as is apparent from the following data:

Variety	Millions of trees in 1958	Percentage
<i>Comum</i> . . . . .	682.1	46.3
<i>Bourbon</i> . . . . .	591.6	40.1
<i>Mundo Novo</i> . . . . .	174.2	11.8
<i>Caturra</i> . . . . .	15.5	1.0
Mixtures and minor types . . .	11.1	0.8
	1 474.6	100.0

Figure IV illustrates, furthermore, that nearly 30 per cent of new plantings continue to be of the *Comum* variety though *Comum* has in part also given way to *Mundo Novo*. But *Bourbon* is apparently most affected by the invasion of *Mundo Novo* and by the less rapid introduction of *Caturra*, its proportion falling from nearly 50 to only 10 per cent of new planting in the post-war period.<sup>5</sup> At current average planting rates, it would therefore still take several decades for improved varieties to occupy a dominant position in São Paulo coffee production as a whole. However, available statistics clearly indicate that *Mundo Novo* will play a major role in the future development of the industry.

#### 4. PRESENT SIZE DISTRIBUTION OF COFFEE FARMS

The average size of coffee farms in São Paulo is greater than that in most other producing zones in Latin America, especially outside Brazil. The average area in coffee in

<sup>5</sup> Many farmers do not make a clear distinction between *Comum* and *Bourbon*. The current proportion of *Comum* among new plantings is therefore likely to be less than 30 per cent.

São Paulo is estimated at 16.2 hectares, or 14 100 trees per farm unit. In Colombia, for instance, coffee farms average only 3.2 hectares in coffee, and in El Salvador 6.9 hectares. Average production per farm in 1958 was about 112 bags of clean coffee, equivalent to 6.7 metric tons. A relatively large number of small farms (*sitios*), together with a smaller number of commercially important *fazendas*, produce this State average, but this figure does not represent the characteristics of the most typical or the most important farm type.

The principal feature of the size structure of coffee farms in São Paulo is the commercial importance of medium-to-large farms with more than 8 000 but less than 128 000 trees. This size group accounts for over two-thirds of total production and tree numbers. Neither very large nor very small farms are of comparable importance in production though both the number and the proportion of small farm units is large (see figure V).

The following table shows the relative importance of major size groups:

Number of trees	Share of number of farms (Percentage)	Share of production (Percentage)
up to 8 000 . . . . .	56.7	10.0
8 - 32 000 . . . . .	33.8	35.1
32 - 64 000 . . . . .	6.1	17.8
64 - 128 000 . . . . .	2.3	15.5
more than 128 000 . . . . .	1.1	21.6
Total . . . . .	100.0	100.0

An analysis of the size structure of farms established in various past periods seems to indicate that, over the years, the smaller farms have gained in importance, while the larger ones have gradually come to play a smaller role. This trend towards smaller coffee farms appears to have manifested itself in the last 30 years according to the survey.

FIGURE IV  
AVERAGE VARIETY COMPOSITION OF EXISTING COFFEE PLANTINGS AND THE INCREASING IMPORTANCE OF NEW VARIETIES IN RECENT PLANTINGS

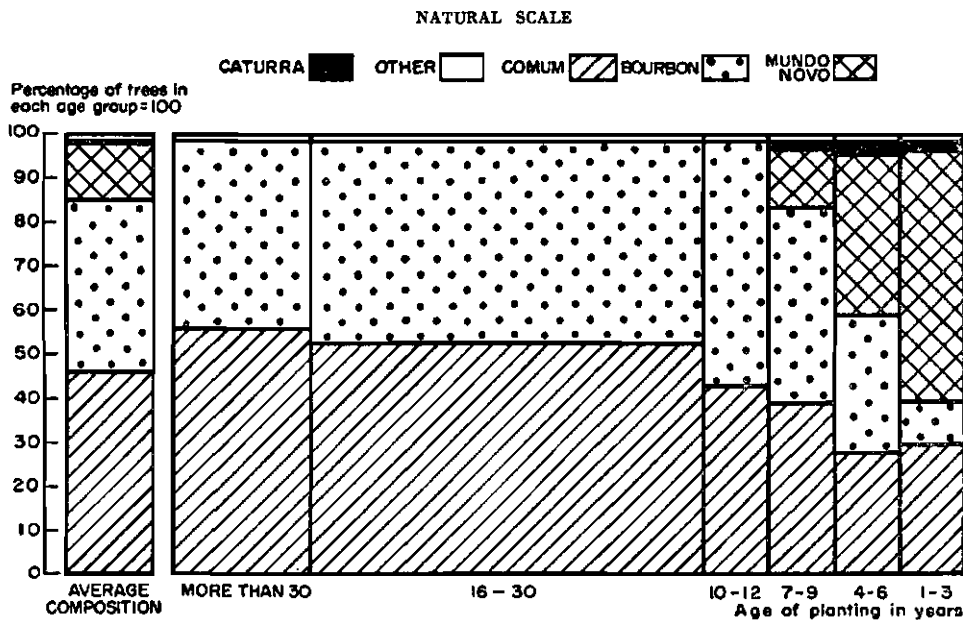
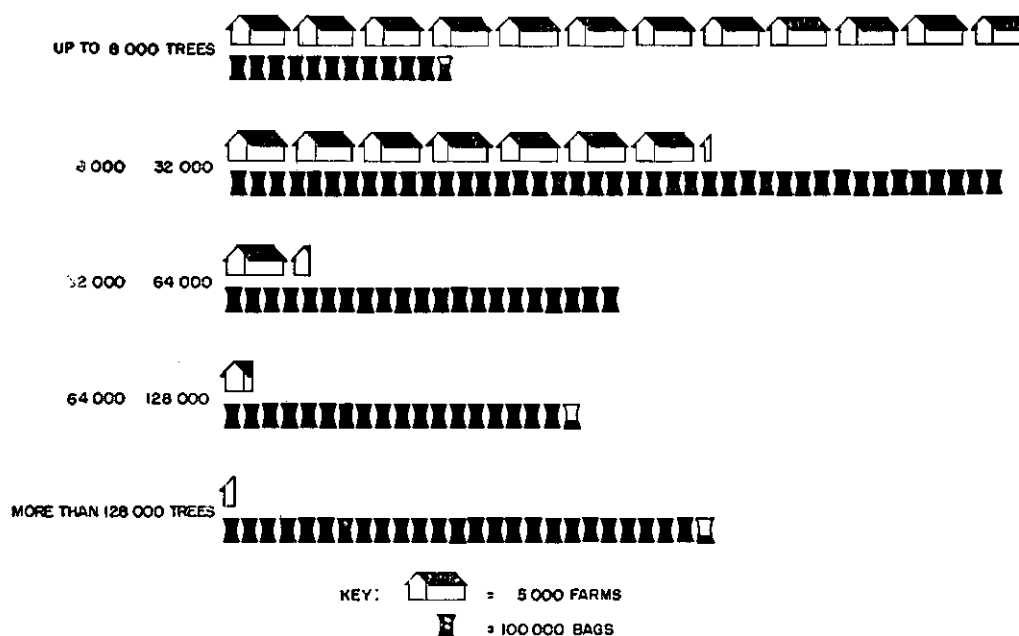


FIGURE V

THE SIZE STRUCTURE OF SÃO PAULO COFFEE FARMS, 1958



5. DIVERSIFICATION OF ACTIVITIES ON COFFEE FARMS

The description of the physical structure of production would not be complete without mentioning the relationship on coffee farms of coffee growing to other activities and the intrinsic importance of the latter.

It was shown in figure 1 that coffee plantings in São Paulo in 1958 occupied some 17 000 km<sup>2</sup>, whereas the total area belonging to coffee farms as a whole was estimated at about 121 000 km<sup>2</sup>, more than seven times as much. The various uses of the land on these farms are indicated in figure VI.

About one half of the total farm area was used as pasture. Cash crops other than coffee took up a total of about 10 per cent of the total farm area. Pastures thus made up an area over three times that in coffee and cash crops other than coffee covered an area equivalent to about two thirds of that used for this staple crop.

The estimate of the area in crops includes both that directly planted by farm-owners and that contracted under various share-cropping arrangements. Such arrangements generally allow the individuals concerned relatively little independent management, unlike the situation of share croppers in some other countries. In São Paulo, a large part of the main food crops, especially maize and rice, are produced in this way, and this accounts for the fact that more than five per cent of the total land on coffee farms is let out on share-cropping contracts.

A further 3.2 per cent of the land of coffee farms was allocated to hired labourers (*colonos*) in partial remuneration for their work in the coffee plantings. While much of this area is also used for the growing of food crops, this output goes to supply the needs of the *colonos* and their families and does not contribute to commercial production.

Finally, an important part of the total farm land (17.4 per cent and including woodlands, fallow and otherwise idle land) was not used commercially.

In general, the quality of land within a farm may vary considerably and this affects the use of each part. The best lands are generally used for coffee growing, the remainder being left for non-coffee enterprises. Nearly all farms also produce most of their internal food crop requirements, and a considerable number of them engage in the commercial production of food or other crops as well. The depleted lands naturally remain for livestock production or are not usable.

Though less than one sixth of the average farm area is thus directly employed for coffee production, the role of this commodity is far greater than that of any other single product.

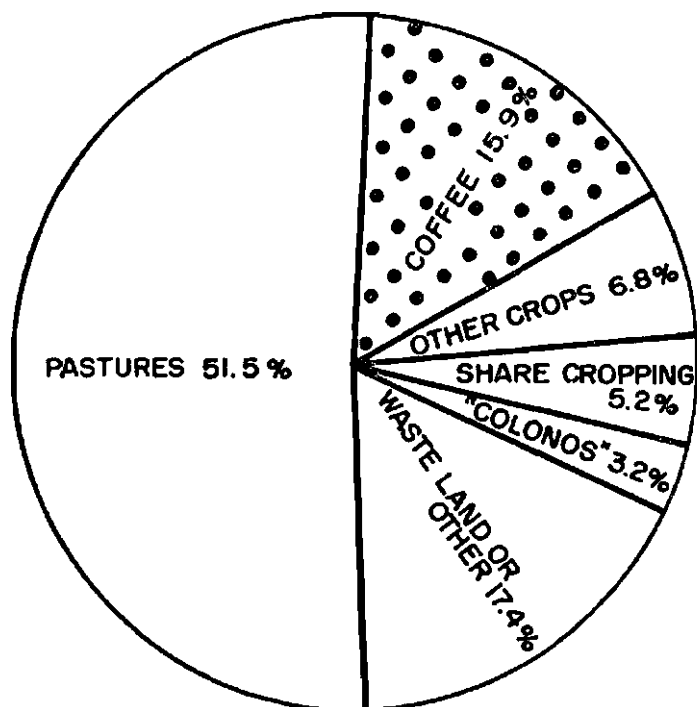
The economic importance of each of the main activities on coffee farms is reflected in the following estimates of gross value produced by each in 1958 (see also figure VII) :

Product	Gross farm value produced on coffee farms, 1958 (millions of cruzeiros)	Percentage
Coffee . . . . .	20 590	51.6
Cattle (except milk) . . . . .	3 900	9.8
Milk . . . . .	3 250	8.1
Sugar cane . . . . .	2 940	7.3
Cotton . . . . .	2 150	5.4
Maize . . . . .	2 110	5.3
Rice . . . . .	1 210	3.0
Eggs . . . . .	990	2.5
Pigs . . . . .	820	2.1
Groundnuts . . . . .	510	1.3
Castor beans . . . . .	440	1.1
Other . . . . .	990	2.5
Total gross value produced . . . . .	39 900	100.0

The predominant role of coffee in the total value obtained emerges clearly from these data, as the value of its production was almost three times as high as the estimated value of cattle and milk together, and about seven times that of sugar cane, the most valuable single crop after

FIGURE VI

THE USE OF LAND ON COFFEE FARMS, 1958

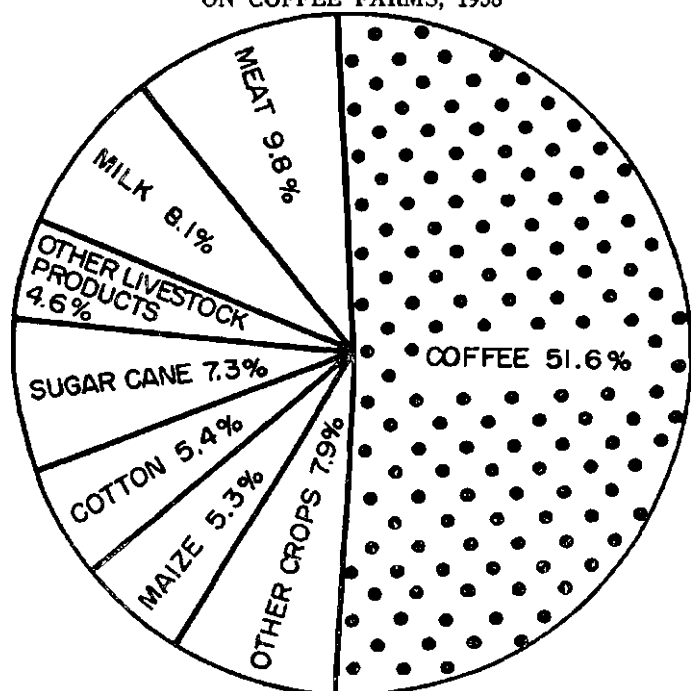


coffee. But the evidence also demonstrates that commodities other than coffee have already acquired considerable commercial importance. Taken together, the non-coffee-growing activities contributed nearly as much to the total gross value of farm production as did coffee growing itself.

Unfortunately it is impossible to compare these estimates for 1958 with similar ones for other periods. Yet it ap-

FIGURE VII

DISTRIBUTION OF GROSS FARM VALUE OF PRODUCTION ON COFFEE FARMS, 1958



pears that the traditionally highly specialized coffee farm structure may have been modified by the rapidly changing economic conditions in the post-war period. This is not to say that there were no other commercial activities existed on coffee farms. The rapid introduction of cotton during the 1930's is a notable example of such a development. But the recent rise in non-coffee activities seems both to cover a wider range of products and also to grow in new directions.

The most important recent development has been the increasing association of animal husbandry with coffee production. The manures produced are especially valuable in connexion with the maintenance or restoration of low-yielding coffee plantings. At the same time animal husbandry could be practiced on the pasture land formerly used for coffee growing, but which no longer provided economic returns.

The association of dairy production with coffee growing has gained special prominence, and it is estimated that currently probably over half of the State's total milk supplies originate on farms also producing coffee. If the value of the meat produced by dairy cattle is added to that of milk production, the total gross value produced by the dairy enterprise on coffee farms may be calculated at about Cr. 4 500 million in 1958. This represents more than one fifth of the farm value of coffee production in the same year.

Another important livestock activity associated with coffee is poultry raising. The introduction of the poultry-coffee combination is of recent origin, and perhaps owes much of its original acceptance to the high nutrient content of chicken manure in restoring old coffee plantings. By now, however, most commercial poultry farms specialize in egg production, and meat and chicken manure constitute important by-products. It is estimated that there were more than eight million chickens on coffee farms in 1958.

Sugar cane, cotton and maize are the principal non-coffee crops on the coffee farms in São Paulo. Together these three crops added about Cr. 6 500 million to the gross value of production, nearly the same value as that contributed by dairy and cattle production together. The total value of all smaller crops, not including the three already mentioned, amounted to close to Cr. 3 000 million, about equal to that of sugar cane production. In addition, maize and beans are widely grown by *colonos* for subsistence purposes.

The competitive situation of the various crops in relation to coffee varies considerably, and this point will be further analysed in section V.

Suffice it to point out here that many crops have apparently already found a place in the production plan of coffee farms and that this process would seem to be part of an important change in the farm structure itself.

The growth of the internal market for food and agricultural products is the main underlying force which now stimulates the diversification process. The strong industrialization movement in São Paulo has raised the level of real incomes and has attracted workers to already large urban centres, thus causing the demand for food and other farm products to rise steeply. Rates of population growth in São Paulo are also high, both on account of natural increase and because of immigration from other parts of Brazil and abroad. Added to this is the fact that coffee yields tend to decline gradually with the advancing age

of trees, and that the present average level is already rather low.

Generally speaking, the degree of diversification of coffee farms is higher in the more easily accessible eastern parts of the State than in the western areas. In the former, dairy and poultry production and the cultivation of fruit and vegetables are of special importance. Those enterprises are favoured by geographic factors and by the fact that coffee yields in the east are smaller than in the west. Further west, the principal non-coffee crops are cotton, ground-nuts, castor beans and other less perishable and relatively high-priced cash crops.

As long as farm prices for coffee were at high levels, the returns from coffee growing greatly exceeded those of most other agricultural activities. But, in the last few years, prices for coffee have fallen appreciably, both in absolute and in real terms, while the prices of other products have usually at least kept up with the rise in the general price level. These divergent price tendencies have no doubt exercised a strong influence in recent years.

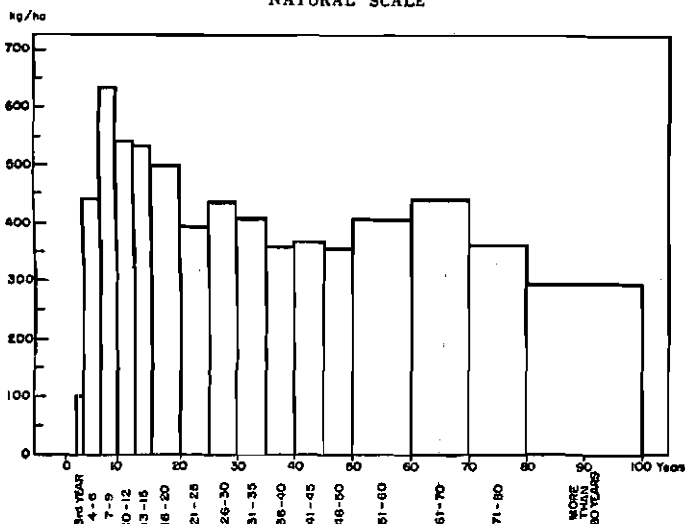
## 6. VARIATIONS IN COFFEE YIELD

Coffee yields on individual farms, or on specific groups of plantings, are determined by a host of different physical and economic factors. Owing to the perennial character of coffee growing, the yield of any one year is affected as much (or more) by the accumulated conditions of previous years as by those prevailing in the year of the crop.

A large part of the variations in yields of coffee plantings is explained by the impact of two important physical variables mentioned earlier: age and variety. The evidence shows that, as conditions are in São Paulo, these two factors have a strong impact on yields, especially in the first 20 years of the planting's existence, which are at the same time its most productive years.

Figure VIII gives the average yields, in 1958, of coffee plantings for age groups up to more than 85 years. These data refer to all plantings in the State, regardless of variety, soil type, cultivation technique or other important factors.

**FIGURE VIII**  
AVERAGE YIELD PER HECTARE OF PLANTINGS OF DIFFERENT AGES, 1958  
NATURAL SCALE



No yield was reported for plantings one or two years old. In the third year, which is still generally considered to belong to the formation period, a small production of 99 kg per hectare was registered. Plantings 4 to 6 years old showed the first complete production at 441 kg per hectare. Another sharp increase can be noted for the 7 to 9 year old plantings, which yielded 634 kg per hectare. The latter figure was at the same time higher than that of any other age group and therefore appears to coincide with the maximum of the age-yield cycle. The next most productive age group showed yields somewhere between those of the 4 to 6 and the 7 to 9 year old plantings. Further declines, smaller than those registered immediately after the maximum, took place subsequently, average outputs approaching 400 kg per hectare for plantings just over 20 years old.

It should be emphasized that, after the initial maturation period, a large part of the age-yield fluctuations are actually a reflection of inadequate growing methods, particularly the failure to replenish soil nutrients. Under fully modern conditions no large decline in yields need occur after ten years.

The fact that maximum yields in São Paulo seem to fall within the 7 to 9 year group, as compared with the 10 to 12 year group in both Colombia and El Salvador, merits some attention. It is perhaps explained by the rapid introduction of higher-yielding trees in the past decade, the commercial production performance of which is not yet fully known over a long period. The lack of shade cover may be another factor which tends to advance the yield maximum of São Paulo plantings, for it is known that this also leads to higher output in the first productive years. Insufficient data are available for it to be concluded definitely whether the occurrence of maximum yields in the 7 to 9 year group is a characteristic feature of coffee cultivation in São Paulo or whether the 1958 figure has been influenced by special factors. The following average yields were obtained in 1958 for specified age groups up to 25 years:

Age of plantings (years)	1958 yield per hectare (kilogrammes)
3	99
4-6	441
7-9	634
10-12	541
13-15	536
16-20	499
21-25	392

For ages up to about 25 years, it may be assumed that these yield differences approximately reflect the experience of individual plantings over a like period, at least in relative terms. No significant portion of these relatively young plantings is likely to have been eliminated or abandoned up to 1958, and average yields in that year therefore represent a cross-section of the plantings established in a given period.

Though the yields of age groups up to 10 years are higher than "normal" due to the introduction of new varieties, it will be seen that, starting with the 10 to 12 year groups, yields fall significantly for each succeeding group. Plantings of 21 to 25 years produced, in 1958, yields 25 to 30 per cent below those obtained in the 10 to 12 year group. This reveals a marked influence of age and soil depletion on yields.



On the other hand, there appears to be no clear relationship between age and yield for age groups over 25 years, as is seen from the following data:

Age of plantings (years)	1958 yield per hectare (kilogrammes)
26 - 30	435
31 - 35	405
36 - 40	357
41 - 45	365
46 - 50	355
51 - 60	406
61 - 70	440
71 - 80	361
more than 80	294

Except for the very oldest plantings (over 80 years), average yields in these age groups fluctuated irregularly around 400 kg within a margin of about 10 per cent on either side. Yet it would not be reasonable to conclude that age has no effect on yields after plantings have reached the age of 25 years. The evidence is that older plantings are still subject to further degeneration, but that for the more advanced age groups 1958 yields no longer represent an average cross-section. This is due to the fact that the older plantings are subject to a continual process of selection, abandonment and/or elimination, as their yields decline further. For that reason, the majority of older plantings which still exist are of better than average quality. More fertilizer is also used on older plantings, as the survey results have shown. These tendencies seem to compensate for most of the natural effects of age, and soil depletion and they indicate that farmers take remedial action when certain minimum levels of yield are reached.

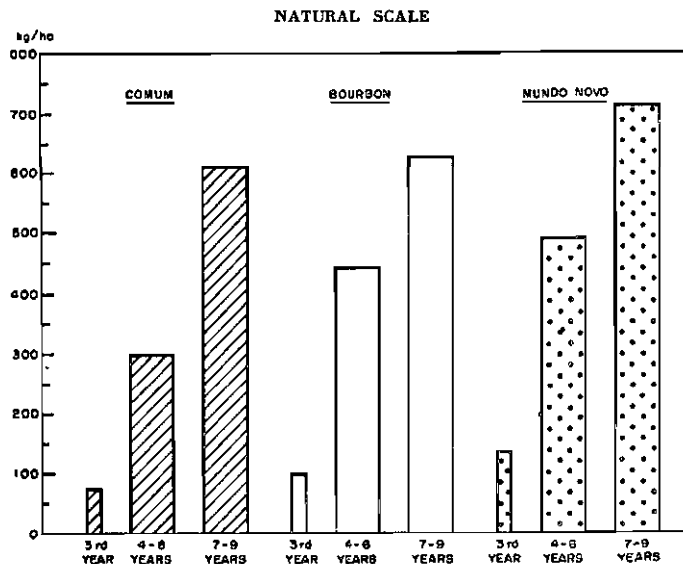
It is interesting to note that these factors gradually become important after the plantings have passed the age of 20 years, which, in 1958, also coincided with yields of about 400 kg per hectare. Detailed estimates, made for purposes of the present survey, also indicate that this level corresponded, on the basis of 1958 cost and price relationships, roughly to the minimum yield for coffee growing to be profitable. The two findings are apparently consistent.

It was mentioned earlier that yields in the younger plantings not only reflect the maturing process but, in the specific case of São Paulo, also the impact of the shift towards improved varieties, which was already discussed. As the new trees produce higher yields, this factor raises average yields in the age groups up to 10 years. The following average yields result by main varieties:

Age of planting (years)	Yields per hectare, 1958 (kilogrammes)		
	Comum	Bourbon	Mundo Novo
3 . . . . .	74	100	135
4 - 6 . . . . .	297	442	491
7 - 9 . . . . .	610	625	710
10 - 12 . . . . .	525	551	...
13 - 15 . . . . .	544	532	...
16 - 30 . . . . .	451	460	...

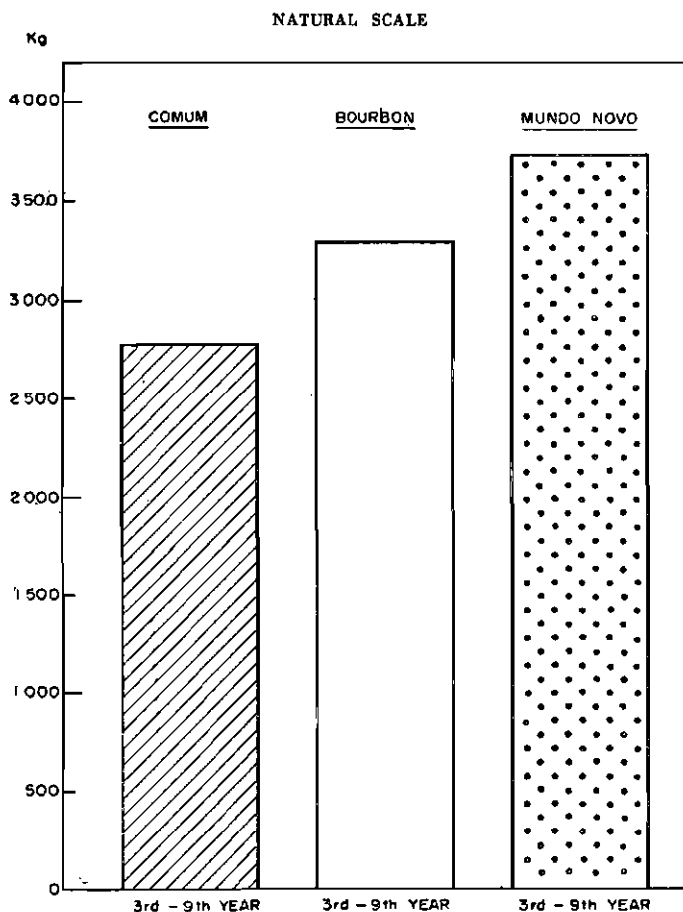
The superiority of *Mundo Novo* over *Comum* is apparent from these figures. Up to the age of nine years, a hectare of this type produced, under average commercial conditions, nearly 1 000 kg of coffee more than *Comum* (see figures IX and X). As the value of this additional production alone represented about two-thirds of the entire establishment costs of the *Mundo Novo* planting, the power

FIGURE IX  
ANNUAL YIELDS UP TO NINE YEARS FOR COMUM, BOURBON AND MUNDO NOVO, 1958



ful incentive to change to this variety becomes apparent. This is further enhanced by the fact that the introduction of *Mundo Novo* does not require other changes in growing methods or extra investment. The yield margin for

FIGURE X  
TOTAL PRODUCTION OF ONE HECTARE OF COFFEE OF DIFFERENT VARIETIES IN FIRST SEVEN PRODUCTIVE YEARS



this tree-type thus brings a significant increase in net profits. Consequently, once *Mundo Novo* became available for distribution, this type was used on more than half of all new plantings.

The remarkably higher yield of *Mundo Novo*, which was established through the survey, is representative of all the plantings of this type thus far made in São Paulo, some 87 million of which produced a crop in 1958. Tests carried out under above-average conditions may show even better results, but the significance of the figures just presented is that they reflect normal commercial conditions of production, which are, of course, not optimum.

The comparison of *Bourbon* with both *Mundo Novo* and *Comum* is complicated by the circumstance that, in the past decade, new improved strains of *Bourbon* were distributed, which are indistinguishable from earlier strains for the purposes of the present survey. But the available figures show that for existing plantings of up to nine years *Bourbon* produced a margin over *Comum* of some 500 kg per hectare, whereas it fell short of *Mundo Novo* by approximately 450 kg. Average yields for *Bourbon* were therefore more or less equidistant between those of *Comum* and those of *Mundo Novo*.

### III. MAIN ECONOMIC FACTORS AFFECTING PRODUCTION

The combination in São Paulo of relatively low yields and of declining coffee prices in the last few years has led to a price-cost squeeze on many farms in the State. At the same time, the large-scale introduction of new varieties and types of trees, and the intensive experimentation with more modern cultivating techniques are focusing attention increasingly on the cost structure of coffee growing and on methods to improve this structure in accordance with present technical and economic possibilities.

In order to appraise such possibilities, it is necessary to review briefly the current situation as regards production costs. Detailed data were collected through the survey on the use of capital and labour, the principal inputs, and on the application of fertilizers, machinery and equipment in the various phases of coffee production.

#### 1. USE OF FIXED CAPITAL

Due to the perennial character of coffee cultivation, fixed investment per unit of product greatly exceeds that of annual crops. In 1958, an average of 77 400 cruzeiros was invested in each hectare of coffee planting and in the corresponding share of farm buildings and equipment, which is equivalent to 159 cruzeiros per kilogramme of coffee produced. As one kilogramme of coffee on the farm in 1958 had a value of about 29 cruzeiros, this means a capital-output ratio of more than five to one.

More than three fourths of this capital investment is accounted for by the coffee trees themselves (51.2 per cent) and by the value of the land (26.1 per cent). The next important item is workers' housing, which is practically always owned by the farm. Among the smaller investments items are, in order of declining importance, installations for coffee processing, automotive power, work animals and miscellaneous equipment (see figure XI). The following table shows the average investment per hectare

An evaluation of the improved varieties for a longer period is not yet possible, for *Mundo Novo* was available on a commercial scale only after 1950. On the other hand, the use of *Caturra* was too infrequent in any year for its average performance to be measured by a sample survey of limited coverage. The performance of *Bourbon* in plantings of ten years and older differed very little from that of *Comum* according to the reported data. But the yield differences in favour of the improved varieties, especially *Mundo Novo*, in the first ten years after establishment have apparently already been amply sufficient to justify their large-scale introduction and to prove their competitiveness.

Despite the significant variation in yields between age groups and between different varieties, it is stressed that many other factors, such as soil type, tree density, cultivation practices, etc., also affect yields. After a detailed analysis, which will be presented separately, it is concluded, however, that a large part of the differences in yield may be attributed to the independent effects of age and of variety. But as the available data cover only one year, they are intended primarily as an illustration of the yield structure, rather than as a measure of future yields.

of coffee planting for nearly 500 representative farms which were covered in the survey:

Type of investment	Amount invested per hectare of planting, 1958 (thousands of cruzeiros)	Percentage
Land . . . . .	20.2	26.1
Trees . . . . .	39.7	51.3
Housing, etc . . . . .	9.9	12.8
Processing installations and equipment . . . . .	3.3	4.2
Automotive power . . . . .	2.9	3.8
Work animals, etc. . . . .	0.8	1.1
Miscellaneous equipment . . . . .	0.6	0.7
Total . . . . .	77.4	100.0

It will be seen that 95 per cent of the total investment referred to consists of fixed capital and only about 5 per cent of other kind of capital. At the same time, at least two thirds of the total farm investment is represented by the capitalized value of the farm's own labour, whereas only about one third of the investment consists of land or items in the non-agricultural sector. The former category of items includes the coffee trees themselves and a large part of the housing and other construction. Practically the only items originating outside the farm are automotive power and some minor installations and equipment. These characteristics are important as they affect the degree to which growers would be able to modify the farm structure and the pattern of production with available resources.

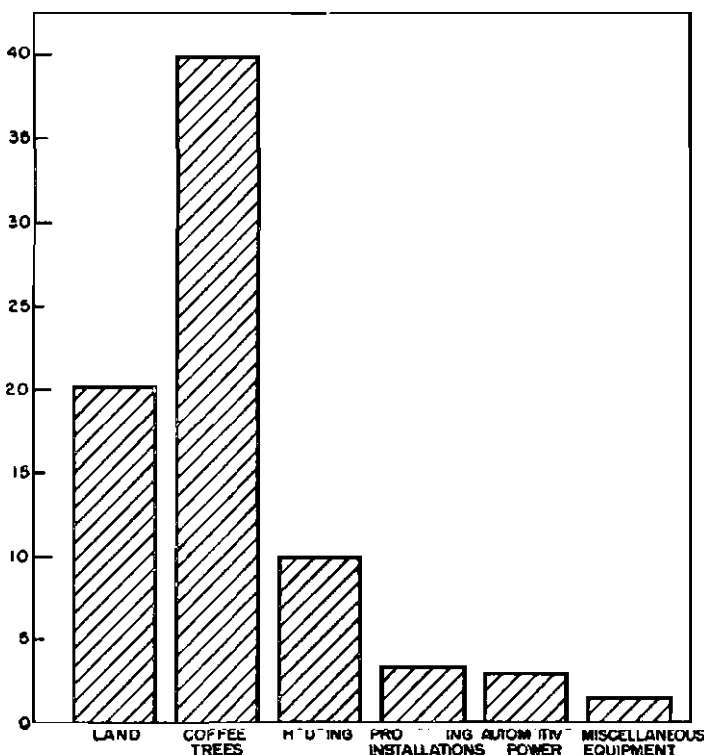
The data on capital investment also illustrate the low level of mechanization on coffee farms. Practically the entire investment in machinery and power is for the coffee-processing installations and lorries and other vehicles required for the transport within the farm of the crop and of materials such as fertilizers and manures. This is a

FIGURE XI

AVERAGE VALUE PER HECTARE OF COFFEE PLANTING, 1958

NATURAL SCALE

Thousands of cruzeiros



result of the difficulty of mechanizing the principal growing operations, especially the harvest itself, which on the average absorbs nearly 40 per cent of total labour requirements. As sufficient labour is maintained on the farm to guarantee the timely harvesting of the crop, the farmers are also less interested in mechanizing operations such as weeding, which are performed in other months of the year. Apart from this, the high cost of all machinery as compared with the outlay on labour is of course one of the principal factors working against the mechanization of coffee growing in a more general sense.

It is difficult to estimate accurately what share of production costs is accounted for by the use of capital. The rate of capital depreciation depends largely on the way in which the plantings are managed, the type of soil and its susceptibility to erosion, the age of the trees, etc. However, if the additional economic life of the average existing coffee planting in 1958 is considered to be 20 years, that of constructions 30 years, and that of mechanical equipment, installations and work animals 10 years, it may be estimated that the cost of depreciation of a hectare of coffee planting amounted to about Cr. 3 000 in 1958. This is equivalent to Cr. 4.6 for each kilogramme of coffee produced on the average.

No depreciation of the land is included in this estimate, although most coffee land is subject to considerable physical deterioration as a result of erosion and depletion. It is considered, however, that the reported land values were also determined by many factors unconnected with coffee production or with agricultural productivity in general.

The cost of the use of capital itself, i.e. the interest to be applied to the amount invested must be added to depreciation, in order to find the total capital cost. The use

of a conventional interest rate of 6 per cent seems indicated here, since it may be assumed that the current value of coffee properties fluctuates in accordance with rises in the general price level, and the rate need not therefore make allowance for inflation. The average cost of interest would be of the order of Cr. 4 600 per hectare of planting, and Cr. 6.9 per kilogramme of coffee at 1958 prices. (The average farm price in 1958 was Cr. 28.7 per kilogramme.)

As might be expected, larger farms have in general a more economic capital use pattern than smaller ones because their investment in housing, other constructions and installations is correspondingly lower per hectare.

A close relationship was found between the amount of capital invested per unit of product and yield. The following table referring to the 500 farms covered shows that, as yields increase, the amount of capital required per unit of product falls steadily:

Yield per thousand trees (kilogrammes)	Capital investment per 100 kg of coffee (thousands of cruzeiros)
up to 200	22.4
201 - 300	20.6
301 - 400	12.0
401 - 500	14.2
501 - 600	12.5
601 - 700	11.0
701 - 800	10.4
801 - 900	7.6
901 - 1 000	8.1
1 001 - 1 100	6.1
1 101 - 1 200	7.1
more than 1 200	9.9

This influence of yield on capital cost per unit of product is a strong argument in favour of high-yielding plantings, especially since it will be seen later that similar findings apply for many other important cost items. The advantages derived from a situation of high yields must, therefore, not be examined in the light of capital utilization only but must take due account of the entire production relationship. But one general conclusion stands: owing to the high proportion of fixed and overhead costs, profits from coffee growing vary more sharply with yields than those of most other farm activities.

## 2. USE OF MANPOWER

On the majority of farms and at present levels of technique, manpower is still practically the only variable input in coffee production in São Paulo. The individual farmer faces the problem of cultivating a structure of plantings, which can only be modified at considerable cost. Non-labour items of expense, on the other hand, such as fertilizers, pesticides, machinery and equipment, are of much smaller economic importance, and their use is mainly limited to a relatively small minority of progressive farmers. There are no indications so far that the heavy dependence on manpower for coffee production is diminishing, and even the wide application of technical improvements would bring little or no change.

In the year preceding the 1958 crop, an average of about 72 man-days were used in attending each hectare of producing coffee plantings, which corresponds to 95 man-days per 1 000 coffee trees. Correspondingly, one kilo-

gramme of coffee represented, on the average, a current labour use of 1.18 man-hours and an actual labour cost of 9.4 cruzeiros.

Harvest operations accounted for 37.6 per cent of all labour use and absorbed 217 man-hours per hectare (see figure XII). Weeding represented most of the remaining use of labour (about 36 per cent of the total). Other operations were of much smaller importance than the two major categories already mentioned. They included the preparation and application of fertilizer (8.8 per cent), the maintenance and repair of installations and equipment (6.8 per cent), the control of pests and diseases (4.8 per cent) and various other activities (6.5 per cent).

The labour cost per 100 kg of coffee seems to vary considerably from one region of the State to the other as is illustrated by the following findings:<sup>4</sup>

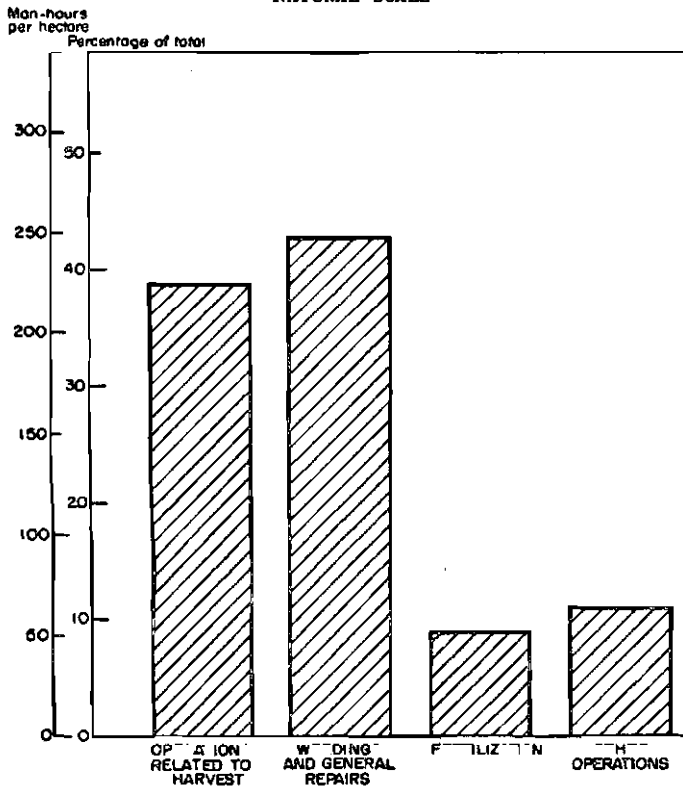
Region	Number of farms in sample	Use of cultivating and harvest labour per 100 kg 1958 (man-hours)	Yield per ha 1958 (kg)
Mogiana . . . . .	50	161	408
Alta Mogiana . . . . .	63	143	330
Central . . . . .	119	88	612
Araraquarense . . . . .	69	152	432
Noroeste e Alta Paulista	84	118	498
Sorocabana . . . . .	92	119	498
<b>São Paulo . . . . .</b>	<b>477</b>	<b>118</b>	<b>488</b>

<sup>4</sup> These figures are based on the second (B) sample of farms, which was less extensive in coverage than the basic (A) sample. For this reason the findings of the two samples are not always identical. The average yield of the above farms (488 kg/ha) is, for instance, slightly above the real State average yield of 446 kg per hectare.

FIGURE XII

THE USE OF LABOUR BY MAIN OPERATIONS, 1958

NATURAL SCALE



The regional data show that the variations in labour cost are closely related to yields. The lowest costs are reported in the *Central* region, which also has the highest yield average in the State (more than 600 kg). At the other extreme, *Mogiana* has labour costs nearly twice as high as those in the *Central* region and yields around 400 kg. As regards the principal producing zones in the western part of the State, it will be seen that in both *Sorocabana* and *Noroeste e Alta Paulista*, average labour costs are at about the State average level. But *Araraquarense* appears to have higher production costs.

Although the differences between the results obtained on individual farms are very large, farms with the hired-labour (*colono*) system or sharecroppers used labour more efficiently on the average than the usually small family concerns. These three types of farms comprise the large majority of coffee holdings in São Paulo, and average labour use resulted as follows for each type:

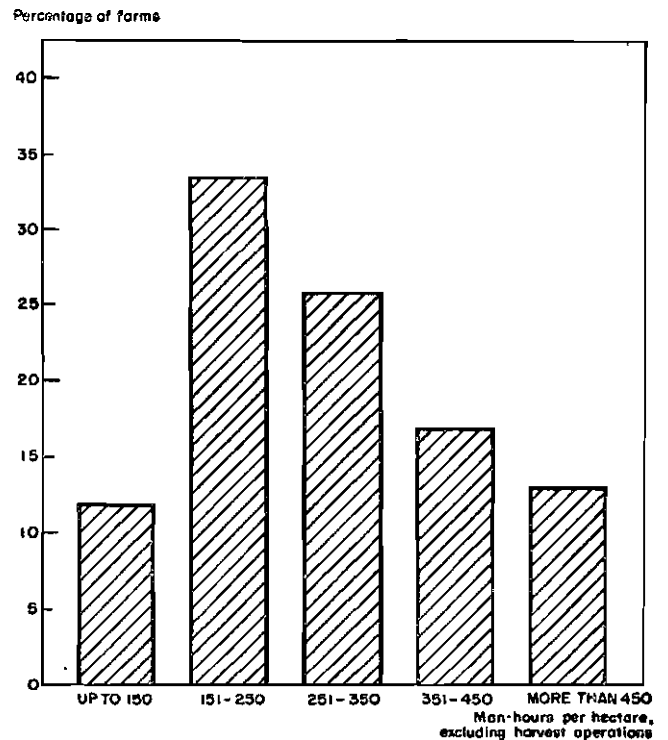
Type of farm	Labour use per 100 kg of coffee (man-hours)
Hired labour system . . . . .	116
Sharecropping system . . . . .	114
Family farms . . . . .	193

It was also established that labour costs are lower for larger farms than they are for smaller ones. This is true despite the fact that techniques of farming do not appear to differ greatly between farms of different sizes. Furthermore, there is little reason to suppose that economies of scale are effected in the manual processes of coffee cultivation. The reasons for the differences in labour costs are attributable rather to the physical structure of the

FIGURE XIII

FREQUENCY DISTRIBUTION OF FARMS BY CULTIVATION INTENSITY, 1958

NATURAL SCALE



respective coffee plantings, i.e. their composition by age and by type of trees, and not to the inherent superiority of large-scale farming as such.

The relative uniformity of growing practices in São Paulo is illustrated by the concentration of a high proportion of the farms in a rather small range of cultivation intensity (see figure XIII). On about 60 per cent of the farms, these intensities (i.e. labour use excluding harvest operations) were found to range between 150 and 350 man-hours per hectare. Nearly 90 per cent of the farms devoted less than 450 man-hours per hectare. The proportion of intensively cultivated farms, with a wider range of advanced operations such as fertilization, pruning, replanting, etc., therefore appears to be small.

Owing to the perennial character of coffee growing, maintenance operations come under the heading of overhead. Regardless of the yields obtained, many current operations, such as three to five weedings annually, must be performed, and the corresponding labour use is relatively constant per area unit. This leads to a clear gain in efficiency for plantings of above average yields.

The close relationship between yield and average labour costs is indicated by the following data (see also figure XIV):

Yield in kg/1 000 trees	Labour use per 100 kg coffee per man-hours		
	Total	Harvest	Cultivation
up to 200 . . . . .	302	130	172
201 - 300 . . . . .	210	93	117
301 - 400 . . . . .	148	75	73
401 - 500 . . . . .	133	72	61
501 - 600 . . . . .	103	56	47
601 - 700 . . . . .	86	48	38
701 - 800 . . . . .	87	49	38
801 - 900 . . . . .	58	37	21
901 - 1 000 . . . . .	63	36	27

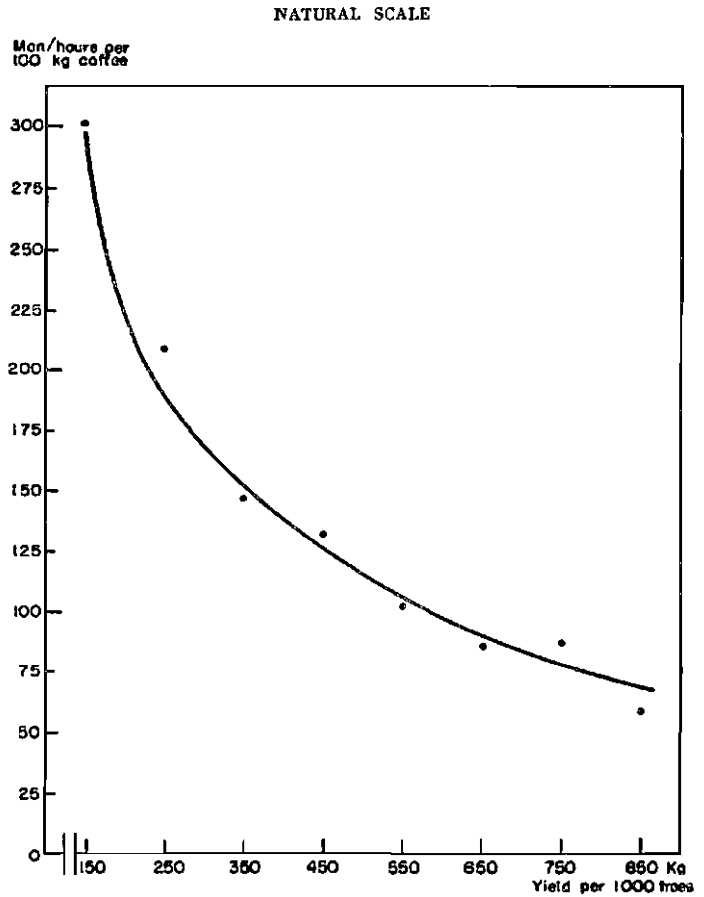
Total labour cost per 100 kg coffee declines steadily as yield increases, from about 300 man-hours per 100 kg for yields below 200 kg per 1 000 trees to less than 100 man-hours for yields above 600 kg per 1 000 trees. This gain in labour efficiency is attributable both to a saving in cultivation operations, as already mentioned, and to lower harvesting costs, as yields increase. High-yield plantings have therefore a strong advantage over low-yielding ones from the point of view of labour use.

As the range in yields in São Paulo is rather large because of differences in the age and variety of plantings, soil conditions, the use of fertilizers, etc., the amount of labour used to produce 100 kg of coffee also varies greatly from farm to farm. Although the average use of labour for the State in the crop year 1958 amounted to 118 man-hours per 100 kg of coffee, 16.6 per cent of the plantings absorbed more than 200 man-hours. On the other hand, 42.8 per cent were able to produce at a cost of less than 100 man-hours per 100 kg:

Use of labour per 100 kg coffee (man-hours)	Percentage of farms	Percentage of trees
up to 100 . . . . .	31.6	42.8
101 - 200 . . . . .	43.2	40.6
201 - 300 . . . . .	12.0	9.2
301 - 400 . . . . .	6.9	4.2
more than 400 . . . . .	6.3	3.2
Total . . . . .	100.0	100.0

The present discrepancy between the intensity of labour input and the average level of resultant productivity em-

FIGURE XIV  
LABOUR COST AT VARIOUS LEVELS OF YIELD, 1958



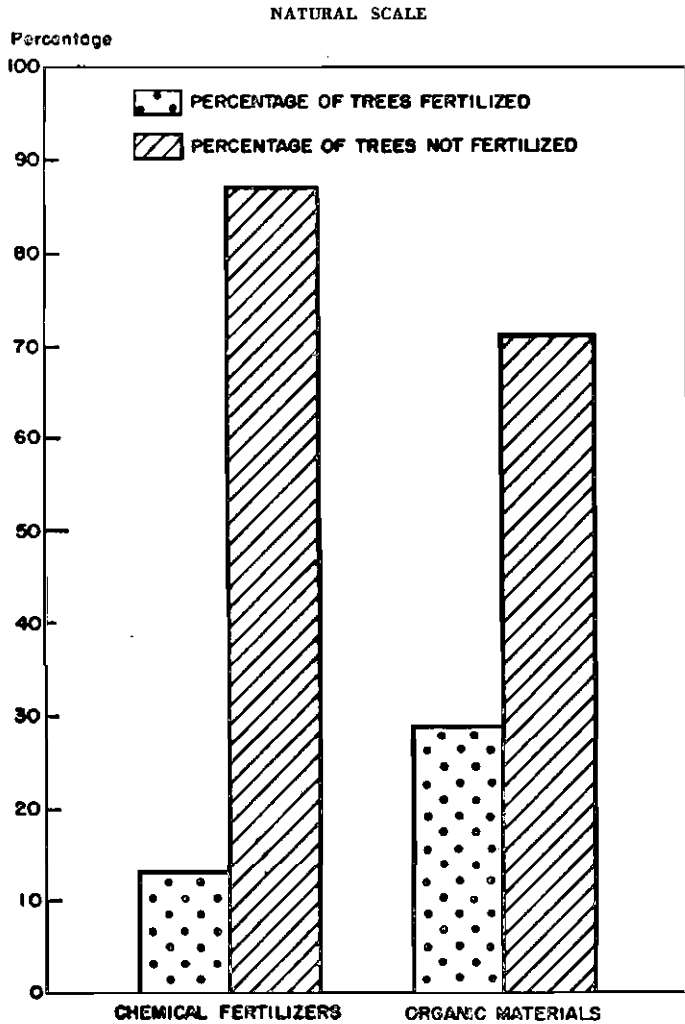
phasizes the fact that this major resource is being used uneconomically in many farms. Though total (excluding harvest) labour input per hectare may fluctuate owing to certain soil-type and other ecological differences, this seems to be largely caused by differences in the quality of the work. Thus no great differences in technology can be observed between farms using, say, 200 and those using 400 man-hours per hectare. Unfortunately it was not possible, for the purposes of the present survey, to analyse operating efficiency within given levels of total labour use.

### 3. USE OF FERTILIZERS

The use of organic and chemical fertilizers in São Paulo has become rather common in the relatively recent past. Available information indicates that few major coffee-producing areas in the world equal this State in the average intensity of fertilization. Yet this is more the result of the very small use of fertilizers in coffee growing than to the intensive application of fertilizers in São Paulo. The large majority of existing coffee plantings are not yet benefiting from the rational administration of either organic or chemical fertilizers, as was clearly established in the present survey.

About 13.2 per cent of all trees received chemical fertilizers in 1958. On the other hand, a considerably larger proportion (some 29 per cent) were treated with one or more types of organic materials. Furthermore, the latter are frequently applied in rotation, which raises the total proportion of trees treated over a longer period. As the

**FIGURE XV**  
THE INTENSITY OF FERTILIZER USE IN 1958



use of both types of fertilizers is common on farms applying chemicals, it may be estimated from these figures that at least 60 per cent of all existing trees were not fertilized at all in 1958, while the remaining 40 per cent received one or more types of fertilizer in varying quantities (see figure XV).

It is estimated that altogether about 103 000 tons of chemical fertilizers were applied in the survey year, as against 4.6 million g of organic materials, the unit nutrient content of which is of course much lower. The estimated contents of the fertilizer main elements of both types of fertilizer are as follows:

TOTAL NUTRIENT CONTENT OF FERTILIZERS APPLIED IN COFFEE PLANTINGS IN SÃO PAULO

	Chemical	Organic
N . . . . .	9 000	30 000
P <sub>2</sub> O <sub>5</sub> . . . . .	11 000	12 000
K <sub>2</sub> O . . . . .	13 000	31 000
	<u>33 000</u>	<u>73 000</u>

The above table shows that two to three times as much nutrient was applied by the use of organic materials than with chemicals (see figure XVI). This is interesting since there has been some controversy about the use of chemical

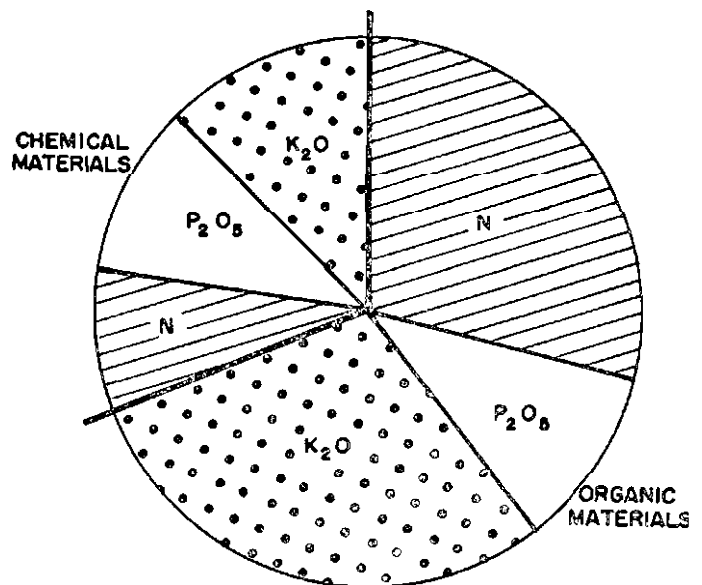
fertilizers. Unfortunately no comparable data are available for years other than 1958, but the present figures at least show that chemical fertilizers now account for a sizable proportion of the total nutrient value applied.

Many different types of chemical fertilizers were used, but more than half were mixed formulae containing various nutrient ingredients. On the other hand, the composition of organic materials was less varied: about two thirds of their total weight consisted of cattle manure, a clear indication of the importance of the coffee-livestock combination. Another 11 per cent was made up of coffee hullings. Smaller quantities of compost, bone-meal, mulches, green manures, etc., were also applied. Among the minor groups, the importance of high-nutrient materials merits special mention. It is estimated that about 80 000 tons of poultry droppings and nearly 50 000 tons of oilseed meals (cottonseed, groundnut and castor bean mainly) were spread on the State's coffee plantings. The importance of poultry manure reflects the increasing frequency of the coffee-poultry farm already mentioned. On the other hand, the use of oilseed meals on a relatively large scale is a curious phenomenon in a region of expanding dairy production, where many such meals could be used as feed concentrates if properly processed.

It is significant that more than 90 per cent of the organic materials used as fertilizer are obtained on the farms themselves. This appears to have a strong influence on the farmer's choice of materials. The chemical ingredients must be purchased from outside sources and their prices are relatively high, as a portion of the nutrients is imported.

The issue of organic versus chemical fertilizers therefore has its economic as well as its technical aspects. Chemical fertilizers are expensive and have to be obtained from outside the farm. Most organic materials are available on the farm at a relatively small cost. Nevertheless, the cost of preparing and applying organic fertilizers is

**FIGURE XVI**  
PROPORTION OF FERTILIZER NUTRIENTS\* DERIVED FROM ORGANIC AND CHEMICAL MATERIALS, 1958



\* Based on the sum, by weight, of the nutrient elements N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O.

considerable because of the greater volume of materials handled and their lower nutrient content. It is estimated that the total cost of applying a given quantity of nutrient by means of organic materials in São Paulo, is, on the average, at least twice as high in terms of labour and transport as is the case with chemical materials.

The survey established various interesting differences in fertilizer use among different farm groups. In the first place, it was noted that the use of chemical fertilizers is practically unknown on smaller farms and increases steadily with size, as shown below:

Size group (trees)	Percentage of chemical fertilization
up to 32 000 . . . . .	6.0
32 - 64 000 . . . . .	11.8
64 - 128 000 . . . . .	22.0
more than 128 000 . . . . .	28.2

No important variation in the use of organic materials was found between the different size groups.

It was also observed that farmers try to offset the effects of the increasing age of their plantings, coinciding with greater soil depletion, by increased fertilization. Whereas the proportion of trees under 16 years old, which were fertilized with chemical or organic materials, was about 10 and 24 per cent respectively, the comparable figures for trees of 16 years or older were about 20 per cent and 33 per cent. This supports the conclusion that the older plantings existing today are the better ones of their period and that their average yields would be lower but for the wider application of fertilizers which partly compensates for the effect of soil exhaustion and age on yields.

As regards varieties, *Caturra* received more fertilizer than the other types. The fertilization—both chemical and organic—of *Mundo Novo* and *Bourbon* plantings appeared to be of about the same intensity. *Comum* was not fertilized as intensively as the other varieties though the differences were not very substantial.

Variety	Percentage of plantings fertilized	
	Chemical	Organic
<i>Caturra</i> . . . . .	22	26
<i>Bourbon</i> . . . . .	15	32
<i>Mundo Novo</i> . . . . .	14	30
<i>Comum</i> . . . . .	11	27

Despite the higher proportion of fertilizer used on *Caturra* plantings, the large majority of the improved trees planted in the past decade are not being fertilized. This is an important conclusion, for it is often thought that the introduction of new varieties is also a sign of a more general technological advance.

An analysis of fertilizer use by soil type shows that, on the sandy western soils, which are particularly susceptible to erosion, the intensity of fertilizer use was much lower than on the more clay-like soils of the north-east, at least so far as chemical materials are concerned. The use of organic materials shows rather little variation as between regions and farm types.

On the average, each kilogramme of coffee in 1958 represented an investment of about 3.7 cruzeiros in fertilizing materials, including the value of organic products contributed by the farm itself. The cost of application amounted to an average of 1.0 cruzeiro, so that the total expenditure on fertilization may be estimated at about 4.7

cruzeiros per kilogramme, a major element of production costs.

#### 4. COFFEE PROCESSING ON FARMS

Before the coffee enters marketing channels, it is usually processed on farms up to the stage where it can be stored safely. Although in many cases this farm processing takes the simple form of thoroughly drying the product after it comes from the fields, many farms also have equipment ranging from hulling and sorting machines to mechanical dryers.

According to the survey, the investment in processing installations and equipment amounted to an average of 3 300 cruzeiros per hectare, or 4 300 cruzeiros per 1 000 trees in 1958. This represents 4.2 per cent of the total estimated commercial value of the farm and its coffee plantings, but is about one fifth of the value invested in coffee farms, excluding land and coffee plantings. The importance of processing is therefore considerable in terms of investment requirements especially since machinery is one of the few items in coffee production which has to be bought outside the farm.

About 30 per cent of the farms covered in the sample prepared the coffee up to the green stage after drying—usually on brick platforms and occasionally in mechanical dryers—hulling and sorting. The average amount of labour required for these processes was 16 man-hours per 100 Kg coffee, i. e. some 13 per cent of the total up to and including the harvest. The most labour-consuming operations of the processing phase are drying and hand-sorting after hulling.

The coffee is also commonly marketed in the form of dried berries (*coco seco*). On 37 per cent of the farms, this was the final product sold and handling was limited to drying. In São Paulo the fruit dries suddenly and unevenly on the tree as it matures, leaving little time to pick it fresh as is customary in the mild-coffee countries of Latin America. It is therefore already partially dry when it is harvested.

In certain areas of the State, notably in the higher north-eastern zones, the depulping of fresh coffee by the so-called "wet" process seems to be becoming more widespread. This improves the quality of the end product, but it is also much more expensive for the beans have to be picked individually as is common in Colombia and other countries. In 1958, probably not more than 1 per cent of the crop was processed in this way under the incentive of higher prices for depulped grades.

Finally, 25 per cent of the farms reported no formal processing activities. Among this group were the numerous small units, where the coffee is dried under primitive conditions and/or sold in the same form as it is harvested.

#### 5. COST STRUCTURE AND PRODUCTIVITY LEVELS

Despite the great variation in production costs on individual farms, which in turn results in a wide range in the productivity of all resources engaged in coffee production, some important generalizations can be made about the present cost structure in São Paulo.

One of the foremost characteristics of coffee growing in the State is the large proportion of fixed or overhead expenditure. Because of the relatively high commercial value of land and plantings, the large share of certain minimum routine cultivating operations (e.g. weeding)

and of harvest work in total labour use and a variety of minor fixed items such as general administrative outlay, etc., coffee growing has a rather rigid cost structure under present conditions. The causes of this apparent rigidity, which is noticeable throughout São Paulo, seem to derive from the fact that the technical level of operations is very uniform in the whole State and follows a pattern which has not been modified for a long time. New techniques, especially those that have come to the fore in the past decade, have not so far had a significant impact on coffee growing, though considerable attention is now paid to them.

The use of labour, capital, fertilizers and other items was found to be similar by and large in all regions of the State and with all the various major soil types. Furthermore even the use of new tree types seems to have influenced the pattern of cultivation but little, as is apparent from a comparison of tree-spacing, labour and fertilizer application on *Mundo Novo*, *Comum* and *Bourbon* plantings.

The survey consequently established few clear differences in cultivation methods and cost structures between the groups of farms analysed. Perhaps the most significant one is the fact that large farms appear to be following more advanced methods than the small ones, as is illustrated by the more intensive use of chemical fertilizers, higher yields and the more efficient use of harvest labour on the former.

Another example of a different cost structure is the more intensive cultivation pattern which is followed for *Caturra*. This variety requires special care for optimum efficiency but all indications are that this has been one of the main reasons for its limited adoptions under commercial conditions, which strengthens the conclusion that a rather rigid cultivating system tends to prevail in São Paulo.

The high proportion of fixed costs is of course partly explained by the perennial character of coffee plantings, which require a rather heavy permanent investment and maintenance. But they are also partly the result of poor cultivating techniques. The wider adoption of fertilizers, better spacing and advanced growing practices in general would all result in higher variable and lower fixed costs per unit of product.

Despite the relative uniformity of cultivating practices (i.e. input per area unit), great differences in productivity (i.e. input per product unit) were noticeable in the survey year. Total labour costs per 100 kg coffee ranged from less than 100 to more than 300 man-hours for sizable numbers of farms, and yields from 200 to more than 3 000 kg were obtained per 1 000 trees.

#### IV. BASIC TECHNICAL AND ECONOMIC PROBLEMS

The present study covers all types of coffee farms throughout the State of São Paulo. General conclusions may therefore be drawn for the State as a whole with respect to the basic technical and economic problems affecting coffee growers. An objective discussion of these problems is essential if an effective coffee production policy is to be carried out. The following examination of these problems is not exhaustive but it covers some important issues emerging from an analysis of the survey findings.

With the existing structure of coffee plantings and with the relatively extensive cultivation techniques that are common in the State, yields and hence productivity are especially influenced by ecological conditions and by factors which, for all practical purposes, are fixed from the point of view of the farmer, such as the age and variety of his plantings. Average growing techniques have not yet reached the level where the farmers' own effort is the decisive factor in maintaining yields.

Thus a relatively old producing area such as São Paulo faces considerable difficulty at present in competing with zones such as those of Paraná, where newer soils are planted predominantly with improved varieties of rather young and vigorous trees. Nevertheless, basic techniques are similar in both these principal coffee-growing areas. In fact, typical conditions in the neighbouring State of Paraná today are very similar to those in São Paulo 30 to 40 years ago.

But whereas relatively simple techniques are perhaps justified in frontier areas, they no longer fit the case in São Paulo, which is now fully caught up in a process of rapid industrialization and economic growth. It is therefore not surprising that strong competition should make itself felt on São Paulo coffee farms at this stage.

The technological improvements in coffee growing, which are now available after considerable experimentation, offer much that would seem adapted to the evolving economy of São Paulo, e.g. more intensive utilization of the land, the maintenance of adequate soil fertility levels, the partial mechanization of maintenance operations and the use of the best available varieties. On the other hand, relatively few farmers, as yet have adopted such innovations on a commercial scale. This is not to say, however, that the behaviour of farmers is necessarily irrational. As will be discussed later, there are serious technical and financial obstacles in the way of any important transformation of coffee growing in São Paulo, which would need to be removed in order to assist farmers in modernizing their production structure.

Yet, though the original fertility of the soils in São Paulo has been greatly reduced, climatological and other conditions for coffee growing remain especially favourable, a factor which in the long run favours the State's competitive position over many other producing areas. But there is little doubt that the industry will face great difficulties in the short run, unless action is taken to improve the production structure itself. The characteristics of the existing cost distribution already show that such adjustments will be painful and expensive and that they can therefore be effected only at a considerable outlay and with a special impetus in the desired direction.

##### 1. DEFECTS IN PRESENT PLANTINGS

###### (a) *Old plantings and replacement practices*

Despite the large-scale abandonment and elimination of coffee plantings during the 1930's and the Second World War, and despite high plantings rates in the fifteen post-war years, the proportion of trees over thirty years old reached the impressive figure of 31.5 per cent in 1958 (see again figures 2 and 3), a good portion of them exceeding 50 years.



The fact that yields decline with age as soils become depleted, while maintenance costs remain equal, this shows that the productivity of these old plantings is much less than what it could be if proper replacement practices were followed. Higher productivity would not only result from a better age distribution of trees but also from the gradual modernization of existing plantings in keeping with the technical improvements that have become available since the old planting was established.

So far, the general policy of coffee growers in São Paulo has been to reap the highest possible profits from the original capital invested in establishing the plantings, without much further investment which would guarantee reasonable stability in farming. As a result, coffee growing moved to new lands as the original soils and trees were depleted. The older zones therefore contain large tracts of former coffee lands, now frequently turned into low-productive pastures, and a still considerable number of old plantings, many of which are technically in very poor condition.

Thus it is very difficult to indicate any specific age at which it would be economical to replace the old plantings by new ones so as to maximize profits. Variety and soil type are the main determining factors on a well-kept coffee planting. The profit incentive to shift from depleted lands to virgin areas further west, inside or outside the State of São Paulo, has been much stronger up to now than that associated with the stable types of cultivation, including the application of modern technical principles and reasonable replacement practices on existing farms. Yet, in the long run, traditional practices are unlikely to be maintained as they are wasting too much of the land resources.

The harsh fact of the matter is however, that little further opportunity exists today for coffee migration in São Paulo, owing to the incorporation of the last reserves of virgin land in the recent past. A choice must therefore now be made between two clear-cut possibilities. The first would be to leave the situation as it is. This might lead to a gradual decline in coffee growing in the State and to the aggravation of the already serious problems of low productivity. The second would be to try to revive coffee production in order to adapt it more to the present realities of resource availability and to strong world-wide competition, while imparting a more stable growing pattern.

The existence of a high proportion of old plantings and the apparent absence of adequate replacement practices are two signs that the second choice has not so far been widely selected. Other evidence available through the present survey and from other sources confirms this. Thus coffee producers, as well as the State as a whole, are faced with the grave problems outlined above.

#### (b) *Obstacles to modernization*

At a time when little virgin land remains for coffee production and when cultivation may be considered "mature", in the sense that no spectacular changes comparable to those of earlier periods can be expected, growers are facing the fact that new techniques of production are emerging as the outcome of research undertaken mainly over the last twenty to thirty years.

It has been proved that, taken together, the use of fertilizers, soil conservation measures, new varieties and a better layout of plantings may raise productivity to levels much above the prevailing ones.

The São Paulo industry is in a difficult position to adopt such changes despite the benefits that would accrue therefrom, for most of the improvements cannot be applied on the existing old plantings. The lack of soil conservation measures, inadequate spacing and the existence of traditional varieties all require rather profound and costly changes involving the total replacement of present plantings by new ones. Such changes would of course imply strong financial backing and technical assistance.

But, under present circumstances, the farmers most in need of these improvements are also the ones least likely to have sufficient resources or technical preparation for carrying them out. On many low-yielding plantings few, if any, profits are now made from coffee, as appears from a detailed analysis of survey results. Cash incomes therefore barely suffice for a continuation of existing conditions far less large-scale new investment.

It is therefore clear that there are serious obstacles to modernizing coffee cultivation methods in São Paulo and that a special effort would be required to assist this process.

#### (c) *New varieties*

An estimated 85 per cent of São Paulo's tree stock still consists of the traditional varieties (see figure IV). As new planting is of marginal importance and represents the only possibility of spreading improved types, most farms are not benefiting from this important method of raising productivity. Though it is difficult to make a specific estimate of the potential increase in productivity through the introduction of new varieties, because of incomplete data, the magnitude of this factor under average commercial conditions appears to be of the order of 25 to 30 per cent, other items being equal (see figures IX and X).

At the same time, competing producing areas in newer regions are making full use of the improved seeds, having the additional advantage of fertile virgin soils. The introduction of new varieties has so far been one of the few rather general technical changes made by farmers investing in new plantings in São Paulo, and the question arises whether it would not be useful to enhance the State's competitive position by encouraging the current trend towards improved varieties, on the older farms also. Despite the high proportion of new planting with improved seeds, the entire subject of new varieties is thus of marginal importance in São Paulo and is likely to remain so until the older plantings are replaced by new ones.

#### (d) *Soil depletion*

Soil deterioration is probably the most serious standing problem of coffee growing in São Paulo and has existed since the introduction of this crop in the State more than a century ago. In its westward shift coffee expansion has now reached and surpassed State limits, and virtually no areas remain that retain their original fertility. Furthermore, the new post-war plantings, which occupied the last reserves of land, are situated on generally sandy soils in the west, subject to heavy and rapid erosion.

From the point of view of the State of São Paulo as a whole, the soil problem is therefore assuming critical proportions. Losses in soil fertility affect practically all parts of the State and not only the older ones. As a result average yields have dropped and are considerably below

those obtained in adjacent competing areas. Furthermore, part of the soils in Paraná seem to be of higher quality than those of several western zones of São Paulo, a factor which favours competing producers still further.

The problems connected with soil exhaustion are among the most difficult ones to solve, for heavy investment is required to counteract it effectively, and yet it has proved possible to devise new systems of coffee production on the basis of soil restoration, even in the case of soils which were abandoned years ago for coffee growing. The economic aspects of these technological improvements will be taken up in chapter VI.

## 2. DEFECTS IN PRESENT EXPLOITATION METHODS

### (a) *Labour use*

A detailed analysis of labour use in coffee production reveals several important shortcomings which are naturally closely related to the advanced age and bad condition of the plantings themselves. On the one hand, it was found that a uniformly high proportion of labour is spent on the harvest and on basic routine operations which are indispensable. On the other hand, present variations in the intensity of labour use seem to be largely unrelated to differences in cultivation techniques and in productivity. This would seem to imply wide differences in the operating efficiency of this principal resource, which accounts for more than half of all production costs.

On the large majority of farms, the more advanced cultivating methods, including fertilization, pruning, soil conservation measures, etc., are still the exception. More than 80 per cent of the total labour is employed on minimum maintenance operations and on picking the crop (see figures XII and XIII).

This is particularly serious as labour is one of the main resources on which any structural adjustments would have to be based. The alternative use of available manpower in activities conducive to optimum total farm productivity should be the main objective in the efficient employment of this valuable resource, which is generally in ample supply in São Paulo. In view of the relatively high cost of items such as fertilizers and equipment and of capital for agricultural purposes, the rather intensive utilization of labour in solving the problems facing the industry is often preferred by the individual farmer. But the use of labour in this connexion would have to follow a new policy aimed specifically at utilizing technical improvements to raise productivity.

In the course of the rapid agricultural and industrial development now taking place in São Paulo, the role of manpower in coffee production and the way in which it is used will have to be constantly revised in accordance with changing price and cost factors. Rigidity in growing techniques would be a handicap.

### (b) *Fertilizer use*

About 60 per cent of all coffee plantings received no fertilizer at all in 1958 (see figure XV). Fertilizer use therefore appears to be inadequate for maintaining reasonable levels of soil fertility and this is naturally a principal factor affecting coffee yields. At the same time, a detailed analysis of fertilization practices in 1958 leads to the conclusion that a greater use of chemical fertilizers would

contribute more to net farm profits, under 1958 price and cost relationships, than an increase in any other farm input in coffee growing.

It was also found that the use of fertilizers during the formation period of the planting is exceptional and that heavier fertilization takes place once declines in yields caused by soil depletion on older plantings threaten to eliminate profits altogether. At that stage, however, the net effect of fertilization seems to be less than at earlier ages. Again, more fertilizer is being used on the relatively resistant loamy soils in eastern districts than on the sandy western lands, which are subject to rapid soil depletion and erosion. Even at present fertilizer is not always applied in ways which produce the maximum benefits for the State as a whole.

Under present circumstances, a substantial increase is required in the use of fertilizers, with a certain preference for chemical materials. Though the latter represent a high outlay for farmers, flexibility and efficiency in their distribution and their possible adjustment to the specific requirements of present plantings are factors in their favour.

This is not intended to detract from the great value as fertilizers of locally available organic materials which are often by-products of coffee growing and of other profitable associated enterprises. But it is felt that most of the required expansion in fertilizer use will depend on chemical materials.

### (c) *Combinations of advanced practices*

So far only a very small proportion of farmers (1 or 2 per cent) adopt a combination of various advanced practices. The results show that commercial growing standards follow a rather rigid traditional pattern, with the sole exception of the shift to improved seeds in new plantings and of a moderate increase in fertilizer use, often unrelated to the introduction of improved varieties.

In recent years the value of a considerable number of technical improvements in coffee growing has been proved by experiment; together they could bring about important changes in the São Paulo industry. The principal ones are the introduction of new varieties, more adequate spacing of trees, measures of soil conservation in the basic layout of the planting, and the rational use of fertilizers.

The combined application of these practices, even on "old" soils, may in many cases triple present average yields in the State. A farm might therefore produce as much coffee as it does today on a much smaller land area utilizing the available resident manpower. Routine weeding could be partly mechanized, or effected by the use of weed-killers and a considerable part of the land could be assigned to other remunerative enterprises.

A change along these lines would put coffee growing on a technically advanced level, which also appears to be economically feasible. It would also ensure the more efficient use of available resources without requiring great shifts in rural population. Much interest has therefore developed in technical circles in the large-scale adoption of suitable combinations of the modern farm practices mentioned. The low proportion of farmers actually using these methods proves, however, that it is difficult to secure their general adoption. The main factors involved appear to be financing problems and the need to give the farmer more ample technical instruction.

The data show that at present the application of one

growing improvement is largely unrelated to that of another. Though some 15 per cent of the existing trees are of various improved types, only a small portion of them is fertilized. Furthermore, little difference in tree-spacing and in the frequency of soil conservation practices is evident between the new plantings and the older ones. The latter fact is explained by the rather common use of the interplanting (*dobração*) system to replace the old plantings: under this system, new trees are planted between the existing ones, and the layout of the planting remains substantially unchanged once the old trees are removed.

Thus there is little indication of a systematic adoption of a "modern" cultivation system which differs substantially from that traditionally followed in São Paulo. A small minority of farms is using one technical improvement or the other with partially better results. The changing agricultural picture in the State would justify a much more dynamic process of production adjustment in line with that characterizing all rapidly developing areas.

(d) *Cost structure*

A result of this situation is the very high proportion of fixed costs characteristic of São Paulo coffee production. This constitutes, in its own right, a problem of inflexibility and resistance to the introduction of new technology, for it discourages farmers from shifting their factors of production so as to obtain the best possible results under varying conditions. It also greatly hampers the rechanneling of resources from coffee production to other profitable and useful activities, wherever required by changes in demand.

The factors already mentioned in the foregoing paragraphs affect the present cost structure of coffee production in several ways. The presence of many old plantings, which react less efficiently to increased fertilization and other improve practices, iminis es interest in breaking the vicious circle of inadequate cultivation, declining yield and soil erosion through the more efficient use of labour and other inputs. The spread of new varieties, which yield more even with the traditional cultivation system, provides no major stimulus for technical development of the industry through improved growing methods. Finally, until soil erosion in the relatively new western areas has progressed much further, it seems unlikely that farmers will make large-scale investment in the conservation of land resources.

(e) *Low yields*

The general indicator of the problems already mentioned is the low level of coffee yields obtained in São Paulo. Though yields of adult coffee plantings fluctuate between extremes of 100 kg and more than 3 000 kg per hectare, the State average in 1958 was about 450 kg per hectare, equivalent to 540 kg per 1 000 trees. This average level is low, not only in relation to what healthy and well-kept plantings may normally achieve, but also compared with the results obtained in other important producing areas of the world. The most notable difference is that between São Paulo and Paraná. While both States seem to have very similar production techniques, in Paraná the industry has largely developed in the past two decades. Average coffee yields in Paraná, in years not affected by frost damage, appear to be about double those of São Paulo in 1958.

The low-yield problem is one that affects a large portion of existing plantings, as is shown by the following frequency distribution of trees by yield classes (see also figure XVII):

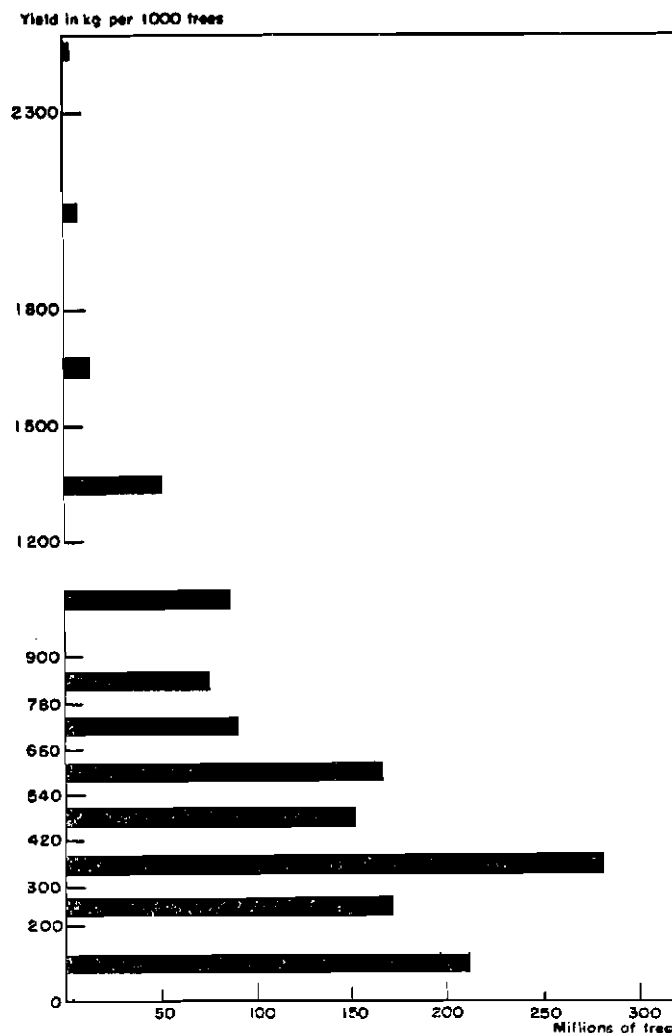
Yield per 1 000 trees (kg)	Millions of trees (rounded figures)	Percentage of trees
Up to 200 . . . . .	210	16.2
201 - 300 . . . . .	170	13.2
301 - 420 . . . . .	280	21.4
421 - 540 . . . . .	150	11.4
541 - 660 . . . . .	165	12.8
661 - 780 . . . . .	90	7.0
781 - 900 . . . . .	75	5.9
901 - 1 200 . . . . .	85	6.7
1 201 - 1 500 . . . . .	50	3.7
1 501 - 1 800 . . . . .	13	1.0
1 801 - 2 300 . . . . .	7	0.5
More than 2 300 . . . . .	3	0.2
All adult trees in São Paulo	1 300	100.0

About one half of the existing adult trees had yields below 420 kg per thousand (equivalent to 7 bags of *vindo de roça* coffee and to approximately 21 bags of *vindo de roça* coffee).

FIGURE XVII

DISTRIBUTION OF ADULT TREES BY YIELD CLASSES, 1958

NATURAL SCALE



fee). The level of 420 kg is often considered the minimum break-even point for coffee production in São Paulo though naturally such a point is never fixed at any given level of yield but fluctuates with the price structure. The magnitude of the problem is well illustrated by this impressive proportion of apparently submarginal plantings, which comprises more than 600 million trees or over half of all adult trees in the State.

The proportion of trees in higher yield classes tends to diminish with each successive level of the table. Nevertheless it is seen that the upper tenth of the distribution had yields exceeding 1 000 kg per 1 000 trees. Between these extremes lie about 40 per cent of the trees with fair to good yields of between 400 and 1 000 kg per 1 000 trees.

### 3. DEFECTS IN THE FARM STRUCTURE AS A WHOLE: EXCESSIVE SPECIALIZATION

Despite certain improvements in the farm structure as a result of the recent growth of other activities, a large section of the farms specialize excessively in coffee production to the neglect of profitable alternative activities. Activities associated with advanced types of coffee cultivation should be given first priority.

It was already stated that there are important indications of the growth of non-coffee activities on coffee farms, both in association with and independent of coffee growing proper. But this movement towards diversification is far from having exhausted all available possibilities. At the present pace of economic development in the State, there is every prospect of creating a rapidly expanding market for locally-consumed food and other agricultural commodities including coffee, especially for those demanded on a rising scale as income levels increase, such as milk and other livestock products, fruits and vegetables.

The traditionally high degree of specialization on coffee farms was no doubt economically justified in the earlier phases of coffee development in São Paulo, when there were unsatisfactory transport facilities, consequent high transport costs, a strong competitive position for São Paulo coffee, a relatively small domestic market for alternative farm commodities, and much greater profits in coffee production than in other branches.

However, these basic conditions have all changed radically, and there is every reason to suppose that a greater relative growth of non-coffee than of coffee production is justified in São Paulo under present and foreseeable future conditions. This conclusion is supported by the current difficulties of the coffee surplus and by the possibility of using São Paulo's agricultural resources, not only for an expansion of the local food supply but also for boosting existing alternative export commodities and for providing certain new categories of exports.

### 4. INTERRELATIONS OF EXISTING PROBLEMS

The preceding section dealt with ten major problems of a general nature, which affect the State's coffee industry as a whole. It is clear that all these problems are of a long-term nature and that they bear little or no relation to the present world market situation. However, the emerging phase of the coffee cycle of production and prices, which has already led to a clearer definition of competitive conditions and to substantial losses in farm prices for coffee, is helping to bring these problems into much

sharper focus than would otherwise have been the case.

The level of yields in São Paulo is unsatisfactory on many farms. With the present price and cost structure and growing methods, there is no doubt that farmer's profits from the low yielding plantings are very small. In fact, if capital costs were properly taken into account, many farms would show a net loss. Such farms remain in operation only by means of the gradual depreciation of existing investments and as long as cash outlays can be kept to a minimum.

On the other hand, it may also be concluded from the survey data that better techniques, especially the more intensive application of chemical fertilizers, the closer spacing of trees and the planting of improved varieties, would result in greater net rewards to farmers, as the detailed analysis of survey data has proved.

Yet it must be remembered that the main cause of the great difference in yields between São Paulo and Paraná can be traced to the fact that the latter State has a high proportion of young plantings and that growing takes place largely on recently deforested virgin lands. Consequently, in raising yields, São Paulo farmers are for the time being at a considerable disadvantage compared with their counterparts in the neighbouring State.

In São Paulo, higher yields can be obtained only through a considerable new investment in coffee plantings, which not only implies the availability of capital for these purposes, but also greater technical preparedness on the part of producers and a willingness to change long-established methods. Again, average production costs on improved plantings might well be higher still, in the end, than those incurred in Paraná under the exceptional conditions prevailing there at present. Nevertheless, the individual farmer in São Paulo can greatly improve his position by the adjustments mentioned.

It must be borne in mind that most of the defects discussed earlier are closely interrelated and that each is very difficult to eliminate. The continued operation of unprofitable plantings is, of course, explained by the failure of farmers to take account of fixed costs. The replacement of poor plantings is therefore unlikely to result spontaneously on a scale which would radically change the present situation.

A much smaller land area could produce the same volume of coffee as now obtained, if better growing techniques were adopted. On the other hand, the cost of operating a hectare of planting would climb steeply as a result. Assuming that the volume of coffee production on a farm remained the same after the introduction of rational practices, this situation would release additional land which could be earmarked for non-coffee activities.

The difficulties of coffee production can therefore be resolved only by measures affecting the farm structure as a whole and by the general reallocation of available resources, with a view to maximizing the profits obtainable under the new conditions.

Such a task is certainly forbidding and difficult to accomplish in a short time. Large capital investment would have to be made in this connexion, and technical assistance would have to be utilized fully in order to obtain satisfactory results. One of the foremost requirements in planning such investment, both public and private, would be the careful establishment of priorities on a district basis with due regard to special local factors influencing farm production.

## V. EVALUATION OF PROSPECTS

### 1. THE CASE OF NO SPECIAL ACTION

The preceding analysis of the basic structure of coffee growing in São Paulo makes it easier to hazard an evaluation of what may happen to coffee growing in the foreseeable future. Owing to the relatively fixed character of coffee production and to special factors in São Paulo that contribute to this situation, many of the changes that are likely to occur in the next five years or so are limited to a certain extent by the current production structure. This is true notwithstanding the fact that São Paulo's total economy, as well as its agriculture, is at present in a state of considerable flux associated with rapid growth. Yet appreciable changes may occur within the industry, depending on market forces and on Government plants affecting coffee growing.

Without special action of some kind, it seems next to impossible that the State will be able to solve the problems of low yields and productivity in a short period. The present situation is not caused by the events of the last few years; it is the cumulative result of the growth of coffee production over more than a century. There is nothing in the present market situation nor in the position of farmers today to indicate that the industry is proceeding to remove the serious interrelated difficulties of soil exhaustion, low yields and old age of plantings without a special impetus in this direction.

The radical changes that would be required to lift the industry as a whole to a higher technical level were already indicated in connexion with the present distribution of plantings by yields (see figure XVII). At current prices and costs, about half of the existing trees apparently fail to produce profits. In most cases little improvement could be brought about by changing the cultivation of these trees. The only adequate solution would therefore be their wholesale elimination and replacement by other agricultural activities, or partly by modern coffee plantings competitive with those of other areas. Such a complete transformation would involve new investment of the order of 30 000 to 40 000 million cruzeiros at 1958 prices, a figure about twice the value of the entire 1958 crop.

During 1957 and 1958, when internal farm prices dropped sharply from their previous levels (about 11 per cent from 1956 to 1957 and about 35 per cent from 1957 to 1958), farmers stepped up considerably the elimination of low-yielding trees. Some 35 million trees were destroyed

in each of these years, according to survey data. Nevertheless, at these rather high rates it would take fifteen to twenty years to remove all the trees which in 1958 could be classified as submarginal. It was also shown that the spontaneous introduction of modern farm practices has so far been very small, being limited to devices requiring little new investment and hardly any change in growing techniques.

The large investment farmers would have to market in order to modify present techniques, not only through the elimination of low-yielding trees but also through the construction of terraces, adequate fertilization, etc., make the spontaneous adoption of the new experimental methods difficult under present conditions. In addition, farmers may simply not wish to adopt systems which differ substantially from those used traditionally and of which they have no personal experience. They may also be hesitant to introduce new and rather costly methods, which do not pay off for several years, at rates that may well be inferior to those obtained by alternative investments ventures inside or outside agriculture and inside or outside the State of São Paulo.

There are therefore serious reasons for doubting whether even the large-scale removal of low-productive plantings automatically result in a fundamental change in the productivity level. Foreseeable elimination rates may affect the situation still less, though the disappearance of low-yielding trees would be a positive contribution by itself. On the other hand, it may also be difficult for farmers to introduce the new practices on a large scale, independently of the removal of their present unproductive plantings.

While the productivity structure is therefore unlikely to change much in the next five years, the same conclusion does not apply to the level of production. Total coffee production in the State may well rise considerably in the same period, unless important new events occur. The maturing of the relatively large number of new trees established during the 1950's, the continued shift to higher-yielding varieties, and a continuation of the trend towards chemical fertilization, at least on a moderate scale are all factors contributing to an increase in output. The following table summarizes the possible affect of these forces on production up to 1964/65, in the absence of significant new factors affecting coffee production and on the basis of three different sets of assumptions:

ALTERNATIVE PRODUCTION TREND ESTIMATES UP TO 1964/65

<i>Alternative conditions</i>	<i>Percentage change in production 1958/59 to 1964/65</i>	<i>Approximate production level 1964/65 (millions of bags)</i>
A. Low planting rate 1959-61 . . . . .	} +18.5	13.8
High elimination 1959-64 . . . . .		
Small increase in fertilizer use 1959/64 . . . . .		
B. Low planting rate 1959-61 . . . . .	} +32.0	15.4
Medium elimination 1959-64 . . . . .		
Considerable increase in fertilizer use 1959-64 . . . . .		
C. Relatively high planting rate 1959-61 . . . . .	} +40.3	16.4
No elimination 1959-64 . . . . .		
Considerable increase in fertilizer use 1959-64 . . . . .		
Planting rate: Low	100 million trees in 3 years	
High	135 " " " " "	
Elimination: Medium	30 " " " " "	
High	50 " " " " "	
Fertilizer Small	25 per cent in 5 years	
increase: Large	50 per cent in 5 years	

The three alternative projections all cover what reasonably might happen on the assumptions described, and provide an estimate of the range of expectation. The postulated planting rates for the triennium 1959-61 would both be well below the comparable actual figure for the preceding three years (196 million trees). The estimates of elimination are within a relatively small margin of what farmers reported the situation to be in the year 1957 and 1958 (35 million trees eliminated each year). The further adoption of chemical fertilization practices would raise the proportion fertilized to 16.5 per cent, or to 20 per cent of all existing trees (the 1958 proportion was 13.2 per cent). Further assumptions are: (a) that differences in weather conditions balance out over the period and would not therefore affect the trend as such; (b) that the incidence of frost would be relatively small in São Paulo, as it has been in most past years; (c) that yields of trees eliminated in the period will be below the State average level of yields in 1958.

What the real level of production will be by the mid-sixties is, of course, still uncertain, even after the detailed consideration of each of the above factors. On the basis of the conditions prevailing up to the beginning of 1960, it would seem that the second alternative (B) might come closer to reality than the other two, or than any other combination of assumptions affecting production. In this case, the total output of coffee would rise at a composite rate of 4.8 per cent per year and might reach a volume of 15 million to 16 million bags by 1964/65. But this figure should in no case be regarded as a valid guide to the actual level of production in 1964, or in any intervening year; it is only an indication of the six-year trend 1958/59-1964/65.

Yet the conclusion is warranted that current conditions all point to a further substantial output increase in the next few years. It seems that more than half of this expected rise is due to the maturation of plantings already in existence in 1958. The other main factors, roughly of similar quantitative importance, making for higher production are the shift to better varieties, the expected expansion in fertilizer use, and the maturation of plantings to be established in the period 1959-61. The reduction in yields of plantings passing the optimum age and the elimination of low-yielding trees will both have an effect in the opposite direction, but are unlikely to offset the positive effect of the factors mentioned earlier.

In conclusion it would therefore appear that, in the absence of special programmes for the industry and of major unforeseen events, the productivity structure of coffee growing in São Paulo in the mid-sixties will not differ basically from that of today. On the other hand, total output is likely to show a sizable increase from the 1958 level.

## 2. PRESENT PLANS

In the past year, important new programmes have been drawn up by the Brazilian Coffee Institute (IBC) to deal with coffee production problems. The Institute's programme is to be financed through agencies of the *Banco do Brasil*; Cr. 1 000 million will be appropriated for this purpose. The programme may be supplemented by similar plans at the State level.

Under these programmes, directed credit will be supplied to farmers for the elimination of three low-yielding

coffee trees and for replanting one new tree in accordance with modern technical principles, established by the State experimental and extension service. These objectives show that it is intended to boost productivity, while reducing the total number of coffee trees.

The Institute's plans for the coffee industry are a new development, constituting a positive effort strike at the deeper roots of the coffee problem. It shows that the Brazilian authorities are well aware of the need for changes at the farm level as a result of the low productivity of many farms.

The execution of the Institute's programme is now in its initial phase, and it is difficult to estimate its possible impact on the São Paulo industry in the coming years. But on the basis of the survey findings it is possible to compare the magnitude of the problem with that of the efforts described.

If it is estimated that the total cost of eliminating three low-yielding coffee trees, of planting one new tree by modern methods and of maintaining it until maturity (three years) would be some Cr. 100 and that the number of low-yielding trees that would be affected on the basis of available funds, would be of the order of 25 million. As the total number of submarginal plantings may be estimated at about 600 million trees, it is clear that the programme could affect only a small portion of the deficient plantings. Further efforts would be required to ensure the success of such a productivity drive, but the programme represents a serious new start on industry-wide structural adjustments. A number of farmers not directly benefiting from the special credits might also be induced to follow suit on their own initiative because of profit incentives, as they became aware of the possibilities.

The campaign mentioned would have relatively little effect on the production trend. The elimination of about 25 million trees might result in a drop in output of little more than 100 000 bags, a figure which would probably be made up three or four years later by the new and high-yielding trees. While total production might therefore be slightly affected by the programme, it is felt that this effect would be very small and transitory. The present campaign is therefore designed much more to show the possibility of raising productivity than to limit production.

In order to affect the existing production trend substantially it would be necessary to undertake much greater modernization efforts and to raise the ratio of trees eliminated to trees planted at least from three-to-one to four-to-one. As it is, each participating farmer may approximately maintain his present output of coffee, while improving cultivation techniques and considerably reducing the area in coffee. In fact, more than two thirds of the area used before the programme was put into effect would be freed for other purposes.

In this connexion it may be noted that present plans are not apparently intended to control the use to which the freed land resources would be put after removal of the old coffee trees. In view of the favourable outlook of the demand for non-coffee farm products and of the varying adaptability of a given farm to one new activity or other, it would be of great practical value to extend the campaign to include credit for additional farm activities. Recent information shows that this idea has already been taken up by the Institute. In this way the entire farm structure could be strengthened through greater diversification, and the State's economy would benefit more fully

from such a change. In view of the relatively small experience of farmers in activities other than coffee growing, they might encounter difficulties if they were left entirely to their own initiative in allocating the freed lands.

To sum up, the plans recently formulated with respect to the São Paulo nursery are an interesting new step towards solving the problems of low productivity and putting coffee growing on a sounder and more stable technical and economic basis. The outstanding problem is, however, of such magnitude that these plans may only affect a small minority of farms in the coming years. The level of production as a whole is not likely to be substantially altered in the course of the various campaigns as scheduled at present.

### 3. PROSPECTS FOR DIVERSIFYING THE COFFEE FARM

The increased diversification of coffee farms more than any other single factor would assist the coffee industry in its present difficult phase. Farmers would be much more willing to remove their inefficient plantings and to reduce the total number of trees, if profitable alternative uses could be found for the resources thus freed. It is therefore of special importance to summarize the conclusions of the survey on diversification prospects.

In the previous paragraphs reference was made to the relatively low coffee yields, to the present degree of diversification on coffee farms, and to the fact that the rapid economic development of São Paulo creates a favourable environment for agricultural production for the domestic market. The effect of the current situation on prices and on the productivity of various activities will be shown below.

#### (a) Price trends

In the past decade price's of coffee and other agricultural commodities have fluctuated sharply, not only as a result of the unstable coffee situation but also of the changing pace of inflation, which led to annual increases in the general price level ranging from 7 per cent (1948/49) to 35 per cent (estimate for 1958/59).

Yet price trends show quite clearly that the real price level of other commodities has been much more stable than that of coffee, and that the relative position of coffee has deteriorated markedly since the post-war peak of 1954 (see figures XVIII and XIX). While most other products have roughly maintained real prices throughout the decade, real coffee prices received by farmers were, at the end of 1959, little more than one third of those received in 1954 and about one half of those of the 1948-52 five-year average. Even in comparison with 1948, the last year before the post-war peak period, 1959 prices show a decline of more than 20 per cent. There is no doubt then that the relative position of coffee *vis-à-vis* other commodities has markedly worsened in recent years.

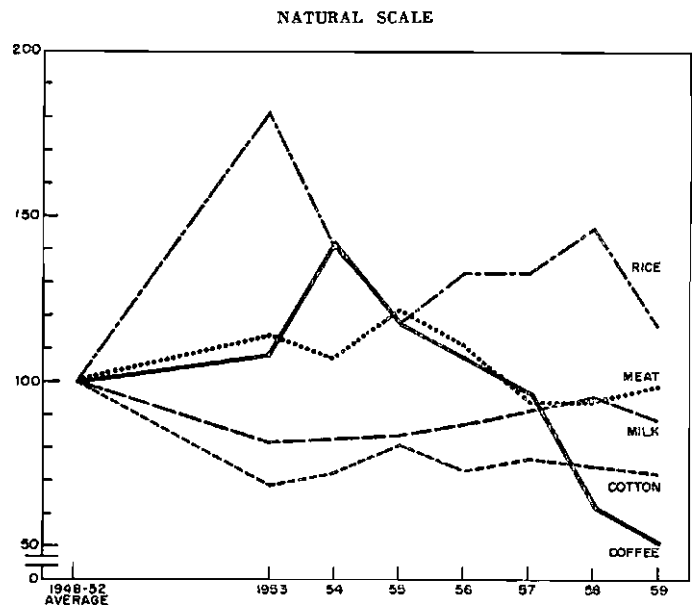
#### (b) Productivity of agricultural activities

In the absence of adequate data on production cost for different agricultural activities, trends in gross farm value produced per hectare provide partial indications regard-

FIGURE XVIII

SÃO PAULO: DEFLATED FARM PRICE INDICES\*

(1948-52 average = 100)



\* Prices received by farmers, corrected for increases in the general price level.

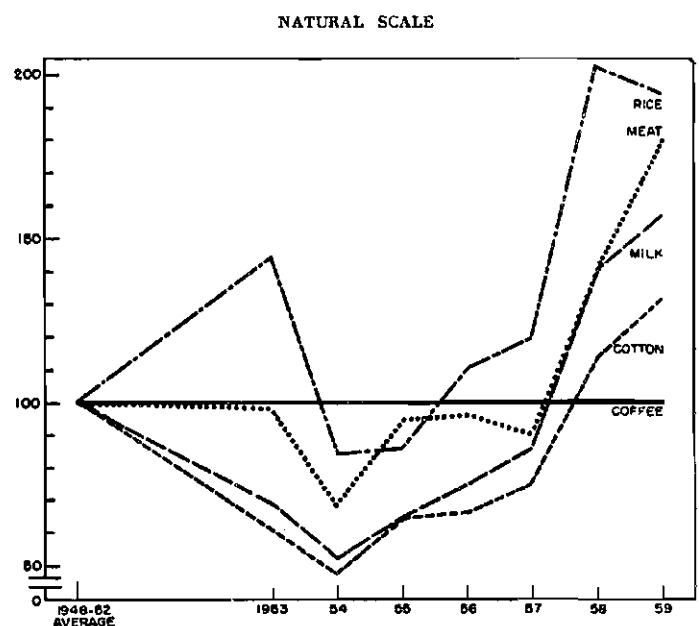
ing the profitability of producing coffee and other crops. These data take into account yields and prices, factors which greatly influence net productivity.

Figure XX illustrates the situation in three different recent periods: before the post-war boom; the peak of the coffee cycle; and the period for which the most recent data

FIGURE XIX

SÃO PAULO: FARM PRICES RELATIVE TO COFFEE\*

(1948-52 average = 100)

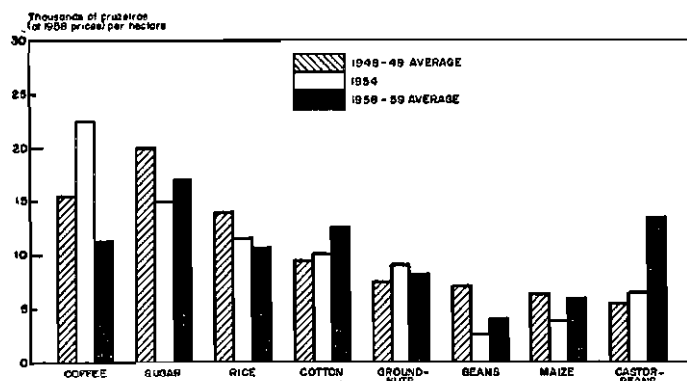


\* Prices received by farmers, divided by similar prices for coffee.

FIGURE XX

VALUE OF OUTPUT PER HECTARE IN SELECTED ENTERPRISES IN SÃO PAULO

NATURAL SCALE



are available. In 1948-49, gross returns per hectare of coffee compared favourably with those of most other crops, margins of 65 to 200 per cent existing with respect to such major crops as cotton, maize, beans, groundnuts and castor beans. This margin was smaller with respect to rice (about 10 per cent only), and sugar cane production gave 25 to 30 per cent higher gross returns than did coffee growing. Many intensive crops such as potatoes, fruits, vegetables, tobacco (not show in the figures) naturally have always produced higher values per hectare than has coffee, but production costs are also much higher and each of these crops has limited possibilities.

In 1954 coffee growing returns naturally greatly exceeded those of 1948/49. But the 1958/59 figures show not only that the 1954 bulge disappeared completely, but also that coffee's relative position deteriorated considerably with respect to 1948/49. Many of the important crops shown now surpass or equal coffee in gross value per hectare. Indications are that this tendency is still continuing, for 1960 coffee prices are again lower in real terms than those of 1959.

The careful survey of several important production combinations such as coffee-sugar cane, coffee-rice and coffee-dairy products shows that, under 1958 average conditions, *net returns* per unit of expenditure were only slightly lower than those obtained, on the average, from coffee. It may be concluded from the available data that large sectors now exist where other farm activities can compete effectively with coffee growing for productive resources. The most competitive products, to each of which different circumstances apply, seem to be dairy and poultry products, cotton, beef cattle, sugar cane and rice, but this list is not exhaustive. Other interesting items are oranges, oilseeds and other fruits and vegetables, and eucalyptus trees on poor land.

The general situation seems to be that all of these and several others are equally or more profitable than coffee growing in most cases where coffee yields are less than about 400 kg per hectare. Developments since 1958 are likely to have enhanced the position of other activities even further. This opens up vast prospects, for in 1958 more than half of the existing coffee plantings had yields of less than 400 kg per hectare.

Naturally there are other considerations to be taken into account, for instance, the fact that coffee growing

is less risky and less complicated than other branches of agricultural production. Experience has shown that the price of coffee is likely to be supported at certain minimum levels unlike that of other commodities. On the other hand, traditional coffee production is challenged not only by non-coffee activities but also by the more advanced coffee-growing techniques themselves.

It is no possible to analyse fully diversification prospects in São Paulo in a few pages. Neither has the present survey provided all the necessary information on which to base a diversification campaign. It is essential to have data on each of the State's sub-regions, to indicate specifically which activity would be suitable in present and foreseeable circumstances. The existing structure gives, in many cases, some idea of the suitability of the various possible activities. Examples of this are the present concentration of dairy, fruit and vegetable production in the north-eastern part of the State and that of cotton and groundnuts in the west.

But it may be affirmed that ample possibilities exist in São Paulo for expanding agricultural production for the domestic market on a basis competitive with coffee. This situation is only the natural result of the gradual transformation of the State's economy from a primary commodity exporting area to a major industrial region. If these favourable basic conditions are taken advantage of in formulating agricultural policy, it is likely that substantial results will be obtained in a relatively short period.

4. SUMMARY OF PROSPECTS

The two aspects which are most likely to change spontaneously through the play of market forces are the total level of coffee production and the importance of commodities other than coffee on coffee farms. The volume of coffee output is likely to increase further in the next five years at an average rate of about five per cent per annum. Although the actual rate will also depend on conditions developing in the coming years, the existing structure already determines the probable approximate range of production increases as a result of the age distribution of plantings in 1958.

Expanding domestic demand and the fact that coffee prices are declining in relation to non-coffee farm products are major factors which are likely to lead to a greater output of the latter. Much of this increase will take place on farms producing coffee, because of the predominant position of the latter in the State's agriculture, and the outcome will therefore be a greater diversification of the coffee farm structure.

Despite the fact that there is a considerable fund of technical knowledge, which might substantially raise the productivity of coffee growing if applied on a large scale, it is difficult to see how the adoption of these new methods could take place rapidly in the absence of large and well-organized campaigns. This seems true despite the fact that farmers' profits could also be increased in this process. But there are many difficulties to be overcome, e.g. the fact that farmers might make larger profits investing in activities other than the modernization of coffee production and that there is no proper link between the experimentally proved results and the daily working conditions of most farmers. Only the most simple, most successful and least costly innovations are likely to be adopted spontaneously on a commercial scale. The introduction of improved



varieties generally meets these prerequisites, and consequently the majority of farmers are now using them when establishing new plantings.

One important new step is the recent formulation of special programmes to do away with the lowest-yielding plantings and to use modern techniques in setting up new ones. These programmes are being started by the Institute. The campaigns approved so far may deal with only a small part of the problem of low productivity, but they may profoundly change the situation of the participating

farms. On the other hand, they are likely to have little effect on the total supply of coffee.

Although the current situation of the São Paulo coffee industry is characterized by considerable rigidity in many aspects, it is also true that the rapid growth of the economy and tested innovations in the technology of coffee growing provide a favourable environment for change. Efforts to remove the obstacles impeding the modernization of coffee production and greater diversification might therefore enjoy considerable success in the coming years.









Reprinted from ECONOMIC BULLETIN FOR LATIN AMERICA  
Vol. V, No. 2, October 1960