

UNITED NATIONS

ECONOMIC
AND
SOCIAL COUNCIL



GENERAL
E/CN.12/435
20 April 1957

ORIGINAL: SPANISH

ECONOMIC COMMISSION FOR LATIN AMERICA
Seventh Session
La Paz, Bolivia
15 May 1957

C O F F E E I N E L S A L V A D O R

EFFECT OF LABOUR INPUT AND OTHER FACTORS,
AND PRODUCTION TRENDS

Joint report of the Economic Commission for Latin America
and the United Nations Food and Agriculture
Organization

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INTRODUCTION

1. Objectives and Methods of the Study

This study was conducted in response to resolution 63 (V) of the Fifth Session of the Economic Commission for Latin America, the text of which is given below:

Studies of the Coffee Industry in Relation to Economic Development

Resolution 63 (V) adopted on 25 April 1953 (E/CN.12/342)

The Economic Commission for Latin America,

Considering that the production of, and trade in, coffee are of great importance to the economy of several Latin American countries,

Considering that, with the present technical levels of cultivation and processing of coffee, the efficiency of labour is very low because it is impossible to mechanize important phases of the productive process, and

Considering that the aforesaid characteristics of coffee cultivation tend to keep large sections of the population at low income levels,

Recommends that the secretariat study, in collaboration with FAO and other inter-governmental bodies, in specified areas where coffee is the main source of income, those economic and technical aspects of coffee production which exert the greatest influence on economic development.

The report on El Salvador represents the pioneer country study under this resolution. Field work on the second study, in Colombia, has been completed, and the report is now in preparation.^{1/}

1/ See Progress report on the study on coffee in Colombia (E/CN.12/436).

Subsequent to the resolution, an agreement was reached between the Economic Commission for Latin America and the United Nations Food and Agriculture Organization to the effect that the study should be undertaken as part of their joint work programme, and for this purpose a small working group of experts from these two organizations was set up.

In view of the magnitude of the task and the limited availabilities of personnel and resources, it became clearly evident that the study could not be carried out without the full collaboration of the Governments of the coffee-growing countries. The authorities in El Salvador, were the first to display interest. Coffee-growing techniques used in El Salvador are among the most advanced in Latin America, and its average yields per hectare are the highest in the region. El Salvador was also particularly suitable for this survey, because of the small extent of its territory and the concentration of the coffee plantations in specific areas. It was therefore felt that it offered a suitable place to serve as a test both of the feasibility of the project and of the soundness of the methods adopted. Further, experience there could be of value in carrying out later research in other countries where the area under cultivation was much larger.

Invaluable assistance in this study was received from the Salvadorean Ministries of Agriculture and of Economy, and from the statistics and Census Department (Dirección General de Estadística y Censo), which is a dependency of the latter. The Asociación Cafetalera de El Salvador and the Compañía Salvadoreña del Café also collaborated in a variety of ways. Producers, mill-owners, and, broadly speaking, all those who have anything to do with the coffee industry in El Salvador, likewise gave their generous co-operation. At no time was there any hesitation in supplying the data needed by the Working Group of the two international organizations.

In accordance with the general purposes stated in the resolution, there were two specific objectives of the study: (a) to determine the inputs of labour, materials and capital used in coffee-growing in relation to

/production in

production in the agricultural year covered by the survey (1954/55); and (b) to provide a basis for forecasting trends in production, exports and domestic consumption of coffee during the subsequent five years.

Under the first objective, the aim was not to determine production costs in money terms. Physical quantities have a much more permanent meaning, owing to the effects of varying prices and costs. As will be seen later, the most important conclusions on coffee inputs can be measured from the physical inputs alone. Nevertheless detailed information was gathered on monetary costs which, although not used to calculate a cost per unit of product, made it possible to examine current expenditure on the crop.

This analysis is based on a scientific sample selected from all the commercial farms in the country.^{2/} A total of 1,040 plantations were visited and carefully drawn-up questionnaires were used. Of these 32 were discarded as invalid for various reasons, and the remaining 1,008 - representing approximately 5 per cent of the whole area under coffee in El Salvador - were utilized as a basis for estimating totals for the entire country.

The statistical sample included representatives of all the types of plantations existing in the various ecological areas where coffee is produced with a larger proportion of plantations of more than two hundred hectares. In the final tables, all figures were weighted so as to give an accurate estimate of the national totals.

The questionnaires, which were carefully revised after an experimental field test, included enquiries on: (a) the age distribution of the coffee plantations, and the extent of new plantings and replantings; (b) the number of man hours used in the establishment of a new plantation, from the time when the seed is sown in the nurseries until the plantation enters full production; (c) the number of man hours worked during the agricultural year 1954/55, broken down by operations, as well as the corresponding volume of coffee produced, and (d) wage-rates for workers and employees, quantities and prices of the materials used in production, and estimated

^{2/} See Appendix I.

values of the land, buildings, livestock, and equipment.

In addition, 27 coffee mills were visited and studied, with respect to their efficiency. Information was also gathered on the role of coffee in El Salvador's national economy, on the domestic marketing of the product and on other related topics.

The questionnaire used for the interviews at the coffee mills included the number of man hours worked at the different stages of coffee processing, capital investment, costs of materials, the quantities of each grade of coffee processed, and prices paid and received for coffee.

2. Summary of major findings

As is well known, coffee is a major factor in the economy of El Salvador. In 1954/55, it contributed about one-quarter of the gross national product about 30 per cent of the Government's fiscal income, and nearly 90 per cent of the value of exports. The position and prospects of the coffee industry, and possible lines along which it could be made more efficient and more productive, are therefore of great importance to the nation.

National estimates, based upon the sample survey, reveal the following major facts about the Salvadorean coffee industry:

In 1955, there were about 20,000 plantations producing coffee commercially with an area of about 137,000 hectares in coffee trees. This represents about 25 per cent of the total land suitable for cropping or tree-crops, as reported in the 1950 census. Plantings of less than 10 hectares (88 per cent of all commercial farms) occupied 22 per cent of the total area; those between 10 and 100 hectares 49 per cent and plantings over 100 hectares 29 per cent.

The value of the commercial coffee plantations and their work animals and equipment was estimated by their owners at about 400 million dollars in 1955. Another estimate based on the costs of the labour and materials used in establishing the plantations, and of the estimated value of the work animals and equipment - but excluding the original value of the land - comes to only 106 million dollars, which with certain reservations may be regarded as the real investment in El Salvador coffee plantations, at 1955 wage rates

and prices.^{3/} The total value of coffee-processing plants was estimated at about 7 million dollars.

(a) Inputs in relation to output

The coffee industry in El Salvador is at present characterized by a high average input of labour per hectare, which together with the application of fertilizers and other materials during the 1954/55 coffee-crop resulted in average yields of 660 kilogrammes per hectare, one of the highest yields in the world.^{4/} This pattern of production is the result of an abundant labour supply and of the relative scarcity of first-class land for coffee cultivation.

During the 1954/55 coffee season, on the average 1,566 man hours of labour were used per hectare of adult coffee plantation, or the equivalent of 196 man days of 8 hours each. Thus, each kilogramme of green coffee produced represents 2-1/3 hours of human labour on the plantation. In addition, the establishment of a plantation represents for the country as a whole 5,500 man hours (687 man days) per hectare until the trees reach normal production at five years of age. A reasonable amortization of this input plus labour inputs in coffee processing would raise to about 3 man hours the human labour necessary to produce 1 kilogramme of green coffee.

Apart from labour, during the 1954/55 crop year the application of materials averaged 114 kilogramme of mineral fertilizers per hectare, 850 kilogramme of composts, and 4 kilogramme of insecticides and fungicide mixtures.

^{3/} Undoubtedly, the declared value of the coffee properties - 400 million dollars - was considerably affected by the high level of coffee prices in recent years. On the other hand, coffee being a permanent crop, it is almost impossible to separate from this figure how much corresponds to the value of the land and how much to the plantation itself. Furthermore, coffee land in El Salvador has undergone a continuous process of improvement which in turn makes it difficult to establish how much of the land value may be properly termed investment. All these points deserve a more detailed investigation than was possible.

^{4/} This figure may be compared with those registered in the 1955 FAO production yearbook for other countries, e.g. Brazil, 407 kilogrammes; Colombia, 548; Venezuela, 142; Guatemala, 395; Mexico, 411; Angola, 433; French West Africa, 263; Madagascar, 299. All these figures represent the average for the period 1948-52.

From the point of view of total cash outlays, however, the data shows that by far the largest share, or 53 per cent, represents the cost of labour; whereas fertilizers and composts represent only 9 per cent and insecticides 1 per cent. The rest is accounted for by general management, transportation and other costs. Since apart from the land other physical inputs are negligible in coffee cultivation,^{5/} to establish the productivity of the labour factor is of decisive importance for the coffee economy of the country. This report places particular emphasis on the analysis of this factor.

Whereas the average labour intensity is high, striking differences exist from farm to farm, from region to region and between small farms and large farms. Along with regions having an average labour input of less than 1,000 man hours per hectare, other regions register labour intensities of over 1,700 man hours. Similar divergencies exist between farms having less than 10 hectares and those having more.

By the same token, and as a result of variations in input of both labour and materials, yields were also found to diverge considerably according to specific conditions of location, investment and farm size. In general, the western districts had higher yields than the eastern districts. The plantations on higher elevations had higher yields than those on lower locations. The larger plantations had larger yields than the smaller ones. Plantations with higher values per hectare had larger yields than those with lower value.

To some extent all these factors are interrelated. For example, the larger plantations were generally at the higher elevations, used more labour and materials per hectare, had higher valuations and were located mainly in the higher-yielding districts. Because of this inter-correlation among the various factors, simple tabulation of the data, based on classification of one factor at a time, does not by itself give a dependable measure of what were the precise net effects on yields and productivity of variations in any one of these factors.

The fact that plantations with the highest estimated value per hectare had in general the highest yields probably reflected differences in fertility of the land and suitability to coffee production, as well as differences in actual cash investment in long-term improvements. The special study made of

^{5/} As discussed later, the use of farm machinery in coffee cultivation is practically nil.

the labour and materials used in establishing the plantations showed that part, but only a small part of the differences in average value per hectare were explained by differences in development costs. These data therefore give no firm basis for judging what is the point of diminishing returns for capital investment in improving the coffee plantations.

A close causal relationship appears to exist between labour intensity and yields per hectare. Whether the farms are grouped by size, location in the various coffee regions, altitude above sea-level, or scale of labour intensity, to a larger labour input (including or excluding the harvest) generally corresponds a higher yields.^{6/} In order to investigate the effect that some of the variables mentioned may have on yields one simple and two multiple correlations were worked out. The results were (a) that the simple correlation between labour intensity and yields showed a highly significant relationship between these two variables; (b) that altitude above sea-level and size of the plantation did not have a significant

^{6/} See graph V. The following data shows the relationship between labour input and yields, by scale of plantation size, altitude above sea-level and labour intensity, including and excluding the harvest:

Scale	Labour input (man hours)		Yields (kilogrammes)
	Total	Ex-harvest	
<u>By size</u>			
Less than 10 hectares	997	632	397
10 to 100 "	1,681	1,001	691
More than 100 "	1,741	1,100	780
<u>By altitude</u>			
Less than 600 mts	886	542	408
600 to 1150 "	1,521	1,007	701
More than 1150 "	1,689	996	812
<u>By intensity</u>			
Less than 300 M.H.	219	113	146
300 to 700 "	558	344	337
700 to 1400 "	1,057	659	447
1400 to 2100 "	1,665	1,038	807
More than 2100 "	2,754	1,828	1,050

/independent effect

independent effect on yields; and (c) that other factors such as labour intensity, and apparently, fertilizers, soil and climatic conditions, were more important than altitude and size taken together.^{7/}

More elaborate analysis than is possible through a sample survey would be required to measure the true relation between the various input factors and the resulting output. In this connexion, and adequate experimental programme to test the effect of various levels of application of the different factors, particularly fertilizers, would reveal more accurately the influence they may have on land, labour and capital productivity. It would then be possible to compute the point of diminishing returns and to indicate with more precision whether it would be economical or efficient to use more or less labour, fertilizers, etc., in various regions and at various altitudes.^{8/} Needless to say, national averages can only be taken as illustrative of the over-all situation. Ultimately, the optimum combination of land, capital and labour resources must be determined by each farmer for his own plantation.

(b) Operations in coffee mills

Most of the green coffee grown in El Salvador is prepared for the market in coffee mills, either by the dry process or as washed coffee. The large plantations generally have mills of their own. These are operated as separate enterprises, and process coffee not only for the plantations which own them but also for near-by smaller farmers. In general, the mills buy the coffee outright, and sell the processed coffee on their own account. The margins taken for this operation vary widely between mills using different processes. Undoubtedly the concentration of this operation in specialized concerns reduces the costs and increases the efficiency of the operation. To determine whether the small growers suffer by paying an undue share of the total costs would involve a more detailed study of coffee marketing than was made in this survey.

^{7/} So far as they can be represented by linear relationships.

^{8/} For this type of analysis see, for instance, M. Ezekiel, Methods of Correlation Analysis, New York, John Wiley & Sons, 1941.

For both types of plants, dry-process and wet-process, labour inputs decline as the size of the plant increases. Thus in wet-process plants, labour per 100 kilogrammes of milled coffee declines from 14 man hours for plants of up to 1,000 tons of green coffee per season, to 8 man hours in plants of over 4,000 tons. Capital investment per machine operator however, is higher in the larger plants; but during the 1953/54 milling season, when some of those plants did not operate at full capacity, total processing costs were somewhat higher than in the mills with lower investment. The wet-process requires more labour than the dry-process - 11 man hours per 100 kilogrammes as against 6. However, the dry-process also involves 25 additional man hours for drying on the farm, so that in total farm and mill work, the wet process is far more efficient. In addition, washed coffee is of higher quality and commands a higher market price.

c) Prospective expansion in coffee production and exports

According to the survey, possibilities do exist for expanding coffee production in El Salvador by the extension of the acreage in plantation, and especially by the use of more intensive methods. Existing coffee plantations include some 70,000 hectares of land suitable for coffee production, and not yet planted to the crop. If this were all planted, that would represent an increase of over 50 per cent above the present producing area. However, most of this land is already under other crops, and some of it is of such poor productive capacity as to be marginal or sub-marginal.

By means of the data obtained by the survey on the age of existing plantations, both bearing and not yet bearing, and on the yields at different ages, it is possible to make a rough projection of the probable trend of production over the next few years. This projection assumes that farmers will continue to replant the older trees at about the same rate as in the past, and that such factors as prices, weather conditions and intensity of operations will remain unchanged. The effect of current coffee prices on future plantings is not involved, as only those trees already planted at the time of the survey can come into bearing by 1959/60.

/On the

On the basis of these calculations, it may be estimated that by 1959/60 Salvadorean production of green coffee will total between 84,000 and 86,500 tons approximately, and exports will range from 78,000 to 80,000 tons.^{9/} This would mean an increase of 14 per cent over the 1954/55 levels, and a rate of growth of 2,8 per cent per year. This possible rate of growth is much higher than that of 1 per cent registered during the period 1930-55, but lower than that of 6 per cent per year which prevailed in the 'twenties.

The increase is expected to result more from a probable rise in yields due to the recent high levels of replantings than from an actual increase in the area under cultivation. In 1954 new plantations less than 1 year old accounted for only 1.8 per cent of the total area under cultivation, but the rate of replanting in the same year represented about 4 per cent of the coffee-trees at the stage of production.

Rather more than 70 per cent of the commercial coffee plantations were over 10 years old. According to the data collected, yields increase until the coffee plantation is 10 or 11 years old, but subsequently decline at an annual rate of 4 - 5 per cent.^{10/} Consequently, if the yield of the coffee plantations is to be maintained and the effects of old age counteracted, a rate of replanting equivalent to this annual percentage is necessary for more than 70 per cent of the area under coffee. Whatever policy is adopted by farmers in this respect will be reflected in the outputs obtained after 1960.

Output after that date will also be affected by decisions on the part of producers as to the further expansion of their area under coffee. The fact that new plantings did not expand more rapidly in response to the unprecedented rise in prices from 1950 to 1954 suggests that the more moderate prices now prevailing are unlikely to stimulate any very marked further increase in production in El Salvador in the near future.

^{9/} See chapter VI, figure VII.

^{10/} See chapter VI, figure VIII.

d) Possibilities of increasing efficiency and productivity

In any case, because of the great significance of coffee in the Salvadorean economy, it would be of considerable importance to increase the efficiency of production, since this would result in a reduction of production costs and better utilization of the scarce land resources. Within the present price and wage structure and pending further and more detailed studies, it appears that a selective intensification of input application on coffee plantations would be justified in certain situations.

It has been ascertained, for instance, that income per hectare is generally low in the group of small farms, in farms showing a reduced value per hectare or in those located in some regions of the country. It seems that a higher input of labour in certain operations such as pruning, terracing and, particularly, replanting, as well as a more extensive use of fertilizers, is justified on many of these farms. In this connexion more effective government action would be advisable in order to provide small coffee farmers with suitable credit services so that they might enjoy the benefit of both short-term and long-term loans at low rates of interest.

As a result of the present skewed seasonal distribution in the demand for coffee labour, which in the main picking season entails the absorption of about one-fifth of the total national labour force by the coffee industry, it would appear desirable to stimulate especially those operations that may be performed in months other than November, December and January. This would contribute to greater stability in the coffee industry and in the income of coffee farm labourers.

As is clearly suggested by the type of apparent functional relationship existing between labour intensity and yields,^{11/} coffee cultivation in El Salvador is, on the average, in the range of diminishing marginal returns, as far as these two variables are concerned. Although, according to this function, to an increase in labour input corresponds a higher yield per hectare, the marginal product per additional unit of

^{11/} See chapter IV, figure V.

labour input, as well as the total product per man hour, or average productivity, tends to diminish. This is of no particular significance as long as the marginal cost of all inputs does not exceed the value of the marginal output; but on farms where the application of labour and other inputs has reached a high level, much greater caution should be exercised in increasing input application than on the farms mentioned above.

In general, since land is the scarce factor and labour is abundant in El Salvador, there is positive interest in maximizing the output per area unit. Even so, a sharp fall in coffee prices or a rise in coffee wages may cause net income to decrease to a critical level. It will therefore, be necessary to review at regular intervals the changing relationships between coffee prices, factor costs and the intensity with which the various inputs are utilized, in order to guide farmers in the adoption of timely decisions.

On many plantations a high degree of labour intensity and sound soil conservation practices prevailed during the period of formation of the coffee fields. On most of these farms intensive investment continues when the trees enter full production, so that the value of the plantations is very high and the capitalized inputs are reflected in higher yields. Unfortunately, although the research carried out gives some indications of the dynamic relationship between sound farming practices during the formation period and the income obtained once the plantation reaches maturity, it covered only the 1954/55 crop, and no clear conclusions can be established on this matter. As no other data of the kind are available in El Salvador, it would be extremely important to undertake the appropriate research. In order to accomplish this, specific plantations should be studied throughout their whole process of development.

As regards coffee processing, the most expensive operation was found to

/be drying

be drying. It would therefore be advisable to give attention to drying costs in further studies concerned with the improvement of productivity in the mills.

As previously stated, while the present report indicates some of the major problems facing the Salvadorean coffee industry today, it has by no means exhausted the subject. More analyses along the lines already suggested would be needed to provide additional conclusions on all the possibilities that the development of the coffee industry in El Salvador may offer.^{12/}

^{12/} The final printed edition of this study will include a especial annex containing additional statistical data.

Chapter I

GENERAL FEATURES OF COFFEE-FARMING IN EL SALVADOR

1. Ecological conditions

Rainfall and temperature (as determined by altitude above sea-level) are the basic climatic factors influencing the pattern of coffee cultivation in El Salvador. Owing to the tropical latitude, there is no clear distinction of the four seasons, but in general the year may be divided into a wet period (April-October) and a dry period (November-March). Despite the smallness of the territory, variations are recorded from one area to another as regards both the annual volume of rainfall and its distribution throughout the year. Most of the official data on rainfall refer to regions of little importance for coffee. Some planters have compiled precipitation data for their farms, but these have not been published. At the present time the meteorological services are being reorganized with a view to the improvement of the observations recorded.

Rainfall in the coffee zones is normally sufficient for the growth of the coffee tree and for the production of its crops. Annual average precipitation for the last 40 years is given by the National Meteorological Service of the Ministry of Defence as around 1,822 millimetres. However, the distribution of rainfall varies greatly, especially during the critical period of fruit-setting, and substantial annual fluctuations are inevitably registered in the volume of the crops. Although, broadly speaking, the climate of El Salvador is favourable to coffee growing and processing, years of excessively heavy rainfall and years of drought may sometimes constitute a serious handicap to coffee production.

Holdridge ^{1/} describes the following thermic belts in relation to the altitude above sea-level and to the natural vegetation:

^{1/} Quoted by Fritz Loenholdt in, The Agricultural Economy of El Salvador, (report of United Nations Technical Assistance Mission to El Salvador).

(a) A zone of "dry tropical forest" with an annual average rainfall of 1,000 to 2,000 millimetres, extending from the coast to a height of 500 to 600 metres above sea-level, where it coincides with the 24° centigrade isotherm;

(b) A zone of "wet sub-tropical forest", lying between the altitudes of 600 and 1,500 metres above sea-level, with an average rainfall usually higher than 2,000 millimetres, and

(c) A zone of low-growing "wet forest", stretching from 1,500 metres above sea-level to the highest volcanic peaks.

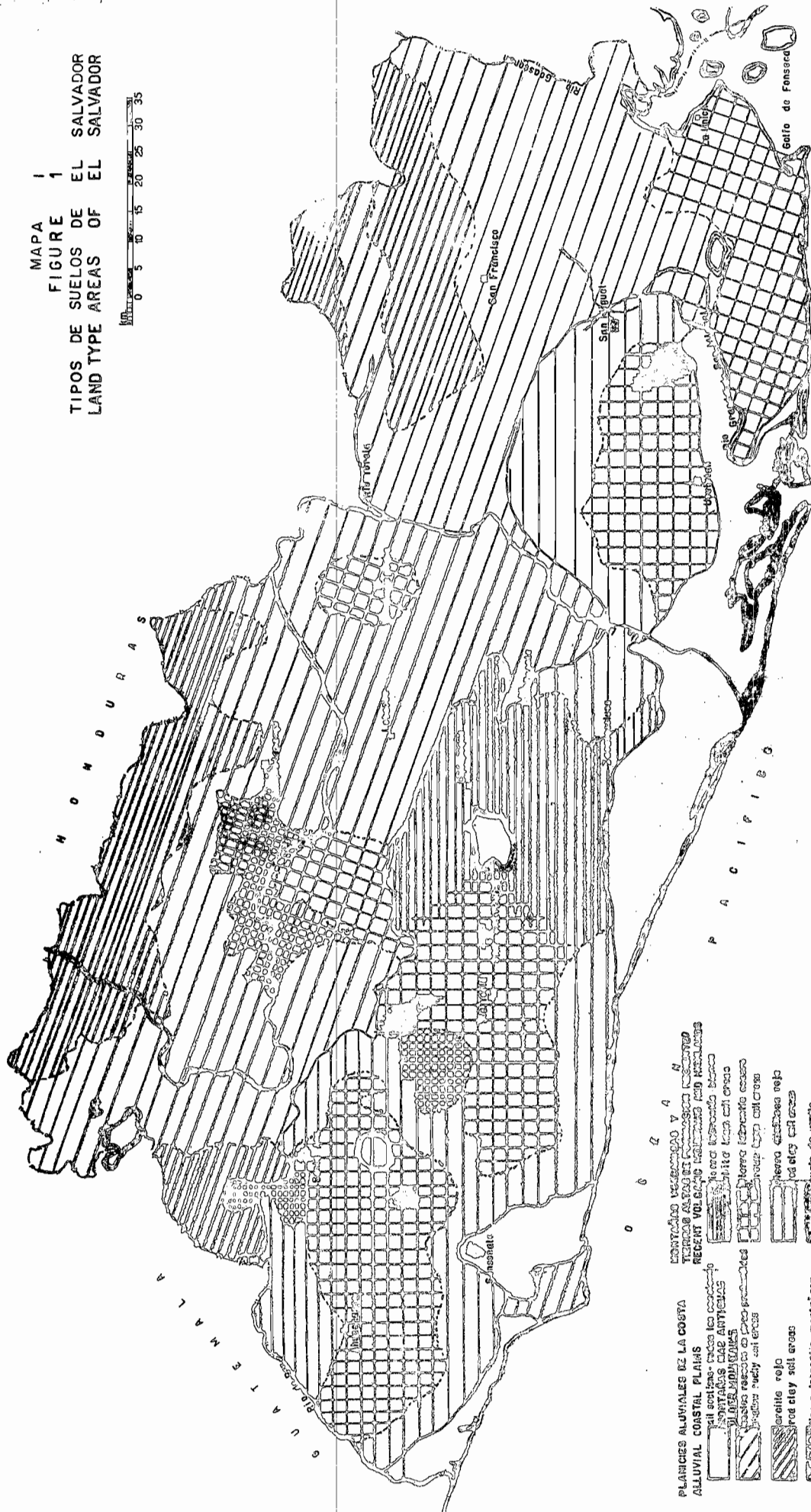
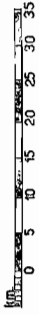
Coffee-planting is mainly concentrated in the second of these belts. In some of the high zones, strong winds occur in October, November and December, and may cause serious damage to the coffee trees; hail, on the other hand, is very rare, and damage from this cause is apparently insignificant.

With regard to geological formation, topography and agricultural potential of the soils, the country may be divided into three zones: a coastal plain, a belt of recent volcanic peaks and a belt of very old mountains and hills. Most of the coffee plantations are found in the more recent volcanic zone, which covers some 6,000 square kilometres and is made up of dark soils of relatively new formation, old red clay soils, and recently-formed fine sandy loams composed of detrital layers of white pumice stone. ^{2/}

The soils and subsoils of El Salvador are characterized by a high mineral content. Good agricultural yields can usually be obtained from them provided they are rationally managed and protected against excessive erosion. According to the findings of this survey, approximately half the area at present under coffee needs protection against erosion on account of the

^{2/} See Van Beers, The Agricultural Economy of El Salvador, op. cit.

MAPA I
 FIGURE 1
 TIPOS DE SUELOS DE EL SALVADOR
 LAND TYPE AREAS OF EL SALVADOR



- | | |
|--|--|
| <p>PLANICIES ALUVIALES DE LA COSTA
 ALLUVIAL COASTAL PLAINS</p> <p>0</p> <p>1</p> <p>2</p> <p>3</p> <p>4</p> <p>5</p> <p>6</p> | <p>RECENT VOLCANIC TERRACES AND TERRACES</p> <p>7</p> <p>8</p> <p>9</p> <p>10</p> <p>11</p> <p>12</p> <p>13</p> <p>14</p> <p>15</p> <p>16</p> <p>17</p> <p>18</p> <p>19</p> <p>20</p> <p>21</p> <p>22</p> <p>23</p> <p>24</p> <p>25</p> <p>26</p> <p>27</p> <p>28</p> <p>29</p> <p>30</p> <p>31</p> <p>32</p> <p>33</p> <p>34</p> <p>35</p> <p>36</p> <p>37</p> <p>38</p> <p>39</p> <p>40</p> <p>41</p> <p>42</p> <p>43</p> <p>44</p> <p>45</p> <p>46</p> <p>47</p> <p>48</p> <p>49</p> <p>50</p> <p>51</p> <p>52</p> <p>53</p> <p>54</p> <p>55</p> <p>56</p> <p>57</p> <p>58</p> <p>59</p> <p>60</p> <p>61</p> <p>62</p> <p>63</p> <p>64</p> <p>65</p> <p>66</p> <p>67</p> <p>68</p> <p>69</p> <p>70</p> <p>71</p> <p>72</p> <p>73</p> <p>74</p> <p>75</p> <p>76</p> <p>77</p> <p>78</p> <p>79</p> <p>80</p> <p>81</p> <p>82</p> <p>83</p> <p>84</p> <p>85</p> <p>86</p> <p>87</p> <p>88</p> <p>89</p> <p>90</p> <p>91</p> <p>92</p> <p>93</p> <p>94</p> <p>95</p> <p>96</p> <p>97</p> <p>98</p> <p>99</p> <p>100</p> |
|--|--|

steep slope and edaphic conditions of the land.^{3/}

The practice adopted in El Salvador of planting coffee under shade-trees modifies the natural ecological conditions and provides a milder micro-environment for coffee growing.

In designing the statistical sample used as a basis for this investigation, due account was taken of the various ecological factors so as to include farms with varying characteristics. Map I shows the major soil types to be found in El Salvador, in accordance with Bourne's classification.^{4/} Map II indicates the seven coffee zones into which the country was divided for the purpose of this survey. As can be seen, the soil association within each region is broadly uniform. Altitudes above sea-level are also indicated in Map II.

2. Varieties of coffee grown

For many years the predominant type of coffee cultivated in El Salvador was of the Arabica typica variety.^{5/} Bourbon^{5/} and Maragogipe^{5/} were also grown. Typica and Maragogipe are among the finest varieties of coffee in the world as regards both taste and appearance. However, as they are late varieties with relatively poor yields and are not very well adapted to the lower altitudes, they have gradually been replaced by Bourbon, both in new plantations and in re-plantings.

The Bourbon variety, which is also of the Arabica species, has taste characteristics similar to those of the Typica, and at the same time is hardier, earlier and better adapted to low altitudes, while its yields are somewhat higher. Bourbon coffee beans are smaller than those of the Typica variety.

3/ The practice most commonly followed for the protection of the soil on coffee plantations in El Salvador is the so-called "izoteado", consisting in contour barriers or hedges of izote (Yucca.sp.).

4/ Bourne et al., Preliminary Survey of Conservation Possibilities for El Salvador, Institute of Inter-American Affairs.

5/ Coffea arabica L. var. typica Cramer; C. arabica L. var. Bourbon (B. Rodr.) Choussy; C. arabica L. var. maragogipe, Hort ex Froehner.

In recent years the cultivation of a spontaneous strain of the Bourbon variety called "Nacional" has spread considerably. The outstanding characteristics of this strain --especially its higher yields-- are well-known even outside El Salvador. Although Typica is still grown, especially by small-scale coffee-planters who are inclined to cling to tradition, in most of the country's coffee plantations Bourbon of the "Nacional" type predominates. Owing, however, to the interplanting of the different varieties, spontaneous crossings occur, resulting in heterogeneous coffee-tree stands.^{6/}

3. Area, distribution and organization of coffee plantations

The expansion of the sample taken in El Salvador indicates that in 1955 there were 19,789 commercial coffee farms ^{7/} with 113,470 hectares of coffee in full production and 23,355 hectares covered by trees less than 5 years old. Thus, the total area under coffee was approximately 136,825 hectares. These figures refer exclusively to coffee plantations engaged in production for the market, and consequently they differ from the relevant statistics in the 1950 Agricultural Census. They were obtained by extending to the universe the findings for the sample used in the survey; no previous information of this kind existed in El Salvador.

The size of the coffee plantations varies considerably. Table 1 shows the estimated number of farms and the area covered by the adult coffee plantings by size of farm.

The largest estate studied in the sample contained 410 hectares under coffee, but the biggest in the country has over 1,500. At the other extreme there are non-commercial farms with only a few coffee-trees which

^{6/} El Salvador's agricultural experiment station (Centro Nacional de Agronomía) and some individual planters are experimenting with imported strains. Up to now, however, no definite results have been obtained.

^{7/} The following definition of the commercial coffee farm was used in the study: "All those producing more coffee than needed for home consumption, or having sufficient new coffee plantings for this purpose".

produce for consumption on the farm itself.

Half of the plantations producing for the market are comprised in the under-one-hectare group, and almost 90 per cent of the total number is made up of plantations of less than 10 hectares. However, farms of up to 10 hectares occupy only 22 per cent of the area covered with adult coffee-trees. The largest percentage of the coffee area (35 per cent) is in farms which have between 10 and 50 hectares under coffee. Farms with between 50 and 200 hectares under coffee cover 28 per cent of the total area and are consequently also of great importance. At the top of the scale, 61 farms account for about 15 per cent of the whole coffee area of El Salvador.

In table 2 the number of coffee farms and the area covered by adult coffee plantings have been arranged according to elevation. Altitude above sea-level appears to have a significant influence on yields.

In terms both of the area under cultivation and of the number of farms, coffee-growing is concentrated between 600 and 900 metres above sea-level. The largest plantations are usually at the higher altitude. The average size of farm, which reaches only 5 hectares up to 1,150 metres above sea-level, rises to about 14 hectares in the higher regions.

Almost all the coffee plantations are managed by their owners. The renting or share-cropping of land under coffee is an almost unknown practice, and seems never to have been of any importance in El Salvador as a system of coffee-land tenure and coffee-farm operation. While the small planters owing less than 10 hectares under coffee usually live on their farms, practically all the large-scale landowners reside in neighbouring townships or distant cities. Absentee landlords generally pay frequent visits to their plantations, especially at harvest-time, but managers are employed to undertake responsibility for the day-to-day activities of the plantation. In the larger estates managers are assisted by overseers, office employees and other permanent staff. Each overseer is in control of 10 to 30 workers, according to the type of operations carried out.

An 8-hour working day is the most common. The average daily wage for male workers on the coffee plantations in 1954/55 was 0.75 dollars, including the cost of food rations. At harvest-time, the custom is to issue food rations -maize "tortillas", beans and salt- to the workers at mid-day

Table 1

EL SALVADOR: COMMERCIAL COFFEE PLANTATIONS AND AREA UNDER ADULT PLANTATIONS, BY SIZE OF PLANTATION

Size of plantation (hectares)	Commercial plantations		Area under adult plantations	
	(Number)	(Percentage)	(Hectares)	(Percentage)
Less than 1.0	9,795	49.5	3,691	3.3
1.0 - 10.0	7,652	38.7	21,508	18.9
10.1 - 50.0	1,912	9.7	39,562	34.9
50.1 - 100.0	248	1.2	16,825	14.8
100.1 - 200.0	121	0.6	15,138	13.3
More than 200.0	61	0.3	16,746	14.8
Total	19,789	100.0	113,470	100.0

Source: ECLA/FAO Survey

Table 2

EL SALVADOR: COMMERCIAL COFFEE PLANTATIONS AND AREAS UNDER ADULT PLANTATIONS, BY ALTITUDE ABOVE SEA-LEVEL

Altitude (metres)	Commercial plantations		Area under adult plantations	
	(Number)	(Percentage)	(Hectares)	(Percentage)
Less than 600	2,885	14.6	12,091	10.6
601 - 900	10,975	55.5	51,370	45.3
901 - 1,150	3,933	19.9	22,887	20.2
1,151 - 1,350	1,254	6.3	21,207	18.7
More than 1,350	742	3.7	5,915	5.2
Total	19,789	100.0	113,470	100.0

Source: ECLA/FAO Survey

/and when

and when the day's work is over. This practice is less frequent at other seasons of the year. When payment is made on a daily basis, women generally receive the equivalent of two-thirds, and children approximately one-half, of a man's wage. Women and children take part mainly in special operations such as planting, replanting, and harvesting. Work on a jobbing basis is as a rule confined to specific operations requiring no special skill, while for certain delicate tasks, such as pruning, day-labour is hired. Wage levels of course vary according to the type of work, and also from one district and even from one plantation to another. Workers are usually paid weekly or fortnightly.

Permanent employees receive annual salaries ranging from 300 to 1,000 dollars, according to their position and also to the size of the estate. On the larger plantations managers usually earn up to 3,000 dollars a year. As a rule all permanent employees get housing and certain staple food items in addition to their salaries.

4. Manpower and its seasonal distribution

Coffee-growing according to the practices followed in El Salvador, by its very nature calls for a large input of manpower. The various operations keep a man employed for an annual average of 195 working days, or approximately 1,566 man-hours per hectare under coffee. Without taking into account the input of labour used for the establishment of the plantations, in 1954/55 an average of 238 man-hours was used for each 100 kilogrammes of coffee beans produced. Again, it was estimated that the establishment of the plantations represented 687 working days, or approximately 5,449 man-hours per hectare. The amortization of this initial investment would account for a further 367 man-hours per hectare harvested,^{8/} which, added

^{8/} It was estimated that the economic duration of an adult coffee plant without replantings would be about 15 years.

to the previous 1,566, would give a total of 1,933 man-hours.^{2/} With a similar amortization, the production of 100 kilogrammes of coffee presupposes a labour input of 293 man-hours.

The processing of the coffee involves on the average an additional 31 man-hours per 100 kilogrammes of coffee when the berries are dried, and 11 extra hours for washed coffee, bringing the previous figures up to 324 and 304 hours of work respectively.

Table 3 shows average total employment of labour in terms of man-hours from the establishment of the coffee plantation to the time when it begins to yield. Of the total number of hours worked, 3.4 per cent corresponds to work in the seedbeds, 12.2 per cent to work in the nurseries and 84.4 per cent to all the other operations required until the new coffee-trees become adult and enter full production.

Table 4 gives the average number of man-hours worked per hectare under adult coffee-trees in El Salvador and in each of the zones into which the country was divided for purposes of the survey. There are wide differences in the input of manpower between the western part of the country (zone I to IV) -where most of the oldest and best-organized plantations are to be found- and the eastern region (zones V to VII). In the Santa Ana district (zone II) which is one of the best coffee areas, an average of 5 man-hours per day is worked on every hectare of coffee throughout the year, and similar figures are registered in the other western districts. In contrast, the labour input per hectare is much less in the eastern zones (V to VII).

Seasonal labour requirements of course vary substantially from one farm to another, according to the methods used by the farmer and the intensiveness with which the various operations are carried out. In view of the importance

^{2/} This average labour input in the El Salvador coffee plantations is approximately 17 times as great as that recorded in the United States for the cultivation and harvesting of one hectare of wheat, and is somewhat more than is required for the same operations in the case of tobacco, this last being one of the agricultural activities absorbing the largest amount of manpower in United States farming.

Table 3

EL SALVADOR: LABOUR EMPLOYED DURING THE VARIOUS PHASES OF THE
ESTABLISHMENT OF A COFFEE PLANTATION
(Man-hours per hectare)

Phase	Total	Percentage
Seedbed (3 months)	188	3.4
Nursery (1 year)	675	12.2
In the field:		
First year	2,043	37.2
Second year	655	11.9
Third year	496	9.0
Fourth year	641	11.7
Fifth year	<u>801</u>	<u>14.6</u>
Total	4,636	84.4
Grand total	5,499	100.0

Source: ECLA/FAO Survey.

Note: According to customary procedure in El Salvador, the period of formation of the coffee plantation was taken as 5 years. The reason for this is that yields rise sharply from the fifth year onward.

Table 4

EL SALVADOR: LABOUR INPUTS PER HECTARE UNDER COFFEE BY ZONES
(Man-hours per hectare of coffee plantation)

	I	II	III	IV	V	VI	VII	Total for the country
Total operations previous to pick- ing	932	1,047	912	1,346	615	704	455	1,000
Picking	667	703	544	606	449	353	292	566
Total direct labour input	1,599	1,750	1,456	1,952	1,064	1,057	747	1,566

Source: ECLA/FAO Survey.

Note: In this and subsequent tables columns I to VII represent the seven zones into which the region was divided.

/of coffee

of coffee in the national economy, the sharp monthly fluctuations registered in the employment of manpower in this activity radically affect over-all employment and the other agricultural and industrial sectors of the country.

The characteristics of coffee-growing, the methods preferred by the Salvadorean farmers and the climate of the country are the principal factors determining the distribution of demand for manpower over the course of the year. Human labour is most intensively utilized in the period October-January, nearly 60 per cent of the total labour force being employed during those four months. (See figure I.) This is because the two operations absorbing the largest labour input -weeding and harvesting- are performed during the period in question.

It is on the plantations at the two extremes of size -i.e., those of less than one and more than 200 hectares- that employment is most unequally distributed and the concentration in October-January is the greatest. In the case of the former, this fact is attributable to the high proportion of total work represented by the two operations mentioned, since they are almost the only ones carried out on an adequate scale. On the large estates, on the other hand, the main cause seems to lie in the higher yields obtained, which in turn demand greater quantities of manpower at harvest-time (see table 5).

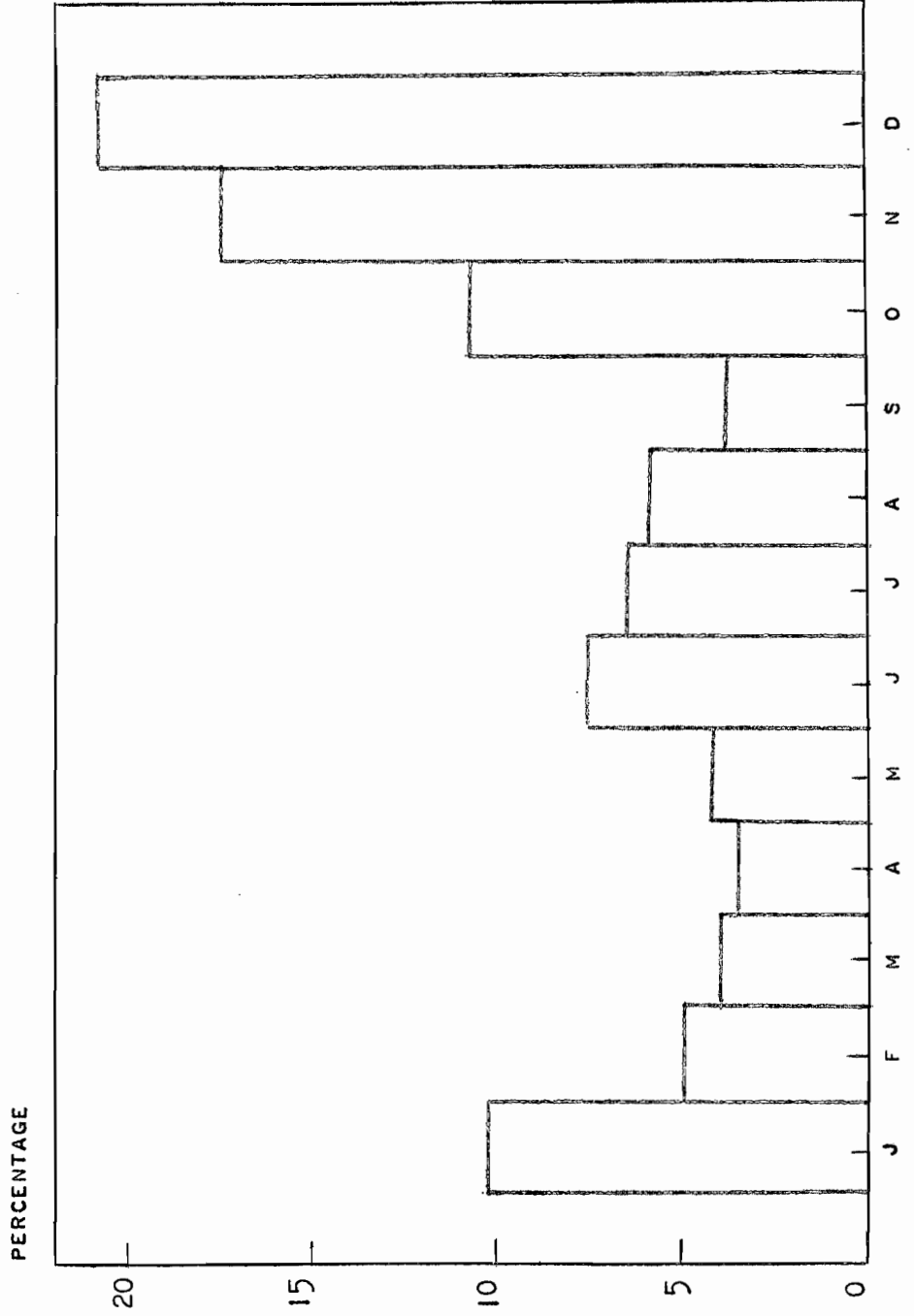
5. Farming methods

Coffee cultivation is fundamentally dependent upon manual labour. The often steeply-sloping land and the presence of shade trees make it difficult to utilize mechanized equipment for the most important operations. Mechanical harvesters for coffee are still in the experimental stage, and picking which is the most labour consuming operation, has to be done by hand. Some coffee-planters have experimented on their own account with the use of tractors-drawn subsoil ploughs to improve drainage before establishing a new coffee field. Attempts have also been made to make use of the plough so as to plant the young trees in furrows instead of digging the traditional planting-holes. However, it does not seem likely that these practices will become very widespread in the near future. Recently, some planters have tried growing coffee on small plots without shade and under irrigation. Similar experiments are being carried out by the Centro Nacional

FIGURE 1

SEASONAL DISTRIBUTION OF DEMAND FOR LABOUR ON ADULT PLANTATIONS

NATURAL SCALE



de Agronomia. But in view of the shortage of irrigation water in the main coffee areas and the heat of the climate there is little scope for these methods to be used extensively.

Table 5

EL SALVADOR: SEASONAL DISTRIBUTION OF EMPLOYMENT ON COFFEE FARMS, BY SIZE OF PLANTATION

(Percentage of annual employment)

Size of plantation (Hectare)	Janu-ary	Febru-ary	March	April	May	June	July	August	Sep-tem-ber	Oct-ober	Novem-ber	De-cem-ber	Oct-ober-Janu-ary
Less than 1.0	5.9	5.7	2.4	2.3	3.7	11.1	5.6	5.2	2.4	8.4	18.6	28.7	61.6
1.1 - 10.0	6.6	4.4	3.5	3.5	5.4	10.4	6.7	7.0	3.2	7.9	16.0	25.4	55.9
10.1 - 50.0	8.6	5.4	3.9	3.5	5.3	9.7	7.1	6.8	3.7	7.5	17.8	20.7	54.6
50.1 - 100.0	3.8	3.6	3.3	3.4	4.2	8.5	9.4	7.7	5.5	7.4	23.5	19.7	54.4
100.1 - 200.0	15.4	6.5	5.7	3.3	4.2	7.3	6.3	7.6	3.1	10.7	10.4	19.5	56.0
More than 200.0	13.8	3.5	3.4	4.2	3.5	5.8	5.0	3.1	4.5	17.8	16.7	18.7	67.0
Average for the country	10.3	4.9	3.9	3.3	4.3	7.6	6.7	6.0	3.8	10.9	17.5	20.9	59.6

Source: ECLA/FAO Survey.

Whether it is more advantageous to plant coffee with or without shade is still a controversial issue in El Salvador, since no satisfactory evaluation of these two practices has as yet been made under the conditions existing in that country. Experiments undertaken in Brazil have afforded conclusive proof of the advantages of planting coffee without shade trees, as have also those effected in Hawaii. In El Salvador such experiments have been confined to very small plots and have not been duly multiplied in the main coffee-growing areas. In Guatemala and Colombia, where some of the ecological conditions prevailing in El Salvador are to be found, this question is also being studied through

/field experiments.

field experiments specifically planned to shed light on this problem. A decision one way or the other would exert an important general influence on the efficient utilization of the fertilizers applied, soil protection, unit yields, the probable economic duration of the coffee plantation, the production of other crops by means of interplanting, etc.

It is argued that one of the effects of shade is to promote the more even ripening of the berries, which entails the advantage of a single picking and processing season. A further contention is that coffee and shade trees form a forest-like association which prevents soil erosion and helps to sustain good yields on the same land. In the conditions prevailing in El Salvador there is no possibility of rotation or shifting the coffee plantations from one tract of land to another. Any further research on this question should therefore determine the cost and the effects of planting shade-trees, as compared with those of coffee-growing without shade, over an adequate number of years. Clearly, investigations of this kind must be based on strictly defined experimental methods.

Some trials of weed-killers have been made on coffee plantations, but hitherto no final conclusion has been reached as to their advantage over manual weeding. Neither has due attention been devoted to the possible effect on yields of the spacing-out of the coffee-trees. Broadly speaking, the higher the density of the plantation the better the yields will be, provided that the fertility of the soil is not affected. Moreover, under this system the soil is so well shaded that weeds do not flourish at the foot of the young trees. Dense planting is useful for the less spreading varieties of coffee-trees -such as Bourbon, for example-, and is therefore very common in El Salvador. On the other hand, in the case of varieties that develop more freely -typica and maragogipe-, which are cultivated on a much smaller scale than bourbon, it is better to leave a wider space between the plants. Typica grows well at high altitudes, its economic duration is longer and it produces better-quality berries, while its yields are good, although it is a rather late variety.

The Centro Nacional de Economía and the Agricultural Extension Service of the Ministry of Agriculture are the most important of the Government departments providing technical services for coffee planters. A series of experiments in coffee growing are being carried out on the experimental station jointly managed and financed by the Government of El Salvador and the United States Technical Co-operation Programme.

It should also be pointed out that the Asociación Cafetalera de El Salvador has a training school for overseers in Santa Ana. In addition, the Inter-American Institute of Agricultural Sciences provides technical assistance to the country's coffee industry.

Nevertheless, there are many other problems of vital importance for coffee growing - for instance, the economic evaluation of certain practices such as the application of fertilizers, etc., - which are still unsolved and will call for careful research over a number of years. In 1955 the Government of El Salvador set up the Instituto del Café, one of the aims of which is to intensify experimental research and encourage the development of the coffee industry.

Chapter II

COFFEE IN THE ECONOMY OF EL SALVADOR

1. Coffee and income

About 90 per cent of El Salvador's foreign exchange earnings is derived from coffee exports. Conversely, imports of consumer and capital goods of every kind are dependent upon the volume and price levels of coffee sales abroad.

In recent years, coffee has contributed from 20 to 25 per cent of the gross national product, and its position among crops grown for the market is outstanding since a substantial proportion of El Salvador's agricultural activities can still be classified as subsistence farming. Under these conditions, any fluctuation in coffee prices, in the wages of the workers employed on the coffee plantations, or in the volume of production, has a profound effect upon all sectors of the economy.

The public sector is particularly sensitive to the state of the coffee industry. The rise in coffee prices, and the existence of a flexible tax on coffee exports - which varies according to the international price level - have produced a very marked expansion of fiscal revenue since the war. The share of this tax in total government revenue increased from 7 per cent in 1945 to 20 per cent in 1950, and further to 30 per cent in 1954 and 1955. Moreover, import duties account for over one-third of fiscal revenue, and as the volume of imports is determined by the amount of foreign exchange accruing from coffee exports, it can be asserted that something like two-thirds of the official budget are closely dependent upon the coffee industry.

The tax on coffee exports has represented in recent years approximately one-fifth of the value of the exportable output. Some of the extra profits resulting from the high world market price of coffee have thus been diverted to the public sector and have been used to a considerable degree for the country's over-all economic and social development. While the proportion of the total value of exports corresponding to taxes sharply increased during the decade 1946-55, and while the present system of a flat rate for all sizes of coffee incomes probably tends to be harder on the small farmers, apparently the price incentive to coffee production has not been unduly affected, nor is there any reason to suppose that it is likely to be so in the future. (See figures II and III.)

/2. Farm values

FIGURE 11 - 11

EL SALVADOR : PRICE OF COFFEE (EXCLUDING TAXES) AND FARM PRICE
(AS A PERCENTAGE OF F.O.O.B. PRICE)

NATURAL SCALE

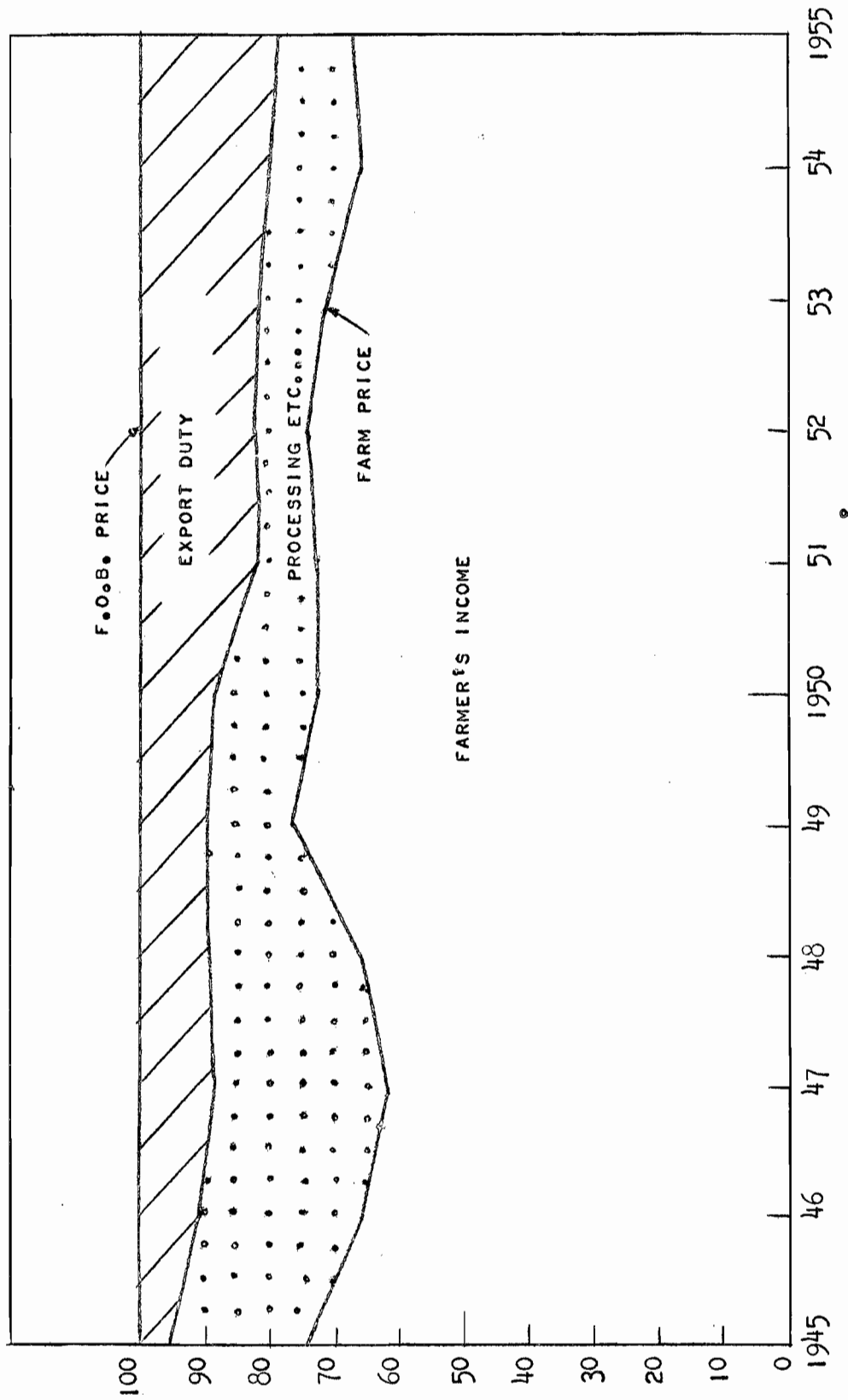
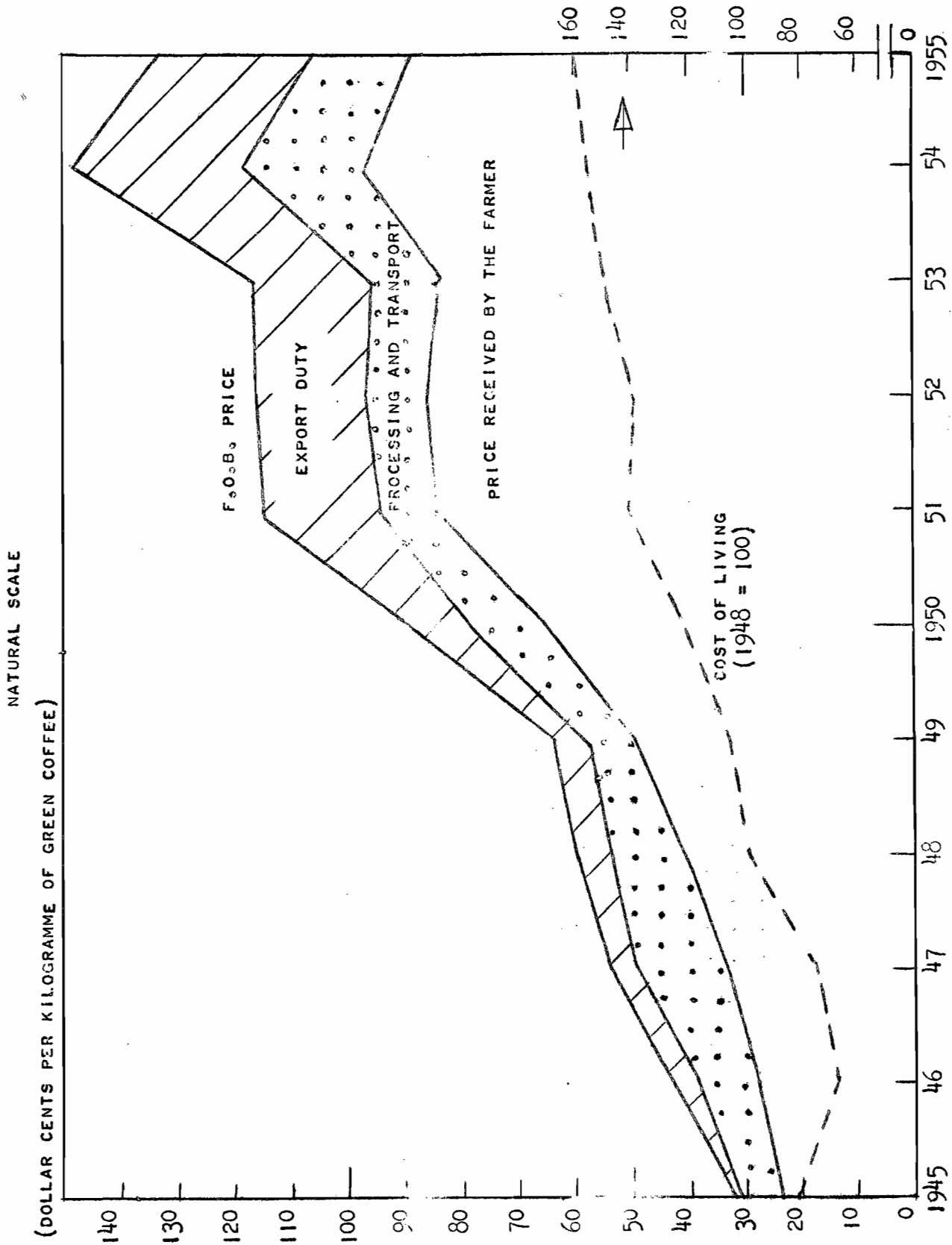


FIGURE 11 - III.
 EL SALVADOR : COFFEE PRICES AT DIFFERENT STAGES OF THE MARKETING PROCESS



2. Farm values and investment

It is no easy task to establish the total value of investment in the coffee plantations of El Salvador. The questionnaires used in the survey included a declaration by the coffee-planters of the estimated value of their estates at the date of the sample. When the data were expanded to the statistical universe, the aggregate estimated value of the commercial scale coffee plantations was found to be about 404 million dollars. This sum included the farmer's estimate of the value of the land and of the fixed investment in buildings, machinery, animals, vehicles, etc. If this estimate is adopted, the average value per hectare of coffee plantation for the whole country would be approximately 3,500 dollars.

Few actual sales of land under coffee or suitable for coffee-growing are taking place in El Salvador. Representative sales data might have provided an effective basis of comparison for checking the values declared by the planters. At the time of the survey, financial and commercial circles in El Salvador were quoting coffee-land values similar to those recorded by the sample, but it should be taken into account that those figures were markedly influenced by the high coffee prices then prevailing and by the fact that virtually the whole of the land best suited to coffee was already in use.

An attempt was made to estimate the real amount of investment in the establishment of coffee plantations, calculating it indirectly from the cost of labour at the time of the survey and other factors utilized from the preparation of the seedbed to the entry of the plantation into full production (usually in the sixth year). Thus estimated, total investment in the coffee plantations - excluding the value of the land, buildings, machinery and other operational equipment - worked out at only 85 million dollars. This figure represents a net average investment of 750 dollars per hectare, including 480 dollars for labour, 120 for various materials - fertilizers, insecticides, etc. - and 150 dollars corresponding to interest. ^{1/} If 21 million dollars corresponding to buildings, machinery, animals, vehicles and other fixed capital are added, a total of 106 million dollars is secured, which in turn

^{1/} Compound interest at an annual rate of 6 per cent.

would mean an estimated investment of 934 dollars per hectare (excluding the value of the land).

This would tend to show that the value of the plantations as declared by the coffee-growers reflected the conditions prevailing in the coffee trade, and that these conditions influenced the intrinsic price of the land and resulted in a revaluation of investment in the coffee farms.

The marked divergency between this last estimate and the values given by the questionnaires would be of fundamental importance for any calculation of the monetary costs of production, to which, at the same time, it imparts a highly fortuitous character. Table 6 sums up total investment values in the coffee plantations as reported by the farmers by coffee zones. This table also shows the estimated investment excluding the value of the land. Table 7 gives the same values by zone and by hectare. From a study of this table it can be deduced that use of capital in coffee-growing was highest in zones II and IV, both per farm and per hectare. Table 7 shows in addition that, apart from the coffee plantation itself, the largest part of the value is in the operator's residence and offices, while workers' housing facilities constitute only a small proportion of the total.

Again, table 8 indicates the close relationship between the value per hectare under coffee and the size of the plantation. This may be attributable not only to the fact that the large plantations are usually to be found on the best and most fertile land, but also to better management. Shade trees are kept in better condition, the soil is more efficiently protected against erosion, a larger quantity of fertilizers is applied and the pruning of the coffee-trees is carried out with care.

The proportion of the value represented by the owner's residence of course tends to decrease as the size of the plantation increases. ^{2/} The contrary applies in the case of the workers' dwellings. Investment per hectare in pack and draught animals tends to decrease rapidly as the size of the plantation increases. Farms of less than one hectare have at least one pack or draught animal, which represents a high value per unit of area,

^{2/} For purposes of the study the value of certain residential structures bearing no relationship to farm operations, were excluded.

Table 6

EL SALVADOR: VALUE OF PLANTATIONS, AS ESTIMATED BY FARMERS
AND AS CALCULATED FROM PHYSICAL
AND LABOUR INPUTS, BY ZONES

(Millions of dollars)

Zone	Value of coffee plantation		Housing c/	Other fixed investment d/	Pack-draught animals	Vehicles e/	Other equipment f/	Total	
	A a/	B b/						A a/	B b/
I	48.0	10.7	1.1	0.4	0.1	0.5	0.2	50.3	13.0
II	117.9	26.2	1.6	2.5	0.2	0.5	0.4	123.1	31.4
III	33.2	7.4	0.5	0.7	0.1	0.2	0.2	34.9	9.1
IV	122.4	27.1	4.6	1.8	0.3	0.8	0.4	130.3	35.0
V	12.4	2.8	0.5	0.1	0.2	0.1	0.1	13.4	3.8
VI	43.9	9.8	0.8	0.6	0.1	0.3	0.1	45.8	11.7
VII	5.1	1.1	0.4	0.2	0.1	0.1	0.1	6.0	2.0
Total for the country	382.9	85.1	9.5	6.3	1.1	2.5	1.5	403.8	106.0

Source: ECLA/FAO Survey.

a/ Value declared by farmers, including the estimated value of the land.

b/ Estimated on the basis of initial investment in the plantation (excluding the value of the land).

c/ Including buildings used for management purposes and offices.

d/ Including workers' housing facilities, water tanks, grocery stores and warehouses.

e/ Including motor vehicles and carts.

f/ Including tools, office equipment, kitchen utensils.

Table 7
EL SALVADOR: VALUE PER HECTARE OF ADULT COFFEE PLANTATION, BY ZONES a/
(Dollars)

Zone	Value of coffee plantation		Housing c/	Other fixed investment d/	Pack- and draught animals	Vehicles c/	Other equipment f/	Total	
	A <u>a/</u>	B <u>b/</u>						A <u>a/</u>	B <u>b/</u>
I	2,949	655	68	22	7	33	10	3,089	795
II	5,046	1,121	70	109	7	22	15	5,269	1,344
III	3,248	722	50	69	12	24	17	3,420	894
IV	3,659	813	136	54	9	24	11	3,893	1,047
V	1,588	353	70	17	31	19	9	1,734	499
VI	2,371	527	43	30	6	14	4	2,468	624
VII	1,347	299	106	52	20	36	26	1,587	539
Weighted country average	3,375	750	84	56	10	23	11	3,559	934

Source: ECLA/FAO survey.

a/ See footnotes to table 6.

Table 8
EL SALVADOR: VALUE PER HECTARE OF ADULT COFFEE PLANTATION, BY SIZE a/
(Dollars)

Size of plantation	Value of coffee plantation		Housing c/	Other fixed investment d/	Pack- and draught animals	Vehicles c/	Other equipment f/	Total	
	A <u>a/</u>	B <u>b/</u>						A <u>a/</u>	B <u>b/</u>
Less than 1 ha	1,554.8	346.0	377.2	35.0	66.0	20.7	10.3	2,064.0	855.0
1 - 10.0	2,104.2	467.0	128.6	49.0	17.6	44.2	13.7	2,357.3	720.0
10.1 - 50.0	3,016.0	668.0	45.6	38.7	10.6	29.7	10.9	3,151.5	803.0
50.1 - 100.0	3,145.1	699.0	113.7	78.5	9.7	29.1	13.1	3,389.2	943.0
100.1 - 200.0	4,541.6	1,010.0	57.5	90.5	2.5	18.0	11.5	4,721.6	1,190.0
More than 200.0	4,070.0	905.0	97.9	58.1	4.8	10.1	8.2	4,249.1	1,084.0

Source: ECLA/FAO survey.

a/ See footnotes to table 6.

/while on

while on the larger estates motorized transport is used. This does not seem to be any clear relationship between the amount of the other investment items listed in table 8 and the size of the plantation.

3. Production, export and consumption

A noteworthy feature of El Salvador's coffee economy is the maintenance of trees and output on very old plantations. This is a type of coffee-growing which differs markedly from that practised in other areas, such as Brazil, where production is maintained or increased by transferring the crop from land which has lost its fertility to areas of virgin soil. Many plantations in El Salvador were established two or more generations ago, and the chief method of avoiding a decline in yields consists in replacing old or under-productive trees. A large proportion of the land best suited for coffee-growing, which is found only in a small area centering on three recently-formed volcanic zones, was planted to coffee at the beginning of this century. Since then, the development of production through expansion of the area under cultivation has been slow. For this reason, apart from the annual fluctuations registered in any kind of crop, coffee production in El Salvador has remained relatively stable since the end of the Second World War and, in reality, long before that. Nevertheless, a slight upward trend in production occurred during the pre-war years, and there are indications that this trend may be resumed during the next few years. In the period 1900-20, the annual rate of growth of coffee production was in the neighbourhood of 2 to 3 per cent. Between 1920 and 1930, this rate was considerably accelerated, rising to 6 - 7 per cent yearly. In the last 25 years, however, the depressive effects of the economic crisis of the thirties and of the Second World War reduced this annual rate to only 1 per cent per annum. Production even tended to decline after 1948/49. It is only on the basis of the findings of the present study that a reversal of this downward trend can now be predicted as possible in the next few years. Table 9 shows production, exports and consumption of coffee in El Salvador during the last ten years.

Production figures given in table 9 were estimated by adding exports of each harvest to the estimated figure for domestic consumption. This procedure was adopted for want of reliable statistical data on production and domestic consumption. The estimates for consumption were obtained from various sources,

Table 9
EL SALVADOR: PRODUCTION, EXPORTS AND DOMESTIC CONSUMPTION OF COFFEE,
1945/46 TO 1954/55
(Tons)

Crop year	Production	Exports	Consumption
1945/46	51,750	47,150	4,600
1946/47	60,850	56,200	4,650
1947/48	64,350	59,650	4,700
1948/49	79,850	75,050	4,800
1949/50	73,600	68,750	4,850
1950/51	72,150	67,200	4,950
1951/52	61,750	56,700	5,050
1952/53	78,600	73,350	5,250
1953/54	59,450	54,050	5,400
1954/55	76,350	70,750	5,600

Source: For exports: Compañía Salvadoreña de Café.

Note: To obtain the consumption figure for 1949/50, the difference was calculated between census-tabulated production and exports; for other years, the corresponding estimate was based on official population statistics, using 1949/50 per capita consumption. Production equals exports plus estimated consumption.

/partly by

partly by means of direct interviews and partly from the 1950 agricultural census, which was used as the principal point of reference. On an average, the country's annual consumption seems to amount to about 2.5 kilogrammes per capita. Total consumption in El Salvador was obtained by multiplying this estimated per capita consumption by the official population figures.

Although average production for the country has not varied greatly during the last few years, important annual fluctuations have been registered in the history of coffee in El Salvador. It seems that in actual fact a good crop often precedes a poorer one, mainly because of the temporary exhaustion of the coffee trees and the impoverishment of the soil for want of adequate fertilization. Annual variations are even more marked for the different zones than for the national average. Thus, a good harvest in one area does not necessarily imply that results have been the same all over the country. Regional fluctuations from one year to another are often in the neighbourhood of 40 per cent. Despite the small size of the territory, it is not uncommon for weather conditions, especially the volume and distribution of rainfall, to differ markedly in one and the same year in the eastern, central and western zones of the country.

Since the War, El Salvador has traditionally exported a large part of its coffee to the United States, which is also the source of most of its imports. In recent years, however, the European market has been acquiring increasing importance and has partially regained its pre-war position. In the period 1948/49 - 1950/51, about 92 per cent of the coffee exported went to the United States, as compared with only 5 per cent to Europe; whereas in 1953/54 the United States market absorbed only 79 per cent of El Salvador's coffee, while the share of the European countries rose to 20 per cent. During the last few years exports to Europe again expanded, and by 1955/56 represented 46 per cent of total sales of coffee abroad.

4. Credit and farm organizations

Coffee interests in El Salvador are represented by two closely related organizations which are sponsored by the Government and are politically and financially influential. These are the Asociación Cafetalera de El Salvador, created in 1933, and the Compañía Salvadoreña del Café, founded in 1942. Both these organizations were in close contact with the agricultural credit services.

The Asociación Cafetalera de El Salvador, to which most of the owners of commercial plantations belong, is the principal shareholder of the Banco Central de Reserva and of the Banco Hipotecario. These two Banks form part of the credit system sponsored by the Government, and grant loans to coffee producers. The Banco Hipotecario is the main source of long-term credit, although it does also grant advance loans. The Banco Central, which used to provide short-term credit, now gives priority to re-discount operations with other Banks.

The Compañía Salvadoreña del Café, which was originally created with the aim of controlling domestic market prices through its purchases of coffee, has earmarked a major share of its financial resources for the provision of short-term credit to producers and owners of plantations or mills. This organization also buys, processes and exports coffee.

Another source of credit available to producers is the private commercial banking system, and there is also a network of rural credit co-operatives which meets the needs of the smaller-scale producers. These co-operatives, and the federation in which they are associated, form part of the Government-sponsored agricultural credit facilities.

Hence it can be seen that coffee interests exert a powerful influence on the country's bank and credit systems. Coffee receives more assistance in the shape of loans than any other crop, which may also be explained by the fact that its permanent nature minimizes production risks. Both the Compañía Salvadoreña del Café and the commercial banks prefer to transact business with the owners of large plantations or mills. Loans are usually for a term of one year, and the rate of interest payable is between 5 and 6 per cent. However, during the recent price boom, when plenty of capital was available for credit, the rates of interest tended to decline, falling to 4 or 5 per cent annually, especially for important operations. The large-scale producers and mill owners in their turn act as intermediaries for the credit institution, making loans to the small coffee planters, who pledge their crop as security. Under this system, the rates of interest paid by these latter rise to at least 6 and sometimes to 8 per cent. The Compañía Salvadoreña del Café prohibits its

/clients to

clients to raise the rates of interest more than one point above those charged by the Company. Mortgage operations, which usually cover a term of 20 years, yield, broadly speaking, 6-per-cent interest. The Banco Hipotecario is forbidden by law to charge rates of interest more than one point higher than those it pays on its own long-term commitments.

It is significant that the total amount of agricultural credit in portfolio registers very marked seasonal variations, and always reaches its maximum at harvest time. In reality, coffee influences these variations to a greater extent than the official statistics indicate, since during harvest time the large-scale planters mill-owners and exporters obtain substantial loans from foreign banks, either directly or through the Compañía Salvadoreña del Café.

Chapter III

ESTABLISHMENT AND CARE OF THE COFFEE PLANTATION

This chapter presents the findings of the survey on the performance of the various operations involved in coffee growing, the inputs required and the variation that were observed in the intensity with which these inputs were utilized. To give a clearer idea of the various aspects of coffee growing and the complexities of the analysis, the production process will be traced from its initial stages - the formation of a seedbed and subsequently of a nursery - to the establishment of the coffee plantation, and, finally, the operations carried out during a farm year on what may be called an adult coffee plantation in full production.

1. Establishment of the coffee plantation

(a) Work in seedbeds and nurseries

The seedlings required for the establishment and maintenance of the coffee plantations are first planted in the farm's own seedbeds and nurseries or are bought from other farmers who grow them for sale.

The preparation of a seedbed begins with the selection of the ripe coffee berries, which are depulped by hand, washed and then partially dried in the shade. The plot for the seedbed should be in a damp place or near irrigation water. The soil is carefully prepared, and sand or manure is added to improve its texture. Some light cover is usually provided. The seed is sown in March-April, during the dry season, so that the seedlings will be ready for transplanting to the nursery during the rainy season in June or July. After the seeds are put into the soil, the only operations necessary are irrigation, the application of fungicides and protection against destruction by animals.

The nursery requires more work. Preparation of the soil generally includes the incorporation of manure, ashes and lime in order to improve its quality. Green manure is sometimes applied in advance. Above the nursery a wooden structure, roofed with branches, is set up to provide

/the necessary

the necessary shade. The sides of the structure are also covered with branches and leaves. When the seedlings are transplanted from the seedbed to the nursery, they are spaced out widely enough to facilitate removal to their final location in the field. Fertilizers and insecticides are applied and the soil is cultivated and irrigated repeatedly during the period of nursery growth. On any unoccupied ground, a small nursery of shade trees may also be prepared.

Coffee planters who cannot afford the relatively high cost of establishing seedbeds and nurseries may utilize the seedlings which have sprung up spontaneously in the adult coffee plantation. However, this practice is not very common in El Salvador.

In El Salvador coffee seedlings remain in the seedbeds for nearly two months and, on an average, 94 man/hours are required for every thousand plants. After that, they are transplanted to the nursery and usually left there for a year. On an average, 338 man/hours are taken up in the preparation of the nursery and in the care of the young trees during this period. Consequently, a total input of 432 man/hours per thousand coffee-trees is needed for seedbed and nursery operations (see table 10).

In seedbed and nursery alike, the preparation of the soil absorbs most manpower, representing in each case more than 36 per cent of the total input of labour. In seedbeds, the second most important item is irrigation, and in nurseries, the building of the wooden structure to provide shade. Irrigation is not particularly important in the nurseries because these are started at the beginning of the rainy season. Considerable manpower is also required for sowing and for transplanting from seedbed to nursery.

Labour requirements per 1,000 seedlings tend to decrease as the size of nurseries and seedbeds increases. According to the survey - which provided data on hundreds of these throughout the country - seedbeds containing from 6,000 to 10,000 seedlings and nurseries with over 10,000 young trees required the least labour per thousand seedlings (see table 11)

Coffee plantations in El Salvador generally have an average of 2,000 coffee-trees to the hectare. Consequently, the average labour input for

Table 10

EL SALVADOR: AMOUNT OF LABOUR REQUIRED INPUT FOR THE ESTABLISHMENT OF SEEDBEDS AND NURSERIES

Labour	Man/hours (per 1,000 plants)	Total	Grand total
		(Percentages)	
<u>Seedbed</u>			
Preparation of the soil	34	36.2	7.8
Preparation of the seedbed	19	20.2	4.4
Sowing	15	15.9	3.4
Irrigation	22	23.4	5.0
Other operations	4	4.3	0.9
Total	94	100.0	21.5
<u>Nursery</u>			
Preparation of the soil	126	37.3	29.2
Shade	82	24.3	19.1
Transplanting	72	21.3	16.8
Application of manures and fertilizers	8	2.4	1.8
Cultivation and irrigation	40	11.8	9.3
Other operations	10	2.9	2.3
Total	338	100.0	78.5
Grand total	432	-	100.0

Source: ECLA/FAO survey.

Table III-11

LABOUR INPUTS PER 1,000 SEEDLINGS, BY SIZE OF SEEDBEDS AND NURSERIES

(Man/hours per 1,000 plants)

Member of seedlings in seedbed or nursery	Seedbed labour	Nursery labour
Less than 2,000 coffee-trees	133	369
2,000 to 6,000	104	346
6,001 to 10,000	77	326
More than 10,000	81	305

Source: ECLA/FAO survey.

/The cultivation

the cultivation of the seedlings required for planting one hectare in coffee is equivalent to 863 man/hours.

(b) Field operations

To establish a new coffee plantation, the farmer usually begins his field work towards the end of the rainy season (October). Almost all the operations are performed by hand, with simple tools. The ground is cleared and the position of the future coffee trees is staked out. Planting-holes are afterwards dug on the spots previously marked. The texture of the soil and its water-holding capacity largely determine the size of these holes. This operation is usually carried out some time before planting, when the soil is relatively soft. As a rule each hole is manured, in accordance with the farmer's economic resources and technical ability. Sometimes the hole-digging and other operations take place as much as a year before planting.

If the planter wishes to keep investment down, he selects shade trees from among those already existing in the field, cutting down and burning the remaining vegetation. In El Salvador, however, the most common practice is to plant shade trees (principally leguminous trees of the genera Inga and Cliricidia) before the young coffee-trees are transplanted to the field. As the permanent shade trees grow rather slowly, other fast-growing shade plants (usually bananas or castor beans) must be cultivated in the meantime to protect the young coffee-tree and the ground from the direct impact of the sun and the heavy rains. At high altitudes, where the climate is cooler, farmers often leave the young coffee-trees without cover so as not to discourage growth.

When the ground has a steep slope, contour terraces and/or hedges of such plants as Yucca sp. ("izote") and Sansevieria sp., may be established to prevent erosion. However, it is still fairly common to omit these soil conservation practices. In the higher altitudes wind-breakers are usually planted.

Planting is generally scheduled for June or July. Seedlings between one and two years old are used. When transplanting from the nursery to the field some of the nursery earth should preferably remain attached in a clod to the roots of the tree for purposes of protection.

/Once a

Once a new coffee-field has been established, maintenance operations until the coffee-trees yield their first full crop, are similar to those performed on adult plantations. New coffee-fields are generally weeded once or twice a year, and they may receive one or more applications of fertilizers or manure ^{1/} or both.

In addition, diseases and pests are regularly controlled in the growing plantation. Trees which are developing badly or have not taken root are replaced during the formation process. Young coffee-trees are subjected to the so-called "formation prunings", and the adult coffee-trees and shade trees are also pruned at regular intervals. It is a common practice to dig around the trees "manuring ditches" in which fallen leaves, weeding residues, pulp residues from the coffee mills, and other organic matter are buried.

The amount of investment per hectare in the establishment of a new coffee plantation may vary widely according to the financial means and the technical skill of the planter, and the natural conditions of the land. Those who are unable or unwilling to invest heavily in their new plantations can partially prepare the land, reduce the number of shade trees specially planted and devote less care to the digging and manuring of the planting-holes. They may also abstain from forming terraces before planting out the coffee-field. Once the plantation is established, the farmer whose resources are more limited may confine his operations to weeding up to harvest-time.

In any case, during the formation period, it is in the first year that the labour input is greatest. This is a point of vital importance for the farmer who is thinking of enlarging his coffee plantation or establishing a new one. Figure IV and table 12 show that in its first year the plantation needs on an average 2,043 man/hours per hectare, which represents more than twice the investment required in each of the subsequent formation years, and nearly 30 per cent more than the annual demand for manpower on an adult coffee plantation in full production.

^{1/} Green manure, coffee pulp, animal manure, other forms of organic matter and leaf mould are used.

FIGURE III - IV

EL SALVADOR : TIME DISTRIBUTION OF LAEOUR INPUT IN THE ESTABLISHMENT OF A COFFEE PLANTATION

NATURAL SCALE

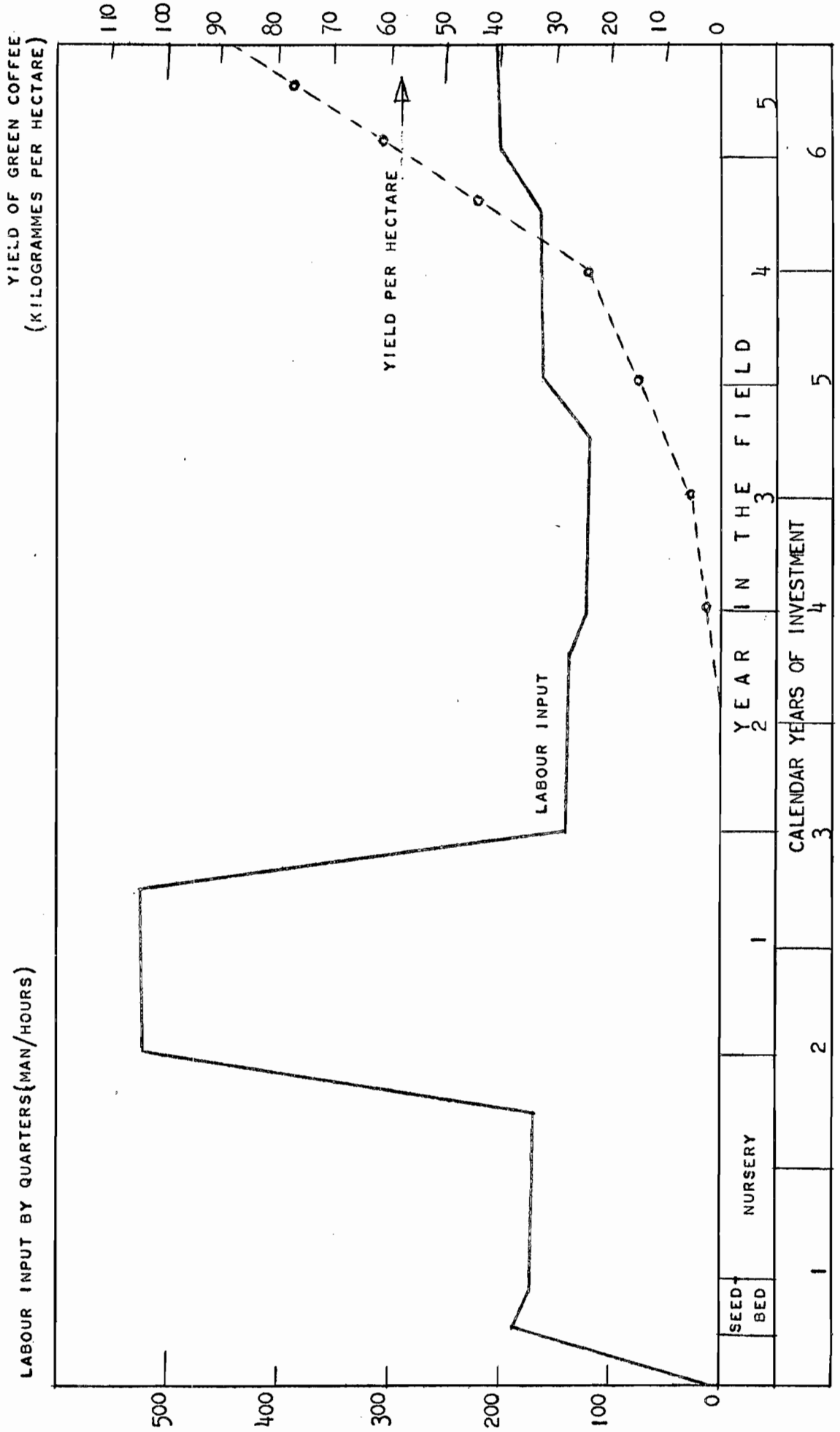


Table III-12

EL SALVADOR: LABOUR REQUIRED FOR ESTABLISHING A NEW COFFEE PLANTATION
DURING THE YEARS OF FORMATION, BY MAIN OPERATIONS

(Man/hours per hectare)

Operation	1st. year	2nd. year	3rd. year	4th. year	5th. year
Land clearing and lay-out	263	-	-	-	-
Planting and maintenance of shade trees	136	57	18	-	-
Hole-digging	446	-	-	-	-
Fertilizing and manuring	265	73	46	81	151
Planting of coffee-trees	563	-	-	-	-
Weeding	262	306	303	303	298
Replanting	-	35	30	33	27
Pest and disease control	-	46	32	34	63
Picking	-	2	36	103	262
Other operations <u>a/</u>	108	136	31	87	-
Total	2.043	655	496	641	801

Source: ECLA/FAO survey.

a/ Mainly erosion control and training of coffee-tree.

/The main

The main operations during the first year are the digging of the planting-holes (446 man/hours per hectare) and the delicate and labour-consuming task of transplanting the young trees from the nursery to the field (563 man/hours) but other tasks are also important. These include the application of fertilizers and manure (265 man/hours per hectare), weeding (262 man/hours), preparation of the ground and layout of the coffee-field (263 man/hours) and planting of shade trees (136 man/hours).

A sharp decrease in labour requirements occurs after the first year and continues into the third year. The most important operations during the second and third years are weeding, fertilizing, pest and disease control, maintenance of shade trees (pruning and replacement) and replacement of badly-developing coffee-trees or of those which have not taken root. After the third year, manpower requirements gradually increase. The operation requiring the greatest labour input during the last part of the formation period is still that of weeding, which calls for a more or less stable annual input of 300 man/hours per hectare. Harvesting begins to acquire importance in the third year, when 36 man/hours are invested on an average in this operation, to be followed by 103 in the fourth and 262 in the fifth years; the application of compost and fertilizers gains importance as from the fourth year. These two operations - picking and fertilizing - explain the increase in manpower input after the third year of formation, although part of this is for current production. Shade trees require care during the first three years, after which additional manpower is needed only for pruning.

The high proportion of labour engaged in the application of fertilizers and manure during the first year is due to the practice of filling each planting-hole with organic matter. In subsequent years also the soil is fertilized, but it is only in the fifth year that a relatively large number of man/hours is taken up by this operation. Apparently most coffee planters feel that the application of fertilizers and manures is not profitable during the early unproductive years, and that, on the other hand, when the fifth year is reached the coffee-trees must be given a special stimulus to prepare them for the first important crop.

/Soon after

Soon after the young coffee-trees have been established in their final location, replanting begins, in accordance with the practice followed in El Salvador. After the first year, 5 per cent of the labour input, goes into the replacement of coffee-trees (see again tables 11 and 12).

In their fourth year, the plantations begin to produce significant volumes of coffee, and during the fifth the structure of the labour input becomes similar to that of an adult plantation.

As a general rule, coffee-trees at higher altitudes take longer to reach maturity and produce their first large crop. However, farming practices are designed to offset the effects of the greater altitude and cooler climate. For example, seedlings are kept in the nursery for two years, instead of one as is usual in the lower-lying areas. Consequently, a plantation that is said to be three years old may contain five-year-old instead of four-year-old trees. Also, during the formation period young coffee-trees are generally left without shade at higher altitudes. On the other hand, the use of the "Nacional" variety, which is adaptable to all altitudes, has largely annulled difference in the physical costs of establishing plantations at varying altitudes.

2. Care of the coffee plantation

In adult plantations, certain operations have effects which extend over several years. For example, heavy pruning of shade trees takes place once every three or four years, and, similarly, the coffee-trees themselves are not always pruned annually. Pruning is amongst the most highly-paid operations, and is carried out by skilled workers, men only being employed. The pruning of the shade trees has a favourable influence on yields, as it enables the right amount of sunlight to reach the coffee-trees. Over-intensive pruning of shade trees results in a bumper crop which is usually succeeded by a poor harvest in the following year.

Coffee-trees are pruned in such a way as to concentrate the vitality of the plant in the branches which are likely to produce most. This operation is performed after the pruning of the shade trees and before

/the rainy

the rainy season begins, so that the coffee plantation may benefit fully from the favourable weather which generally prevails during the spring-like season. The wood derived from the pruning operations is collected and used or sold as firewood.

Other operations are carried out according to the needs of each farm, which may vary from one year to the next, and to the degree of care with which the plantation is tended. Soil conservation measures include the repairing of terraces and the interplanting or replanting of the contour hedges. Shade trees sometimes have to be replaced to fill gaps in the protecting canopy. Unproductive coffee-trees are replaced, and, for this reason, most adult plantations contain trees of widely varying ages. Replacing is performed either by pulling up the old tree and setting a new one in its place, or by interplanting, in which case the unproductive tree is removed later when the new one begins to bear fruit. Concurrently with the application of fertilizers and compost, the ground is generally hoed, so that full advantage can be taken of the manures and the physical state of the soil improved.

The coffee crop-year ends with the harvest which in El Salvador takes place mainly from November to January. The ripe coffee berries are carefully picked by hand, care being taken to avoid damage to the branches and to the next year's productive buds. Picking is repeated at least once in order to gather the berries which were not yet ripe at the time of the first picking. During harvest-time large numbers of men, women and children migrate to the coffee-growing areas. Each day's pickings are taken to the mill, where they are processed during the evening and night of the same day. The major part of the crop is transported from plantation to mill by lorry or ox-cart; mules are used where roads are scarce or in a bad state of repair. Since most of the plantations are in the mountains, there are few zones for which rail transport is available.

3. Frequency with which the various operations are performed

Apart from the few basic operations which are necessarily carried out on every coffee farm, there are others which are not performed invariably or on all plantations. The practices adopted vary widely, as does also the intensity with which they are applied on the different types of farms.

As can be seen in table 13, only two operations - harvesting and weeding - are carried out over almost the whole of the area under coffee in El Salvador. It should be explained, however, that this does not imply an equal amount of labour input in the performance of these or other operations on all coffee farms. On the contrary, considerable discrepancies in this respect are observable among the various plantations.

The same table shows that other operations relatively widely performed are those relating to disease and pest control, pruning of shade trees, and pruning of the coffee-trees themselves (slightly under 50 per cent of the area planted to coffee was pruned in 1954/55). On the other hand, certain operations of special importance for the improvement, or maintenance, of yields, such as the application of mineral fertilizers and the replacement of unproductive trees, are performed only in about one-third of the coffee area, while manuring and the protection of the soil against erosion are undertaken on a still smaller fraction of it.

Table III-13

MAIN OPERATIONS AND PERCENTAGES OF TOTAL AREA UNDER ADULT COFFEE PLANTATION IN WHICH THEY WERE PERFORMED IN 1954/55

Operations	Percentage of area cultivated
Pruning of shade trees	50.9
Pruning of coffee trees <u>a/</u>	
Pruning	48.6
Removal of excess shoots	42.9
Training	14.2
Replanting of shade trees	35.0
Replanting of coffee trees <u>b/</u>	
Hole digging <u>c/</u>	43.5
Replanting <u>c/</u>	30.7
Weeding	99.0
Erosion control <u>d/</u>	11.2
Digging manure ditches	13.0
Manuring	7.6
Fertilizing	33.6
Pest and disease control	51.6
Interplanting of coffee trees	0.7
Other operation <u>e/</u>	14.9
Picking	100.0

Source: ECLA/FAO survey.

a/ This item includes sawing of lumber and chopping of firewood derived from pruning.

b/ Including removal of old trees, manuring of holes before planting, lifting of the young coffee trees from the nursery and transport to the field.

c/ Some of this work can be done at the time when the plantation is established. Hole digging and replanting are not necessarily carried out within the same coffee year, the holes can be dug in one year and the trees planted in the next.

d/ Terraces, hedges, embankments.

e/ Mainly hoeing, clearing of trunks and painting of these with lime.

CHAPTER IV

LABOUR AND OTHER INPUTS IN COFFEE PRODUCTION

It has already been stated that one of the main objectives of the coffee survey in El Salvador was to determine the total labour input per hectare and per 100 kilogrammes of product in coffee-growing during 1954/55. An average figure for the country as a whole, although useful for illustrative purposes, would of course have little significance in itself. The analysis that follows therefore discusses variations in labour input according to the different aspects of the survey, such as the areas studied, the various phases of coffee-growing, the size of the coffee plantations, their altitude above sea-level, unit yields and other factors. A similar examination of the labour input in the processing plants will be made later.

Before the analysis is embarked upon, some indication of its difficulties must be given. These mainly arise from the permanent nature of the plantations and from the fact that before they begin to produce several years must elapse, during which a large number of operations have to be performed. Consequently, to the total number of hours worked on an adult plantation, those corresponding to the formation period should be added at a specific annual rate of amortization, so that the total manpower input per unit of product can be computed. Hence it is clear that in any given volume of coffee, the labour input required before the adult coffee plantation was harvested is implicit.

Another significant complication is introduced by the fact that when the coffee plantation reaches its adult stage, replantings become necessary which will not bear fruit until they themselves attain maturity, and certain operations which partake of the nature of new investment have to be performed. While it is easy to regard the total labour input during the first five years as "investment", it is difficult to draw a distinction between operations with a retarded effect (investment) and those whose effect is immediate (maintenance), which at the adult stage make up the whole of the work on the plantation. In El Salvador coffee farm practices are designed to prolong the period during which the plantation

/is productive.

is productive. Such operations as replanting are among each year's regular tasks, and, consequently, the input registered in this kind of work has been considered as "maintenance". Similarly, on some farms other investment operations such as the building of terraces, exceptionally heavy pruning of the shade trees, etc., were performed in 1954/55, while on others such work seems to have been carried out in 1953/54 or in 1955/56. Nevertheless, the average labour intensity registered during the period under consideration did not indicate that net investment had been affected in the country as a whole. Consequently, total inputs of labour and materials in adult coffee plantations were taken at the most accurate measure of total annual farm requirements on an adult coffee plantation in El Salvador.

1. Total average labour inputs

The input of labour varies considerably from one coffee plantation to another. Whether this is because more operations are performed on some farms than on others, or because of the greater or lesser degree of intensity with which these tasks are carried out, the fact remains that some coffee planters employ less than one hour's labour daily, while others provide work for more than one man per day per hectare of coffee throughout the year.

Coffee production in El Salvador is characterized by its high use of manpower. During 1954/55 over 57 per cent of the coffee plantations - representing 80 per cent of the area under coffee - utilized more than 700 man/hours per hectare of adult plantation. (See table 14.) The national average is therefore comparatively high; in the season under review it amounted to about 1,566 man/hours per hectare of adult coffee plantation.

Differences in the efficiency with which coffee plantations are managed result in wide variations in yields per hectare. While some farms obtain less than 100 kilogrammes of coffee per hectare, others produce over 1,500 kilogrammes.^{1/}

^{1/} Throughout this report, references to yields and production are made in terms of clean coffee.

Table 14

EL SALVADOR: PERCENTAGE DISTRIBUTION OF NUMBER AND AREA OF COFFEE PLANTATIONS BY SCALE OF LABOUR INTENSITY PER HECTARE a/

Scale of labour intensity (Man/hour per hectare)	Percentage of total number of plantations	Percentage of total area
Less than 300	13.3	2.4
300 - 700	29.2	17.1
701 - 1,400	32.6	25.1
1,401 - 2,100	16.1	33.2
More than 2,100	<u>8.8</u>	<u>22.2</u>
	100.0	100.0

Source: ECLA/FAO Survey.

a/ Data from Survey. These are not national averages but are representative of the situation in the country as a whole.

Table 15

EL SALVADOR: LABOUR INPUT AND COFFEE YIELD PER HECTARE

Labour input (Man/hours per hectare)	Coffee yield (kilogrammes per hectare)
Less than 300	146
300 - 700	337
701 - 1,400	447
1,401 - 2,100	807
More than 2,100	1,050

Source: ECLA/FAO survey.

/Apparently, there

Apparently, there is a close relationship between labour input and yields. An over-all intensification of operations is generally accompanied by a considerable increment in the volumes of coffee produced per unit of area (see table 15). While the average yield was about 146 kilogrammes per hectare in plantations where the labour input fell below 300 man/hours, it amounted to more than a ton of coffee on those absorbing over 2,100 man/hours per hectare.

The increased intensity in the use of labour is not due to a uniform increase in all the different kinds of work performed. On plantations where advanced techniques are used and labour inputs exceed 1,400 man/hours, special importance is acquired by certain operations, among them pruning, fertilizing, and the control of erosion and of disease, which on the farms where labour is not intensively utilized are undertaken on a very small scale. On farms with an input of less than 300 man/hours per hectare, this group of operations absorbs only 7.3 per cent of the total human labour employed, as against almost 85 per cent utilized for harvesting and weeding. On the other hand, on plantations where the input of labour exceeds 2,100 man/hours, 45 per cent of it is taken up by pruning, fertilizing and erosion and pest control, while picking and weeding account for no more than another 45 per cent.

There are plantations which grow coffee with a minimum of labour outlay because many of the operations which normally precede harvesting are omitted. On these, an average of 21.9 man/hours per hectare and 150 man/hours per 100 kilogrammes of coffee were employed in 1954/55 (see tables 16 and 17). On the other hand, in farms where labour intensity is highest, the manpower input per hectare in the same year reached 2,754 man/hours. However it is worth recalling here the statements previously made on labour input during the period of formation of the coffee plantation. There may conceivably be plantations which produce given quantities of coffee with a minimum of labour, and consequently register an extremely high labour productivity figure. This is because once the coffee plantation reaches the adult stage it can produce coffee even if the pre-harvest operations are not properly carried out.

Table 16

EL SALVADOR: USE OF LABOUR PER HECTARE, TOTAL AND BY OPERATIONS, ON PLANTATIONS
CLASSIFIED BY INTENSITY IN USE OF LABOUR

(Man-hours per hectare worked on the coffee-plantation)

Operation	Under 300		301-700		701-1,400		1,401-2,100		Over 2,100	
	Man/ hours	Per- cent age	Man/ hours	Per- cent age	Man/ hours	Per- cent age	Man/ hours	Per- cent age	Man/ hours	Per- cent age
Pruning of shade trees	11	5.0	50	8.8	91	8.6	135	8.1	209	7.6
Pruning of coffee-trees	2	0.9	50	8.8	118	11.2	260	15.6	423	15.4
Replanting of shade-trees	1	0.5	6	1.1	13	1.2	24	1.5	47	1.7
Replanting of coffee-trees	8	3.7	32	5.7	81	7.7	84	5.1	143	5.6
Weeding	80	36.5	131	23.1	174	16.5	262	15.7	307	11.1
Fertilizing and manuring	-	-	11	1.9	52	4.9	74	4.4	372	13.4
Erosion control	1	0.5	7	1.2	42	4.0	49	2.9	156	5.7
Pest and disease control	2	0.9	28	4.9	38	3.6	102	6.1	79	2.9
Other operations	8	3.6	29	5.1	50	4.7	48	2.9	82	3.0
Total excluding picking	113	51.6	344	60.6	659	62.4	1,038	62.3	1,828	66.4
Picking	106	48.4	224	39.4	398	37.6	627	37.7	926	33.6
Total	219	100.0	568	100.0	1,057	100.0	1,665	100.0	2,754	100.0
Yields (kilogrammes of green coffee per hectare)	146		337		447		807		1,050	

Source: ECLA/FAO survey.

Table 17

EL SALVADOR: USE OF LABOUR PER 100 KILOGRAMMES OF COFFEE PRODUCED,
TOTAL AND BY OPERATIONS, ON PLANTATIONS CLASSIFIED
BY INTENSITY IN USE OF LABOUR

(Man/hours worked per 100 kilogrammes of green coffee)

Operations	Under 300	301- 700	701- 1,400	1,401- 2,100	Over 2,100
Pruning of shade trees	7.5	14.8	20.4	16.7	19.9
Pruning of coffee-trees	1.3	14.8	26.4	32.2	40.3
Replanting of shade trees	0.7	1.3	2.9	3.0	4.5
Replanting of coffee trees	5.5	9.5	18.1	10.4	14.6
Weeding	54.8	38.8	38.9	32.5	29.2
Fertilizing	-	3.3	11.6	9.2	35.4
Erosion control	0.7	2.1	9.4	6.1	14.9
Pest and disease control	1.3	8.3	8.5	12.6	7.5
Other operations	5.5	8.6	11.2	6.0	7.8
Total (excluding picking)	77.3	102.0	147.4	128.7	174.1
Picking	72.6	66.4	89.1	77.7	88.2
Total	149.9	168.4	236.5	206.4	262.3

Source: ECLA/FAO survey.

/The result

The result of a correlation between labour intensity and yields per hectare is shown in figure V. The plantations studied in the sample were grouped in ascending order of labour intensity and the manpower input on each plantation was compared with its corresponding yield. A second-degree curve was thus obtained, and a correlation coefficient of 0.78 was calculated, showing the close relationship between the two variables.

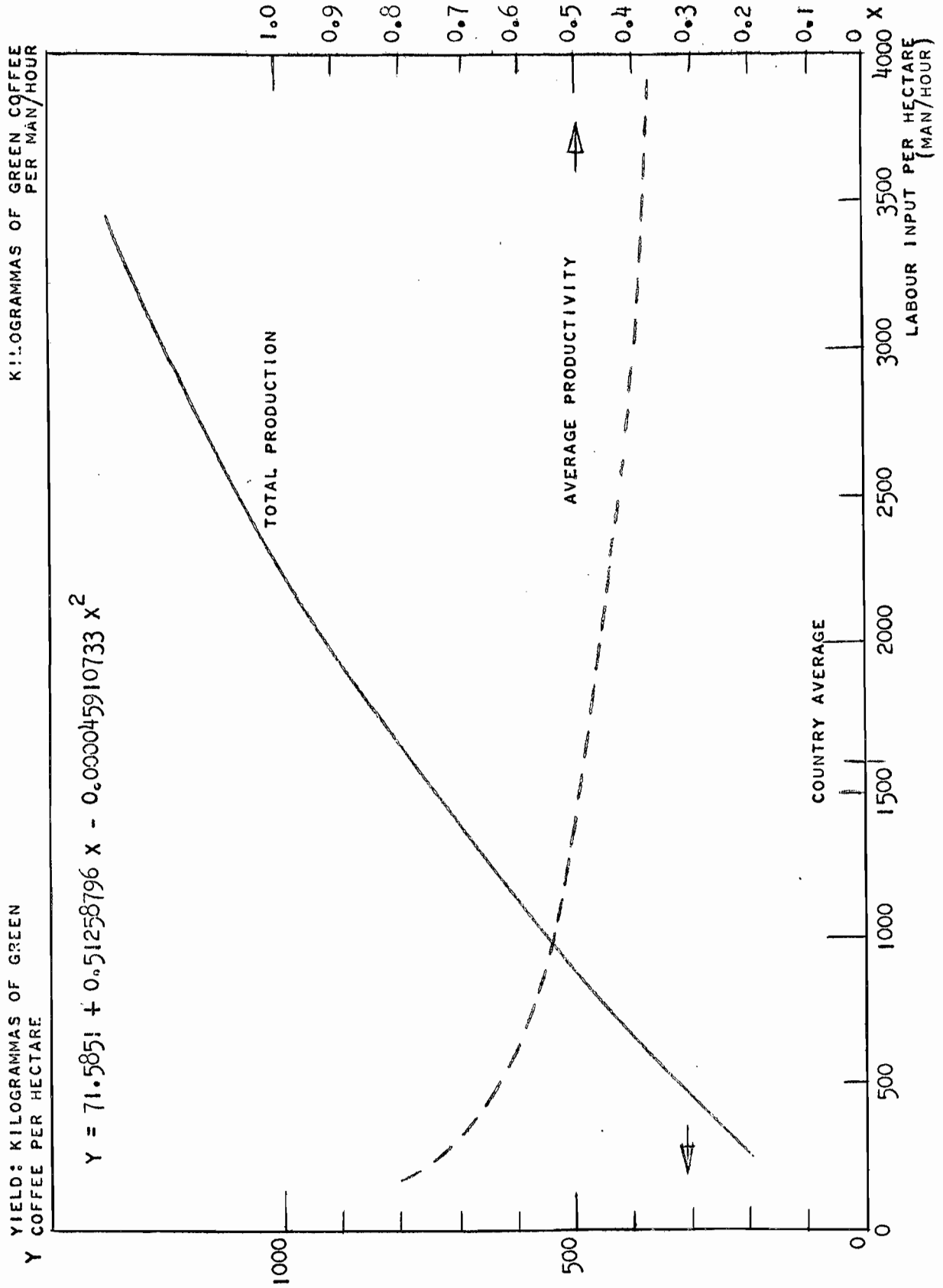
Figure V shows that under present coffee-growing conditions in El Salvador the yield per hectare (Y) increases commensurately with the labour input. However, this statement must be qualified. There are many other factors besides labour inputs affecting coffee yields in El Salvador, among them altitude above sea-level and size of farm. There is considerable evidence that the farms with higher labour inputs also used more fertilizers and pesticides, and were generally located on more favourable altitudes and in better producing zones. Thus, the higher yields per hectare cannot be credited solely to the higher use of labour, as other inputs were also higher. A more elaborate analysis of the data is therefore required before they can provide a sound basis for indicating the most profitable rate of application of labour or other input factors. The curve would indicate that, in theory, the yields could reach an average maximum of 1,500 kilogrammes per hectare when the labour input amounted to some 5,550 man/hours per hectare yearly. Up to this point the marginal yields are positive; that is, new increments of labour (and of other related factors) is accompanied by an increase in the total yield per hectare. It should also be mentioned that in this theoretical and incomplete example, marginal yields show a downward trend.

In practice the maximum average yield for the country - be it above or below the 1,500 kilogrammes per hectare suggested by the calculations presented here - might be attained before an input of 5,550 man/hours^{2/}

^{2/} It should be noted that a national average is referred to here. A considerable number of the farms surveyed obtained yields of around 1,500 kilogrammes with an average labour input of only 3,300 man/hours per hectare.

FIGURE IV - V

EL SALVADOR : RELATIONSHIP BETWEEN YIELD PER HECTARE AND LABOUR INTENSITY



per hectare is reached. Moreover, it may prove that as suggested by the graph, the relationship between input of labour and yields is not proportional and therefore maximum efficiency may be reached at a lower level of labour input.

Figure V also shows that the average product per man/hour used declines at a slow rate. As from labour intensities of above 1,000 hours per hectare, further decreases are almost insignificant.

The fact that the marginal yields per unit of labour input may be declining has little significance as long as favourable cost/price relationships exist, taking into account costs not only for labour but for all the other associated inputs involved. Under the conditions of agricultural under-employment which characterize countries that have not reached an advanced state of development it may be desirable to aim at a greater intensity in the use of labour until the working population can find employment in more productive activities.

2. Relationship between yields and inputs other than labour

Although in El Salvador the role of manpower is preponderant in coffee-growing, yields are also influenced by the use of fertilizers, insecticides, fungicides and other inputs, in addition to the weather and the ecological conditions. In practice, however, it is difficult to establish what proportion of the increment in yields corresponds exclusively to the intensification of labour as compared with the remaining factors of production, and variations in the use of labour generally vary along with differences in the amount of materials utilized.

Nevertheless, the physical inputs were classified in different groups so that their variations according to scale of yields could be observed. The figures include, in addition to mineral and organic fertilizers, insecticides and fungicides, the draught animals and motor vehicles which are used mainly for the transport of the fresh berries from the coffee field to the processing-plants. Although these inputs - which are expressed in animal/day and vehicle/day units - exert no direct influence on production, they have been taken into account here so as to concentrate in single tables all the factors making up the physical input.

Tables 18 and 19 show the average amounts of the various physical inputs used for the cultivation of one hectare or the production of 100 kilogrammes of green coffee, according to the scale of yields. The ratio between yields and amounts of fertilizers (and manures) applied is noteworthy. The average amount of chemical fertilizers utilized in the plantations with the highest yields was 230 kilogrammes per hectare, which is lower than it would be if all growers applied the maximum quantity of fertilizers. However, on some farms as much as 800 kilogrammes per hectare were used. It should also be borne in mind that the inadequate application of fertilizers is generally worse than useless, since without resulting in larger yields it represents heavier physical and labour inputs per unit of area. The shortage of land of the kind best fitted for coffee-growing means that the above considerations are of great importance for the future of the coffee industry in El Salvador. The rate of application of manures did not bear such a close relationship to yields, although the most productive farms used the highest inputs of organic fertilizers with 2.5 tons per hectare.

3. Variations according to size of plantations and their altitude above sea-level

The analysis has brought to light some interesting features with respect to the size of the coffee plantation, but no significant conclusion could be reached as to the efficiency of the methods used or the productivity of labour in terms of the size of the farm.

As has already been pointed out, there are two operations - weeding and harvesting - which are performed on all coffee plantations, whatever their size. The intensity with which these and other tasks are carried out, usually increases as the size of the farm increases. The larger plantations are generally better organized, have access to more adequate credit facilities, utilize more efficient cultivation techniques and, consequently, produce higher yields per unit of area than the smaller farms. Table 20 shows that on properties of over 10 hectares intensity of labour and other inputs is greater than on those of smaller size, a fact which is reflected in higher yields.

Table 18..

EL SALVADOR: PHYSICAL INPUTS PER HECTARE OF PLANTATION, BY YIELDS

Scale of coffee yield per hectare (kilogrammes)	Ferti- lizers	Manures	Insec- ti- cides	Pack- -and draught- animals	Motor vehi- cles	Average yield (kgs per hectare)
	(Kilogrammes)			(Days)		
Under 200	0.76	1.23	0.69	5.19	0.04	133
200 - 400	22.53	189.35	3.93	5.98	0.45	308
401 - 800	121.25	1,150.65	15.04	6.31	0.96	667
801 - 1,200	200.85	584.88	6.29	5.24	1.09	954
Over 1,200	229.70	2,476.14	3.64	19.03	2.41	1,619

Source: ECLA/FAO survey.

Table 19 .

EL SALVADOR: PHYSICAL INPUTS PER 100 KILOGRAMMES OF COFFEE ON PLANTATIONS CLASSIFIED BY YIELDS

Scale of coffee yield per hectare (kilogrammes)	Ferti- lizers	Manures	Insecti- cides	Pack- and draught- animals	Motor vehi- cles
	(Kilogrammes)			(Days)	
Under 200	0.57	0.92	0.52	3.89	0.03
200 - 400	7.32	61.50	1.28	1.94	0.15
401 - 800	18.19	172.64	2.26	0.95	0.14
801 - 1,200	21.06	61.32	0.66	0.55	0.11
Over 1,200	14.19	152.92	0.22	1.18	0.15

Source: ECLA/FAO survey.

/The break-down

The break-down by size given in table 20 conceals variations which seem to suggest that the larger plantations may not always be the most efficient. This question requires further and more elaborate analysis which will only be attempted at a later stage. Nevertheless, in order to show some of these variations, tables 21 and 22 were prepared, summing up physical inputs per hectare and per 100 kilogrammes of coffee on the basis of a more detailed classification according to size.

A detailed examination of table 21 makes it clear that as a general rule the increment in inputs keeps parallel to the increase in the size of the plantation, a slight decrease being recorded in the 10.1 - 50.0 hectare group with respect to fertilizers,^{3/} in the 50.1 - 100 group as regards insecticides and pack- or draught-animals, and, above all, in the 100.1 - 200.0-hectare group in relation to man/hours worked. As for the yields obtained, they follow a progressive upward trend in which virtually the only interruption occurs in the 50.1 - 100.1-hectare group. The same or similar remarks may be made with reference to table 22, showing inputs per 100 kilogrammes of green coffee produced.

As can be seen in tables 23 and 24 and figure VI, in El Salvador the largest farms are found as a rule at those altitudes above sea-level where the best yields are obtained.

In the largest plantations, labour use is more intensive; yields are higher and considerable savings are effected in the number of hours worked to produce 100 kilogrammes of coffee. The average size of the plantations increases until it reaches its maximum between 1,150 and 1,350 metres above sea-level (see figure VI). From then on it diminishes, but, on the other hand, average yields continue to rise. Thus, although altitude influences yields and productivity, it becomes a disturbing element as far as the analysis of the potential influence of the size of the plantations is concerned. In order to clarify the possible effect of the size of the

3/ It is important to point out that, as compared with other inputs, substantial quantities of compost are used on properties of up to 10 hectares, owing to the fact that the small farmers generally have one or two animals whose manure is used for the coffee plantation. On the other hand, the big estates - especially those which have their own processing plant - utilize large quantities of coffee pulp as manure.

FIGURE IV - VI

EL SALVADOR : SIZE AND AVERAGE YIELDS OF COFFEE PLANTATIONS BY ALTITUDE ABOVE SEA-LEVEL

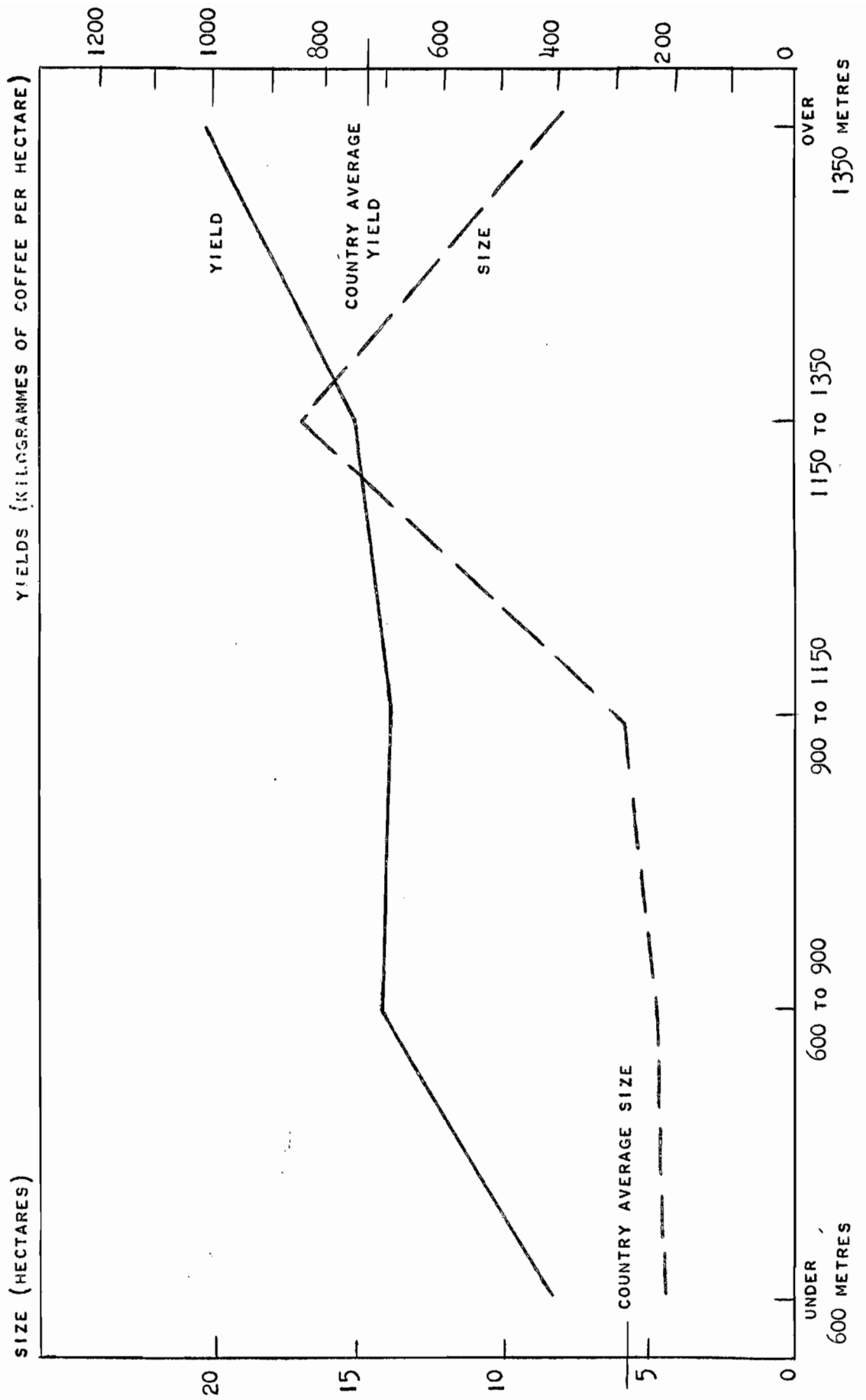


Table 20

EL SALVADOR: LABOUR INTENSITY AND YIELDS PER HECTARE, BY SIZE OF ADULT PLANTATION

Size of plantation (Hectares)	Labour intensity		Yields (Kilogrammes per hectare)	Productivity of labour (Man/hours per 100 kilogrammes)
	Incl. picking (Man/hours per hectare)	Excl. picking		
Under 10.0	997	632	396.8	251.3
10.1 - 100.0	1,681	1,001	690.9	243.3
Over 100.0	1,740	1,100	799.5	217.6

Source: ECLA/FAO survey.

Table 21

EL SALVADOR: AVERAGE PHYSICAL INPUTS PER HECTARE UNDER COFFEE,
BY SIZE OF ADULT PLANTATION

Size of plantation (Hectares)	Ferti- lizers	Manures	Total Col. 1 and 2	Insect icides	Pack- and draught animals	Motor vehi- cles	Man/ hours worked	Average yield (Kgs. per hectare)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Under 1.0	2.0	45.1	47.1	0.5	5.6	-	800	304
1.0 - 10	14.5	162.8	177.3	1.8	5.1	0.6	1,031	413
10.1 - 50	50.4	112.3	162.7	2.2	5.9	0.6	1,589	712
50.1 - 100	41.7	516.1	557.8	1.0	4.7	1.4	1,897	673
100.1 - 200	331.3	1,586.1	1,917.4	3.9	5.8	1.2	1,611	711
Over 200	158.0	1,763.4	1,921.4	10.0	12.2	1.1	1,857	894

Source: ECLA/FAO survey.

Table 22

EL SALVADOR: PHYSICAL INPUTS PER 100 KILOGRAMMES OF GREEN COFFEE,
BY SIZE OF ADULT COFFEE PLANTATION

Size of coffee plantation (Hectares)	Mineral fertilizers	Organic manures	Insect icides	Pack-and-draught animals	Motor vehic.	Man/hours worked
Under 1	0.66	14.84	0.16	1.84	-	263.1
1 - 10	3.51	39.39	0.44	1.23	0.15	249.6
10.1 - 50	7.08	15.77	0.31	0.83	0.08	223.0
50.1 - 100	6.20	76.72	0.15	0.70	0.21	282.1
100.1 - 200	46.62	223.20	0.55	0.82	0.17	226.8
Over 200	17.67	197.25	1.12	1.36	0.12	207.6

Source: ECLA/FAO survey.

Table 23

EL SALVADOR: LABOUR INTENSITY AND YIELDS PER HECTARE
BY ALTITUDE ABOVE SEA-LEVEL

Altitude above sea-level (metres)	Labour intensity		Yields (Kilo- grammes per hectare)	Produc- tivity of labour (Man/hours per 100 kilo- grammes)
	Including picking	Excluding picking		
	(Man/hours per hectare)			
Under 600	886	542	408.1	217.1
601 - 1,150	1,531	1,007	701.2	218.3
Over 1,150	1,689	996	812.2	207.9

Source: ECLA/FAO survey.

Table 24

EL SALVADOR: PERCENTAGE DISTRIBUTION OF NUMBER OF FARMS IN SAMPLE
BY SIZE OF PLANTATION AND ALTITUDE ABOVE SEA-LEVEL

Altitude above sea-level (metres)	Size of plantation		
	Under 10	10.1-100	Over 100
	(Hectares)		
Under 600	16.5	13.8	15.5
601 - 1,150	72.5	75.1	60.6
Over 1,150	11.0	11.1	23.9
	100.0	100.0	100.0

Source: ECLA/FAO survey.

/Coffee plantation

coffee plantation on the average product per man/hour worked, a multiple correlation was made which included these two variables and, in addition, the altitude above sea-level. In a tabulation prepared for purposes of the analysis, the 1,008 coffee farms were classified by altitude and, within each of the altitude groups, by size of adult coffee plantation. From this tabulation was obtained a set of combinations between the size of the coffee plantation and the labour input at each altitude per 100 kilogrammes of green coffee. The multiple-correlation coefficient resulting from this procedure was 0.374, a value which has no statistical significance. The F test also gave the same negative result. Consequently, the part of the variation explained by the multiple-correlation does not sufficiently exceed the part which remains unaccounted for. This means that there are other variables - quality of the soil and labour intensity - which have a greater effect on the productivity of labour than the combined influence of altitude and size of plantation.

Unfortunately, however, sufficiently accurate data to provide a basis for a detailed analysis of the relationship between soil characteristics and the average product per man/hour are not available. Nevertheless, from the data in the study, the effect of labour intensity can be appraised by means of a multiple correlation between this variable, the size of the plantation and its altitude. In this case, the multiple correlation coefficient proved to be significant ($R = 0.5126$). The F test corroborated this conclusion. Both partial regression coefficients were significant, and that corresponding to the regression between labour intensity (Y) and altitude (X_2), independently of the size of the plantation (X_1), was very high. These results indicate the close relationship between these three variables (intensity, size and altitude). Consequently, the effect of the labour-intensity variable is implicit in the two-variable relationship between labour input per 100 kilogrammes of green coffee and altitude. Labour input can be regarded as the principal independent variable influencing productivity and yields. The larger yields apparently obtained on the plantations at a high altitude are therefore mainly attributable to the greater labour intensity.

4. Physical inputs by zones

Tables 25 and 26 present figures for all inputs per hectare and per 100 kilogrammes of coffee according to the different zones into which the country was divided for the purpose of this study.

Zones I, II and IV - which constitute the country's most important producing areas - are where the most labour-intensive practices are followed, where intensity in the use of other inputs is highest, and where the highest yields were obtained in 1954/55.

The largest differences in labour inputs among the different zones can be explained by the little importance attached to fertilizing in the eastern districts of El Salvador. In the western areas (Zones I - IV), on the other hand, large quantities of fertilizers and manures are utilized; consequently, yields are high and, large amounts of labour have to be employed for harvesting. Also, in the eastern districts less manpower is used for pruning and soil conservation operations.

Smaller variations are to be observed in the use of insecticides, except in the case of zone VI, which suffered a serious insect infestation during the year of the survey.

5. Estimated gross income and farm values.

According to the survey, the average gross income of planters per 100 kilogrammes of green coffee sold during the 1954/55 season amounted to approximately 91 dollars at prices then current. The estimated average income per hectare was about 600 dollars.

Apart from their coffee earnings, most of the Salvadorean plantations derive some additional income from the lumber and firewood obtained in the prunings. The size of this income increment depends on the intensity with which these operations are performed in a given year. Much of the firewood is used for fuel on the farm itself, and part of the lumber is turned to account for building. On an average, the extra income from this source can be estimated as roughly equivalent to 2 per cent of the value of the coffee crop.

Table 27 shows the considerable variations in the gross income obtained per hectare and per man/hour of labour in the different coffee zones during the year 1954/55.

Table 25
EL SALVADOR: AVERAGE PHYSICAL INPUTS PER HECTARE OF COFFEE
PLANTATION, BY ZONES

Zone	Ferti- lizers	Manures	Insec- ticides	Pack-or- draught animals	Motor vehi- cles	Man/ hours worked	Average yield (kilo- grammes per hectare)
	(Kilogrammes)			(Days)			
I	76.4	774.2	1.1	5.8	1.4	1,599	820
II	281.4	1,272.4	2.4	3.7	0.5	1,750	735
III	38.1	109.8	2.2	10.3	0.6	1,456	594
IV	128.5	1,356.4	3.4	11.9	1.6	1,952	809
V	2.0	16.0	0.4	9.2	0.4	1,064	318
VI	20.9	425.9	13.5	3.3	0.5	1,057	405
VII	0.9	28.8	1.5	4.8	0.6	747	300
Weighted country average	113.8	854.3	4.1	7.4	1.0	1,566	659

Source: ECLA/FAO Survey.

Note: It can be seen that while physical and labour inputs were higher in some zones than in others, the correspondingly larger yields that might have been expected were not obtained. This is attributable to variation in the different zones on account of weather conditions in the year concerned, and other factors not covered by the study.

Table 26
EL SALVADOR: AVERAGE PHYSICAL INPUTS PER 100 KILOGRAMMES OF GREEN
COFFEE, BY ZONES

Zone	Ferti- lizers	Manures	Insec- ticides	Pack-or- draught animals	Motor vehi- cles	Man/ hours worked	Hec- tares of land
	(Kilogrammes)			(Days)			
I	9.31	94.40	0.13	0.71	0.17	195	0.12
II	38.29	173.14	0.33	0.50	0.07	238	0.14
III	6.41	18.48	0.37	1.79	0.10	245	0.17
IV	15.89	167.73	0.42	1.47	0.20	241	0.12
V	0.63	5.04	0.13	2.90	0.13	335	0.31
VI	5.16	105.21	3.33	0.82	0.12	261	0.25
VII	0.30	9.59	0.50	1.60	0.20	249	0.33
Weighted country average	17.27	129.66	0.62	1.12	0.15	238	0.15

Source: ECLA/FAO survey.

/These disparities

These disparities are to some extent a reflection of the favourable or unfavourable conditions prevailing in the coffee year 1954/55 in the different parts of the country.

Table 28 gives an indication of the relationship between gross income per hectare and per man/hour and the size of the plantation. Clearly, in many cases a process of disinvestment is affecting both soil fertility and the plantation itself.

Table 29 presents average yields and estimated gross income (at 1954/55 prices) in relation to the value per hectare estimated by the farmer.

The relationship between these three variables is almost constant. An increment in the value per hectare is accompanied by an almost identical percentage increase in the average yields and gross income obtained from coffee growing. This means no more than that the commercial subjective value attributed to the coffee lands in El Salvador was something of which all farmers were very conscious at the time of the survey, after the rise in world coffee prices.

Detailed data on real investments by scale would be required to obtain more meaningful relationships. An output-investment ratio for the country as a whole was calculated on the basis of the estimated investment in the formation of a coffee plantation plus the value of buildings, equipment and other minor items. The resulting investment-output ratio was 0.65 in 1954/55.^{4/}

6. Some considerations on the structure of costs.

Table 30 shows the relative importance of the various inputs as indicated by the estimates on current expenditure which were made on the basis of actual physical inputs at wage rates and prices prevailing in 1954/55.

The figures show the basic importance of labour, which, for the

^{4/} The average real investment per hectare (see again table 7) was 934 dollars, and the gross income 612.65 dollars (table 27).

Table 27

EL SALVADOR: GROSS INCOME^{a/} OF COFFEE PLANTATIONS PER HECTARE
AND PER MAN/HOUR, BY ZONES

(Dollars)

	I	II	III	IV	V	VI	VII	Weighted country average
Gross income per hectare	762.62	683.31	552.39	751.93	295.21	376.38	279.13	612.65
Gross income per man/hour	0.477	0.390	0.379	0.385	0.277	0.356	0.374	0.391

Source: ECLA/FAO survey.

a/ Including income from coffee, lumber and firewood.

Table 28

EL SALVADOR: GROSS INCOME OF COFFEE PLANTATIONS PER HECTARE
AND PER MAN/HOUR BY SIZE OF PLANTATION

Size of plantation (Hectares)	Gross income (Dollars)	
	Per hectare	Per man/hour
Under 1	288.67	0.360
1.0 - 10	377.93	0.366
10.1 - 50	658.47	0.414
50.1 - 100	636.35	0.335
100.1 - 200	657.96	0.408
Over 200	811.87	0.437

Source: ECLA/FAO survey.

Table 29

EL SALVADOR: YIELDS AND GROSS INCOME PER HECTARE UNDER COFFEE,
BY SCALE OF FARM VALUES

Scale of values a/ (Dollars per hectare)	Average value a/	Index	Average yield (kilogrammes per hectare)	Index	Gross income	Index
Under 1,200	959	100	195.1	100	181.90	100
1,200-3,000	2,213	231	450.0	230	417.70	230
3,000-6,000	4,565	476	844.1	432	783.50	431
Over 6,000	6,769	706	1,449.5	742	1,345.40	740

Source: ECLA/FAO survey.

a/ Including the declared commercial value of the land.

country as a whole, absorbs on an average a total of 58 per cent of current expenditure in coffee production. Next in importance comes administrative expenditure (salaries and other costs), totalling 23.8 per cent, followed by outlay on fertilizers, which represent 6.8 per cent. With respect to labour, zones II, IV and VII fall below the national average. Zone II is the area recording the proportionally highest expenditure on fertilizers.

Even greater interest may possibly attach to the variations in expenditure according to the size of the plantation (see table 31). Although no hard and fast rule can be laid down, it may be noted that the relative significance of expenditure on fertilizers and manures is higher on the plantations of over 100 hectares than on the smaller farms. This is undoubtedly counterbalanced by the lesser relative importance of labour. Again, as the size of the plantation increases, a natural trend towards a marked decrease in administration expenditure is also observable. Such outlays fall from an average of 35.6 per cent of the total on plantations of under 1 hectare to 19.4 per cent on those of over 200 hectares, despite the high salaries paid in the latter case to the administrative personnel.

Table 30

EL SALVADOR: RELATIVE IMPORTANCE PER HECTARE OR PER 100 KILOGRAMMES OF THE VARIOUS ITEMS OF CURRENT EXPENDITURE IN COFFEE-GROWING, 1954/55

(Percentages)

Items of expenditures	Average for the country	Z o n e s						
		I	II	III	IV	V	VI	VII
Fertilizers	4.5	3.3	9.1	2.0	3.7	0.1	1.4	0.0
Manures	4.1	4.1	5.0	0.7	4.7	0.1	3.6	0.3
Insecticides	0.7	0.2	0.3	0.5	0.4	0.1	3.8	0.5
Pack-and-draught animals	2.1	1.9	0.9	4.0	2.5	4.5	1.7	2.9
Vehicles	6.8	11.3	3.0	5.8	8.5	4.9	6.4	9.0
Manpower	50.0	56.7	46.0	61.7	45.4	57.9	59.2	49.3
Workers' meals	8.0	2.3	9.9	3.0	10.3	11.1	3.4	2.0
Salaries	8.8	9.1	7.3	10.1	8.6	15.7	8.8	8.0
Other expenditures	15.0	11.0	18.4	12.2	15.8	5.5	11.7	28.0

Source: ECLA/FAO survey.

Table 31

EL SALVADOR: RELATIVE IMPORTANCE PER HECTARE OR PER 100 KILOGRAMMES OF THE VARIOUS ITEMS OF CURRENT EXPENDITURE IN COFFEE-GROWING, BY SIZE OF PLANTATION, 1954/55

(Percentages)

Items of expenditures	H e c t a r e s					
	Under 1	1.1 to 10	10.1 to 50	50.1 to 100	100.1 to 200	Over 200.1
Fertilizers	0.2	0.9	2.2	1.4	10.5	5.0
Manures	0.5	1.2	0.6	2.1	6.2	6.9
Insecticides	0.2	0.4	0.4	0.1	0.5	1.3
Pack-and-draught animals	3.5	2.2	1.9	1.2	1.4	2.9
Vehicles	-	6.6	4.9	8.8	7.1	6.5
Manpower	55.3	50.0	57.6	52.7	41.7	48.2
Workers' meals	4.8	7.0	7.8	9.5	7.5	9.8
Salaries	15.4	13.9	8.4	10.8	7.1	6.7
Other expenditure	20.2	17.8	16.1	13.3	18.0	12.7

Source: ECLA/FAO survey.

Chapter V

COFFEE PROCESSING

1. General considerations

Soon after picking, the coffee berries are taken to coffee mills where they are processed into green coffee ready for export. Mills are generally located away from the plantations and near sources of water and of labour supply. Satisfactory transport facilities and the smallness of the territory facilitate the processing and organized marketing of the coffee crop in El Salvador, although no special storage installations exist. Most mills own lorries, and in cases where competition for the crop is keen, coffee is brought for processing from distances of over 70 kilometres.

Since most of the crop - 85 per cent - is processed as washed coffee, and this requires the use of the fresh ripe berries, a much larger volume of raw material has to be transported per unit of finished product than in countries where the dry process is utilized.

Most of the coffee mills are relatively small and employ less than 60 persons at a time during the processing season. However, ten of the 150 odd plants existing in the country handle approximately half the crop. The processing of the coffee crop begins in November when picking starts in the lower-lying zones. The largest volumes are harvested in December-January, but at higher altitudes picking may continue throughout March. However, the mills work until April and even May in order to complete the threshing and sorting operations. The major part of the crop is exported between December and March, but it often happens that substantial shipments are still being made in June.

More than half the output comes from the western coffee zones in the Departments of Santa Ana, Sonsonate and Ahuachapán. The principal port used for export is Cutuco, located far to the east but having the only docking facilities in El Salvador. Next in order of importance for the coffee industry is the port of Acajutla. In addition, about one-fifth of the crop is exported through La Libertad (on the Pacific coast of El Salvador) and Puerto Barrios (on the Atlantic seaboard of Guatemala). Some of the coffee produced in Honduras is also shipped from Salvadorean ports. The principal quality types of coffee produced in El Salvador are

/washed "central

washed "central standard", "strictly high-grown" and "high-grown", which represent on an average 60, 18, and 7 per cent of total exports, respectively. ^{1/} The remainder comprises unwashed coffee (12 per cent) and other inferior types. As a rule, Salvadorean coffee is of a mild high-quality grade and commands better prices on the international market than the Brazilian types, though generally not reaching those of most of the Colombian mild grades.

2. Methods of processing

The sample of coffee-processing plants selected for the survey was representative of the types and sizes existing throughout the country. Twenty-seven mills, which in 1953/54 processed about 34 per cent of the total volume of coffee exported, were investigated. Two grades of coffee are processed in El Salvador, namely, the "washed" type, representing approximately 85 per cent of the crop and the "unwashed", making up the remaining 15 per cent.

The processing of washed coffee comprises a wet and a dry phase. During the former the soft layers of the ripe berry - the pulp and mucilage - are removed, while the latter consists in ridding the beans of their parchment-like husks. In the case of unwashed coffee, all the layers covering the beans are removed by a dry process. "Parchment" coffee is the washed coffee before it has gone through the dry phase. El Salvador exports only a small part of its crop in this form.

Almost the whole of the crop is processed in mechanized plants of different types and capacities; nevertheless, a substantial part of the coffee, kept back for domestic consumption, is husked by primitive methods.

Coffee-processing plants in El Salvador range from the small family-operated unit to modern large plants employing hundreds of workers. Some of them handle only the crop produced in one plantation, while others operate on a commercial basis and process not only the owner's crop but also that of other coffee-planters in the same district who have no mills of their own. In this latter case, the processing plant either buys the coffee, or

^{1/} These are grown at the following altitudes: "strictly high grown" at more than 1350 metres above sea-level, "high grown" from 1150 to 1350 metres and "central standard" below 1150 metres.

mills it at the grower's expense.

A distinction may be drawn between mills according to the services they render. There are two main types. The first is the complete processing plant producing washed and unwashed green coffee, which washes the fresh ripe berries, threshes coffee in parchment and hulls coffee berries dried in the sun; and the second, the incomplete unit, which carries out only a part of the wet process or prepares only unwashed coffee. These incomplete units may be classified in different groups. Some only wash, producing coffee in parchment; others thresh coffee in parchment; and still others hull the dried berries. Combinations of these more simple types are frequent.

In most cases, the absolute level of effective capacity of the coffee mills is unknown, as they do not operate to full load except for very short periods during the processing season. But, as relative hourly capacity for each operation is usually known, the total capacity of the plant may be estimated on that basis. Almost all the mills depend at least partially on sun drying in brickyards, and the size of the yards is often a factor limiting total working capacity.

Most of the large mills usually work at less than maximum capacity, leaving a margin of idle capacity in reserve for use at peakload periods or in cases of bumper crops. The survey shows that in 1953/54 ^{2/} the mills included in the sample operated on an average at some 60 per cent of their capacity.

Improvements in the machinery and techniques used for coffee processing in El Salvador have as a rule resulted from research carried out by specialized machinery-designers and -builders. The techniques employed have remained practically unchanged for several years. Recently, however, alkalis have been used in removing the mucilaginous coating of the parchment-like husk of the coffee bean. This new method was proved practicable in the course of experiments with sodium hydroxide solutions conducted in the Centro Nacional de Agronomía. ^{3/} The new method enables depulping and

^{2/} It should be recalled that from the standpoint of processing, the year 1954/55 had not yet come to an end when the survey was completed.

^{3/} See R. Carbonell, et.al., Centro Nacional de Agronomía, Technical Bulletins Nos. 13 and 14 (1952 and 1953).

washing to be performed as continuous operations, and it is claimed that the practice results in a saving of solids and weight in the end product. In 1953/54 an important mill applied the method to the whole volume of coffee washed. ^{4/} However, the practice is not spreading very quickly for lack of the necessary drying and storage facilities and of the required mastery of the technique. In some mills there is a tendency to replace old and obsolete equipment - especially boiler units - by much more up-to-date machinery. More widespread use of electric motors is also observable.

3. Labour inputs in the coffee mill

The main factors influencing manpower requirements for the processing of 100 kilogrammes of clean coffee, or their equivalent, are the kind of process used (wet or dry), the type of mill, and its capacity.

On an average, more than twice as much labour is required at the mill to process washed than unwashed coffee (11 as against 5 man/hours; see table 32). However, when the farm-drying of the berries (25 man/hours per 100 kilogrammes clean equivalent) is taken into account, the total labour input required for unwashed coffee exceeds by 173 per cent the input needed per unit weight of washed coffee.

On the assumption that two-thirds of the crop is dried entirely in the yards and only one-third in mechanical dryers ^{5/}, drying and hand-sorting represent approximately 41 and 31 per cent respectively of the total labour employed in processing washed coffee. However, if it is assumed that yard-drying has been the only method used -- as is the case in the smaller plants -- drying absorbs no less than 50 per cent of the manpower employed in milling. The volume of coffee dried per man/day and per square metre of drying-yard depends upon weather conditions and the thickness of the layer of coffee put to dry.

^{4/} Mills usually co-operate in experiments undertaken by national research agencies and machinery-designers. For example, in one of the modern processing plants an Italian firm is at present trying out a large new drying-unit for washed coffee, which would enable washing and drying to be carried out as a continuous process.

^{5/} These mechanical dryers are used in combination with the drying-yards.

Table V-32

EL SALVADOR: AVERAGE MANPOWER INPUT PER 100 KILOGRAMMES
OF GREEN COFFEE, BY MAIN OPERATIONS

(Man-hours)

	(Man-hours)	Percent- age
<u>Washed coffee</u>		
<u>Wet phase</u>		
Weighing and reception of ripe berries	0.3	2.7
Depulping	0.7	6.2
Pulp disposal <u>a/</u>	0.5	4.4
Washing <u>b/</u>	0.3	2.7
Yard-drying <u>c/</u>	3.7	32.7
Machine-drying <u>c/</u>	1.0	8.9
Storage	0.4	3.5
Total	6.9	61.1
<u>Dry phase</u>		
Threshing, separation and cleaning <u>d/</u>	0.6	5.3
Hand-sorting	3.5	30.9
Weighing and sacking	0.3	2.7
Total	4.4	38.9
Grand total <u>f/</u>	11.3	100.0
<u>Unwashed coffee</u>		
Farm-dried	25.0	...
Dried at the mill	0.2	3.3
Redrying	0.2	3.5
Threshing, separation and cleaning <u>d/</u>	1.6	27.1
Hand-sorting	3.5	59.3
Weighing and sacking	0.4	6.8
Total <u>f/</u>	30.9	...
Grand total for the plant <u>g/</u>	5.9	100.0

Source: ECLA/FAO.

- a/ Including pulp and residual water disposal.
b/ Including wet parchment distribution in yards.
c/ On the assumption that two-thirds are dried fully in yards, and one-third in combination yard-dryer, plus handlings.
d/ Including grading, winnowing, and mechanical cleaning and polishing.
e/ Including mixing in bulk.
f/ Excluding management activities.
g/ Excluding farm-drying.

/In some

In some plants garden tractors with bulldozer blades are used for stirring and piling up the drying coffee. Suction hoses and auger loaders are also utilized to handle parchment coffee, but almost all the transport of coffee from yard to dryer and from dryer to warehouse is effected by human labour.

Apart from farm-drying, the most labour-consuming operations for unwashed coffee are hand-sorting and hulling. The degree of hand-sorting depends upon the exporters' market contracts and specifications. It is also conditioned up to a point by the quality of the harvest itself and by the efficiency of the processing-plant. The work is done by women, who sort out stained or defective beans before the coffee is put into bags for export.

For the purposes of the study, mills were classified in five size categories. The nominal capacity of size 1 is equal or below 10 tons of green coffee, per season; that of size 2 ranges from 10 to 1,000 tons; that of size 3, from 1,000 to 2,000 tons; and that of size 4, from 2,000 to 4,000 tons; while size 5 can process more than 4,000 tons per season.

A distinction was also drawn between five types of plants. Type (a) only washes, producing coffee in parchment; (b) only threshes coffee in parchment and produces green coffee; (c) combines the two preceding operations; (d) threshes the parchment coffee and hulls the dried berries; and, lastly, (e) comprises the complete plant, which washes and threshes coffee in parchment as well as hulling the unwashed berries.

As can be seen from table 33, the completeness of the operations performed, as well as the size of plant, exert an obvious influence on the amount of labour which goes into the processing of 100 kilogrammes of green coffee, this being especially notable in mills belonging to type (e), which are the most complete. The relationship is clear, in both the wet and dry phases of processing - for any given combination of operations, the larger plants use less labour per unit of product.

As shown in table 34, estimated investment per machine operator in those mills which process only unwashed coffee (type d-5) is much less than in plants of comparable capacity producing washed coffee in all its phases (type e-5). Also, plants of type (a), which produce only coffee in parchment, require the least capital of all the mills processing washed coffee.

Table V-33

EL SALVADOR: AVERAGE MANPOWER INPUT IN THE PROCESSING OF 100 KILOGRAMMES OF GREEN COFFEE, BY SIZE AND TYPE OF PLANT

Scale of size	Type of plant	Washed coffee			Type of coffee produced
		Wet phase (Man/hours per 100 kilogrammes)	Dry phase	Total	
1	(a)	8.8	no	-	Parchment
2	(a)	9.0	no	-	"
2	(e)	8.7	5.0	13.7	Green
3	(e)	8.2	4.8	13.0	"
4	(c)	6.1	5.1	11.2	"
4	(e)	6.4	4.7	11.1	"
5	(e)	4.9	3.3	8.2	"
Average <u>a/</u>		6.9	4.4	11.3	
		<u>Unwashed coffee b/</u>			
2	(e)	no	6.5	6.5	Green
3	(e)	no	6.5	6.5	"
4	(e)	no	6.1	6.1	"
5	(d)	no	4.6	4.6	"
Average <u>a/</u>				5.9	

Source: ECLA/FAO survey.

a/ Weighted average based on total amount of coffee processed in each plant.

b/ Including mills of type (e) which receive coffee for dry processing.

Table V-34
EL SALVADOR: ESTIMATED CAPITAL ^{a/} PER MACHINE OPERATOR AND
PER WORKER BY SIZE AND TYPE OF PLANT, 1953-54

(Dollars)

Type	Size	Capital per machine operator <u>b/</u>	Capital per worker <u>c/</u>
a	(1	1,158.00	384.00
	(2	4,004.80	532.80
c	(3	10,474.80	171.60
	(4	14,676.40	657.20
d	5	20,434.00	464.40
e	(2	11,232.80	872.40
	(3	19,438.80	782.40
	(4	20,375.60	419.20
	(5	32,192.40	965.60

Source: ECLA/FAO survey.

a/ Including fixed capital and value of machinery.

b/ By machine operator is meant the worker in charge of machinery such as a motor or thresher.

c/ The term "worker" specifically refers to those carrying out operations by hand only, as, for example, those responsible for yard-drying, selection, etc.

/In plants

In plants of type (e), investment per machine-worker tends to rise with size of plant.

Salaries and wages constitute the most important item in the structure of mill processing costs. In the production of washed coffee they represent 66 per cent of current expenditure other than for the raw material (ripe coffee). In the case of dry processing, expenditure on labour rises to almost 69 per cent of the total.

The wages of workers and machine-operators are relatively high in the coffee industry. Most are paid by the hour, although some operations are treated as piece-work, as for example, the washing of the parchment coffee, the loading and unloading of the dryers, sacking and weighing. In the 1953/54 season, the normal wages of machine operators, chief mechanics and supervisors ranged from 20 to 35 dollar cents an hour. Assistants and foremen earned from 12 to 16 dollar cents an hour and unskilled workers from 8 to 12 cents. Overtime was usually paid at one-and-a-half times the normal wage. ^{6/} Piece-work was paid for at varying rates, such as 3.2 cents per 46-kilogramme-sack of parchment coffee loaded, unloaded or stored, and 4 cents per 69-kilogramme-bag of green coffee weighed and sealed. Hand-sorting of green coffee by women is paid according to the amount of foreign matter or defects to be eliminated from each grade of coffee. A woman may earn from 6 to 16 cents an hours, the estimated average being 8 cents. Meals are not usually served to workers in a coffee mill. The monthly salaries of permanent employees range from 70 to 350 United States dollars equivalent for managers; from 50 to 80 dollars for mechanics; from 40 to 60 dollars for office clerks; and from 24 to 30 dollars for watchmen. The salaries paid for off-season duties are usually about 40 per cent less. Some managers receive a bonus on the year's profits, and in some mills a month's extra salary is granted to the employees.

When the milling season is over, the permanent employees - mechanics, carpenters, drivers and watchmen - see to repairs and improvements. Managers and office clerks deal with shipping operations and the upkeep of the mill. Generally, they also handle the buying of the new crop in the commercial mills.

^{6/} At the height of the season two or three shifts are often worked.

The proportion between labour-costs - including employees' salaries - and total processing costs is not clearly defined in all types of mills. However, as shown in table 35, the large plants are apt to spend more on labour than smaller mills of the same type, inasmuch as overhead expenditure is relatively higher in the larger than in the smaller plants. Moreover, the bigger mills of a given type utilize a more limited proportion of their capacity and this results in relatively higher overhead costs per unit weight of coffee processed.

Table 36 shows the value added by processing. This margin tends to vary irregularly by size and type of processing, and is generally somewhat smaller for the mills producing unwashed coffee than for those producing washed coffee. There is some tendency, too, for it to be unusually high in the very small mills. Value added per man/hour also shows irregular variations. These irregular fluctuations may reflect unstable averages, owing to the very few mills in the sample for some of the subdivisions.

Another reason for the high value added per man/hour was the exceptionally favourable sales price obtained by most processing-plants. The sharp rise in coffee quotations during the 1953/54 milling season enabled most mill-owners to sell their coffee at a world price level considerably higher than the price at which they had bought the raw coffee.

The ratio between value added and fixed investment is lower in the larger mills of a given type, with the exception of those small new plants the size of which seems to be out of proportion to their nominal capacity (see again table 35). Plants belonging to type (e)-2 appear to register the highest rate, only one-eighth of a unit of fixed capital required for the production of one unit of value added.

It was no easy task to assess with precision the power used by the different machines involved in coffee-processing. It frequently happens that the available power is switched from one operation to another in the course of a single day. Some power units work with steam pressure; others utilize diesel oil, paraffin, petrol and/or electric energy. Various combinations of energy sources are also in use.

Table V-35

EL SALVADOR: SOME INDICATORS OF THE EFFICIENCY OF THE PROCESSING MILLS

Type and size of plant	Relationship between cost of manpower and total processing costs		Relationship between value added and total fixed investment	Available horse-power	
	Washed	Unwashed		Per worker	Per 100 kgs
a) 1	1/6.3	-	1/2.50	1.6	1.8
a) 2	1/2.4	-	1/0.46	1.1	0.7
c) 4	1/2.8	-	1/0.76	0.8	1.2
e) 2	1/2.3	1/1.7	1/0.12 _{a/}	2.4	1.3
e) 3	1/3.0	1/2.6	1/1.53 _{a/}	1.1	1.2
e) 4	1/1.8	1/1.5	1/0.74 _{a/}	0.8	1.0
e) 5	1/2.2	-	1/1.62	1.4	1.7
d) 3	-	1/2.2	1/0.76	-	-
d) 5	1/1.7	1/1.6	1/0.42 _{a/}	0.9	0.4

Source: ECLA/FAO survey.

_{a/} Weighted averages.

Table V-36

EL SALVADOR: VALUE ADDED PER 100 KILOGRAMMES OF GREEN COFFEE
PROCESSED IN 1953/54

(Dollars)

Type and capacity of plant	End product	Sale price	Purchase price	Value added at mill a/	Man/hours per 100 kilo-grammes b/	Value added per man/hour
<u>Washed coffee</u>						
(a) 1	parchment	85.92	67.70	18.22	8.8	2.07
(a) 2	"	104.92	86.48	18.44	9.0	2.04
(e) 2	"	97.96	91.18	6.78	8.7	0.78
(c) 4	green	112.89	98.20	14.69	11.2	1.31
(e) 2	"	116.15	94.88	21.27	13.7	1.55
(e) 3	"	109.74	99.46	10.28	13.0	0.79
(e) 4	"	112.38	100.40	11.98	11.1	1.07
(e) 5	"	114.02	104.40	9.62	8.2	1.17
(d) 5	"	117.92	104.00	13.92	2.6	5.35
<u>Unwashed coffee</u>						
(e) 2	green	105.42	87.60	17.82	6.5	2.74
(e) 3	"	109.26	98.40	10.86	6.5	1.67
(e) 4	"	117.60	107.60	10.00	6.1	1.63
(d) 3	"	118.72	114.00	4.72	-	-
(d) 5	"	117.92	106.40	11.52	4.6	2.50

Source: ECLA/FAO survey.

a/ These values do not take into account certain minor inputs such as fuel, sacks, lubricants, etc., since these are offset by the value of the pulp, which is also disregarded.

b/ Including only workers directly engaged in processing, not managers or office clerks.

/To obtain

To obtain an approximate idea of the power available in the mills studied, the total nominal horse-power (1.01 metric hp) of all units was added together, without regard to the efficiency with which each unit was utilized.

Mills of smaller capacity within the same type have more power per worker and per unit weight of coffee processed. This happens because such plants face difficulties like shortages of water and of drying equipment which, by preventing full utilization of capacity, form veritable bottlenecks. The available power is therefore uneconomically distributed, whereas mills of intermediate capacity utilize their power units to the maximum.

Chapter VI

FUTURE TRENDS IN PRODUCTION, CONSUMPTION AND EXPORTS

1. Projections for 1959/60

At the time of the survey the following important factors which may affect the volume of production up to the year 1959/60 were already in evidence: a) the average age of plantations, and b) the rate at which new coffee plantations had been established and old ones replanted in the 1950-54 quinquennium. All the new coffee-trees planted during that five-year period should be in full production by 1959/60. The study indicates that in El Salvador, the very favourable world market prices prevailing in the last few years have not exerted a marked influence on the area brought under coffee cultivation.

More than 60 per cent of the coffee plantations are over 15 years old and the average yearly rate of new plantings since 1940 has amounted to 2.3 per cent only. If the effect of age on yields is taken into account, this average rate of expansion would not in itself suffice to maintain production at stable levels. In normal circumstances, coffee yields improve during the first 10 or 11 years, but afterwards they decrease at an annual rate of 4-5 per cent.

The rate of new plantings was considerably higher in the period 1949 to 1954 than in the period 1940 to 1948. During the six-year interval between 1949 and 1954 more than 24,000 hectares were planted to coffee. ^{1/} The largest plantings were made in 1950, a year in which an exceptional rise in prices was also registered. From then on the rate of expansion declined slightly, but it rose sharply again in 1955. It should be pointed out that the figures for 1955 are based only on the growers' statements as to their planting intentions at the beginning of that year. As most of the preparatory work for the plantings in question has to be carried out in 1954, the information is fairly reliable. (See table 37 and figure VII.)

The factor which in all probability will most strongly influence production between 1955 and 1960 is the rate at which old or unproductive

^{1/} Only 22,000 hectares had been planted during the 8 preceding years.

FIGURE VI - VII

EL SALVADOR : NEW COFFEE PLANTATIONS AND COFFEE PRICES PAID TO THE PLANTER

NATURAL SCALE

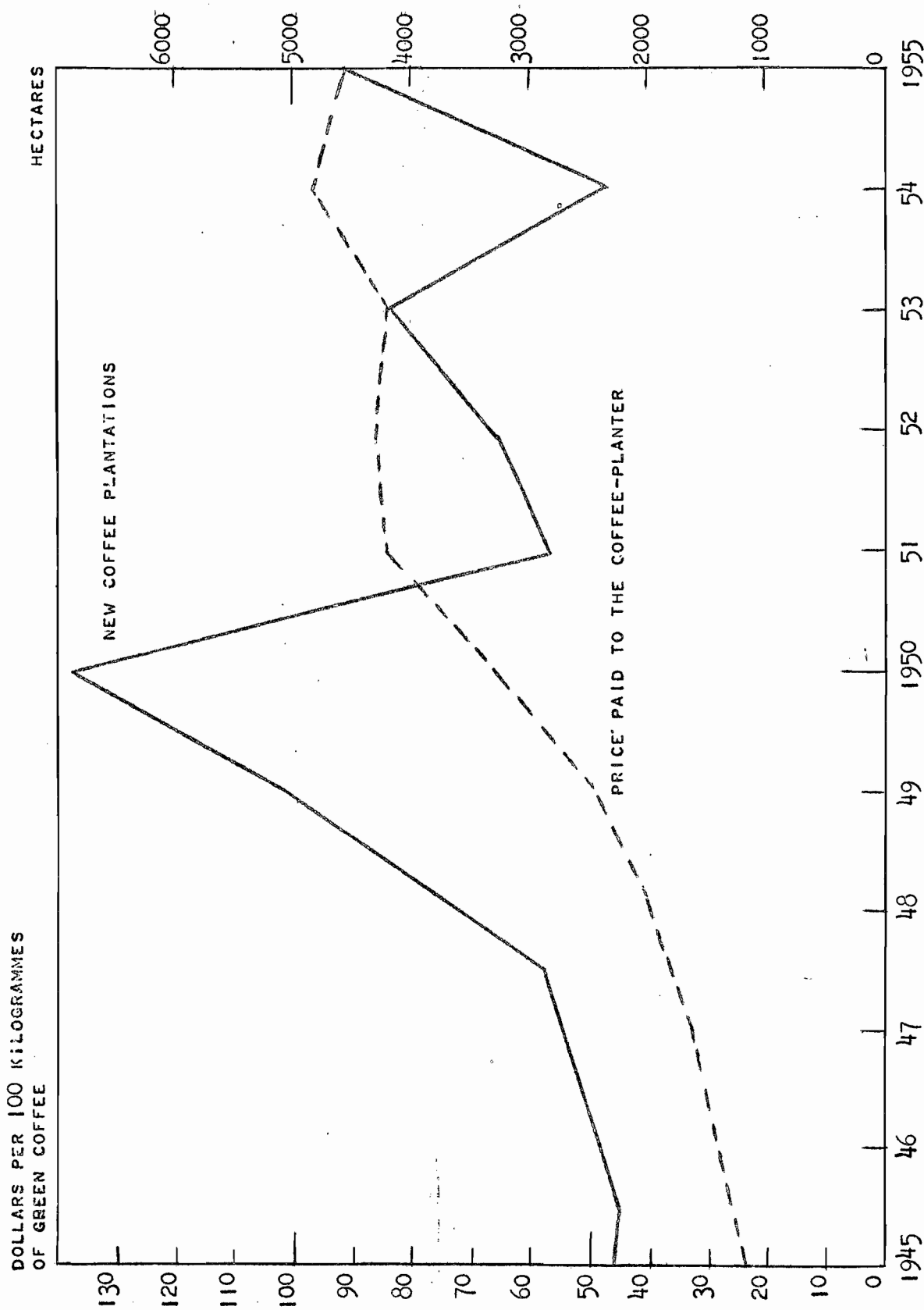


Table VI-37

EL SALVADOR: APPROXIMATE AGE DISTRIBUTION OF COFFEE PLANTATIONS AS IN 1954/55

Year of establishment.	Age (Years)	Hectares	Percent age
1955 <u>a/</u>	Under 1	4,612	3.4
1954	1	2,404	1.8
1953	2	4,177	3.1
1952	3	3,319	2.4
1951	4	2,838	2.1
1950	5	6,347	4.6
1949	6	5,180	3.8
1947-1948	7 - 8	5,631	4.1
1945-1946	9 -10	4,433	3.2
1940-1944	11 -15	12,015	8.8
Before 1940	Over 15	85,869	62.7
		<u>136,825</u>	<u>100.0</u>

Source: ECLA/FAO survey.

Note: The break-down is only approximate, as the coffee-trees in the plantations are constantly being replaced. During 1951-54, the rate of replacement varied from 2 to 4 per cent, so that it may reasonably be assumed that half the coffee-trees in plantations established before 1940 are less than 15 years old.

a/ Plans announced at beginning of 1955.

coffee-trees were replaced during 1950-54. As a consequence of the favourable prices, replantings were intensified during that period to such an extent that more coffee-trees were planted in old plantations than in the new areas brought under cultivation.

Replanting as practised in El Salvador aims at offsetting the unfavourable effect produced on yields by the ageing of the trees. In a plantation where old trees are not renewed, production will tend to decline by 4-5 per cent annually from the eleventh year onward. Figure VIII shows the relationship between yields per hectare and the average age of the coffee-trees in the principal coffee-growing zones of El Salvador.

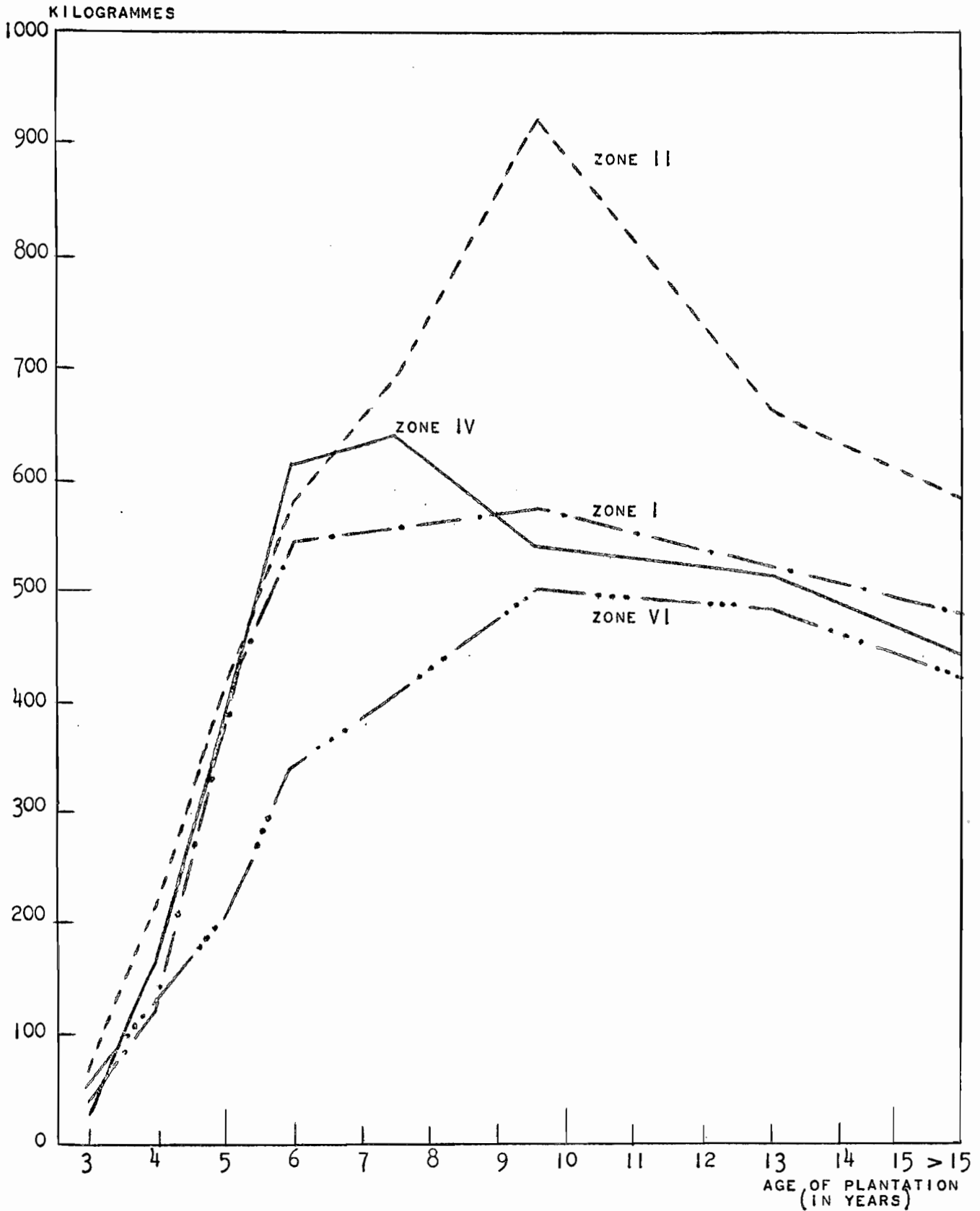
Prices, apart from their possible influence on the rate at which plantations are established or renewed, also seem to affect farm practices and labour and other inputs, and, consequently, yields. If the current high level of prices is maintained, it may therefore be assumed that coffee-growing operations in general will be to some extent intensified, with the corresponding improvement in yields. On the other hand, should prices undergo a marked decline, planters may neglect certain operations on their plantations, cutting down particular items of current expenditure - the purchase and application of fertilizers, for example - and this may result in lower yields.

In 1954/55, a peak year for the consumption of fertilizers and manures, they were applied to only 30 per cent of the area under coffee, and in many cases in such insignificant proportions that they are hardly likely to have had any effect on yields. Whether or not the rate of expansion in the use of fertilizers registered in 1950-55 is to be maintained during the next few years will depend upon the effectiveness of field experiments and extension demonstrations, as well as on the evolution of the farmers' own attitude with respect to the acceptance and adoption of new techniques. This applies not only to the small planters, who at the present time make practically no use of fertilizers, but also to medium-scale coffee-growers, who cultivate a high percentage of the total area. The lack of adequate credit on acceptable terms constitutes a serious handicap to the former group. Those who belong to it remember the crisis of the 'thirties, and hesitate to resort to short-term credits at high rates of interest as long as market prospects continue uncertain. It is therefore believed that the

FIGURE VI - VIII

EL SALVADOR : AVERAGE YIELD OF GREEN COFFEE PER HECTARE
FOR FOUR MAIN COFFEE ZONES, BY AGE OF PLANTATION

NATURAL SCALE



use of fertilizers in coffee-growing will increase only moderately during the next five years, unless the Government launches a vigorous development campaign.

Needless to say, it will not be possible to secure an increment in production before 1960 through the introduction of the improved varieties that are being developed in different parts of the world. If the present experiments yield satisfactory results, reproduction and planting of these varieties will take at least three years, and it will be another four or five before the new trees enter full production.

In any case, it would seem that the capital invested in plantings and replantings in recent years will be enough to ensure an expansion of production between 1955 and 1960, in contrast with the downward trend registered between 1949 and 1954. The estimates presented here (see table 38), show that, assuming continued favourable price relationships, production will tend to increase at an average annual rate of 3 per cent over the next few years. This conclusion, and the projection shown in figure IX, are based on the factors described above, and especially on the levels of planting and replanting attained in recent years. Consideration has also been given to the unit yield according to the hypothetical age of plantations between 1955 and 1960.

According to these estimates, all seven coffee zones will play their part in the estimated increase in production, although with pronounced differences between the rates of increase registered in each. The estimated average rate of expansion mentioned above does not, of course, imply that the 1959/60 harvest will be exactly 14 per cent greater than that of 1954/55. Weather conditions will substantially influence the volume of coffee which will actually be harvested in any one year, while differences in price levels, either up or down, might affect the intensity of care and fertilization.

The annual rate of 3 per cent estimated for the period 1955-60 compares with the rate of about 6 per cent recorded in the 'twenties, and with that of barely 1 per cent which prevailed between 1930 and 1954.

Little information is available on the level of domestic consumption in El Salvador. However, two characteristic features of such consumption as exists may be noted. In the first place, a large majority of the

FIGURE VI - IX

EL SALVADOR : COFFEE EXPORTS IN 1945/46 - 1954/55,
FIVE-YEAR TREND IN 1954/55 - 1959/60
AND ESTIMATED AND PROJECTED TEN-YEAR TRENDS
(THOUSANDS OF TONS)

NATURAL SCALE

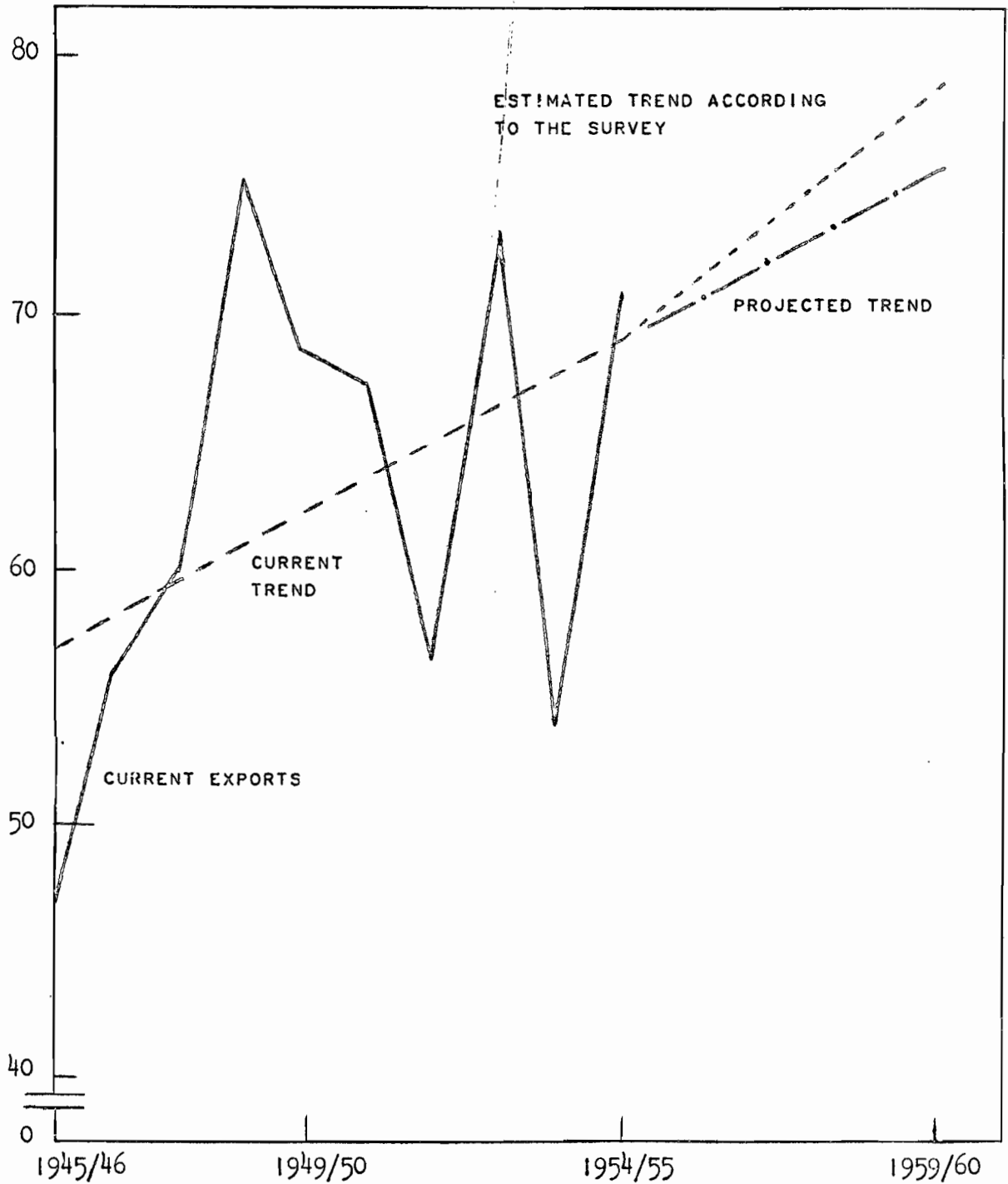


Table VI-38
EL SALVADOR: ESTIMATED INCREMENT IN COFFEE PRODUCTION, 1955-60
(Percentages)

Zone	Total increase	Annual rate
	1955-60	
I	13.5	2.7
II	14.8	3.0
III	26.0	5.2
IV	12.9	2.6
V	23.2	4.6
VI	6.9	1.4
VII	15.2	3.0
Country	14.1	2.8

Source: ECLA/FAO survey.

/Figure IX

population habitually consume low-grade coffee. The practice of adulterating coffee by adding maize or sorghum is common in the urban centres, and as a general rule it is the lower grades of coffee processed by the mills that are kept back for domestic consumption. In the second place, significant quantities of soluble coffee and some kinds of roasted and ground coffee in tins are imported from the United States.^{2/} In the course of the survey it was observed that in rural areas the coffee consumed was of higher quality than in the large towns. This is not surprising, since part of the coffee harvest remains on the plantation or is grown especially for home consumption.

Through the survey and the study of previous estimates a per capita consumption figure of 2.3 kilogrammes per annum was arrived at. A comparison between the total output of coffee in 1949/50 according to the census, and the volume of exports of the same year's crop, brought this estimate up to 2.5 kilogrammes. The total volume of domestic consumption in 1955 was therefore calculated to be 5,600 tons, that is, 7.4 per cent of the crop. Domestic consumption of Salvadorean coffee will probably increase at an annual rate of 3 per cent during the next few years, in view of the prevailing rates of population growth, and without regard to any possible improvement in per capita real incomes.

As the growth of production will keep pace with that of consumption, it is assumed that export availabilities will also increase at an annual rate of 3 per cent during 1955-60. . This compares with a long-term trend of about $2\frac{1}{2}$ per cent per year in the volume of world trade in coffee.

/Appendices

^{2/} . A soluble coffee factory producing for local consumption and for export began operations in 1955.

Appendices

I

METHODOLOGY OF THE SAMPLE

1. Objectives

As was explained in the introduction to this report, the research had two main objectives. These were (a) the determination of the physical and labour inputs and the investment required during the various phases of production, with a view to measuring their productivity in the crop year 1954/55, and (b) the prediction of trends in the production, export and domestic consumption of coffee during the following year covered by the survey.

To fulfil the most important of these aims, representative first-hand information on the condition of the plantations and on farm practices had to be obtained. To this end, with the collaboration of the Institute of Statistics of the University of North Carolina, a random sample was prepared of all the commercial coffee plantations in El Salvador, a description of which is given below.

2. Description of the sample

On the basis of ecological and economic factors, the total coffee-growing area was divided into 7 zones (see map II). Within these the farms were classified in two size categories, comprising those of over and under 200 hectares respectively. The reason for this classification was to ensure that the sample included a sufficient number of large farms, since these account for a considerable proportion of the coffee produced in El Salvador.

The 1950 Agricultural Census data were utilized, and one out of every three of the total number of farms of over 200 hectares existing in each zone was included in the sample. As regards farms of under 200 hectares, 24 sample units, made up in every case of 6 commercial coffee plantations, were selected at random in each zone.

The "commercial coffee plantations" were defined as "all those producing more coffee than needed for home consumption, or having sufficient new coffee plantings for this purpose".

The final selection of the six estates comprised in each unit was based on a complete list by order of location of all the commercial coffee farms in the canton^{1/} included in the sample. The farms were systematically selected on the spot, by which means it was ensured that they were properly distributed throughout the whole of the canton. The following table gives a break-down of the sample by zones and size categories.

BREAK-DOWN OF THE COFFEE SAMPLE IN EL SALVADOR ^{a/}

Zone	Number of coffee farms					
	Under 200 hectares			Over 200 hectares		
	Statis- tical universe b/	Sample	Sampling ratio c/	Statis- tical universe b/	Sample	Sampling ratio c/
I	2,207	144	15.3	34	11	3.1
II	3,788	144	26.3	74	25	3.0
III	1,571	144	10.9	27	9	3.0
IV	6,925	144	48.1	119	40	3.0
V	5,755	144	40.0	25	8	3.1
VI	2,867	144	19.9	42	14	3.0
VII	8,347	144	58.0	34	11	3.1
Country	31,460	1,008	31.2	355	118	3.0

Source: ECLA/FIO survey.

a/ The table represents the original break-down, which differs from the total number of questionnaires included in the analysis owing to the elimination of questionnaires to which no replies were received.

b/ These figures include a considerable number of farms of minimum size (the "non-commercial" plantations which were not taken into account in the survey).

c/ Ratio between the total number of farms (the universe) and the number included in the sample.

^{1/} A "canton" is the smallest administrative sub-division of a municipal district.

This type of sample gave satisfactory results. However, attention may be drawn to some of the drawbacks that arose in the course of the work. In the first place, in large zones where the plantations were numerous a great deal of time and energy was taken up in visiting (on one or several occasions) the farms included in the sample unit, because they were so widely scattered. Secondly, for the study of the economic aspects a smaller sample, such as was afterwards taken in Colombia, would probably have been sufficient. The sample ratio was relatively high in order to deal adequately with the censal aspects of the survey, which covered the number and size of the coffee farms, a break-down of the plantations by age, etc. These data were essential for the forecast of production trends, which constituted one of the two principal objectives of the research.

3. Organization and execution of the work

All phases of both the field and office work were under the direction of personnel attached to the ECLA/FAO Programme, and economist and an agricultural expert specializing in coffee problems having been appointed for this purpose.

Thanks to the invaluable collaboration of the Ministries of Economy (Statistics and Census Department) and Agriculture, the ECLA/FAO Group was assisted by about 20 field enumerators, most of whom travelled all over the country. Three jeeps were available for transport.

After a period during which, inter alia, the questionnaires were prepared and tried out in the field and the personnel were given special training, the field work of enumeration began in mid-November 1954, and continued until the end of February 1955, covering the 1954/55 crop, which was harvested during those months.

In the aggregate, data on 1,040 commercial coffee farms were obtained in the course of direct interviews with producers or owners. 32 of the questionnaires were discarded and 1,008 utilized. If these figures are compared with the break-down of the sample in the table, it will be noted that the questionnaires to which no replies were received, plus the discarded forms, amounted in all to only 10 per cent of the original total assigned, which was 1,126, including farms of both over and under 200 /hectares.

hectares.

As soon as the field work of collecting data was completed, the questionnaires were critically analysed and revised and tabulation and analysis was begun.

Full data were also obtained on 27 processing mills, which exemplified all the types existing in the country.

The ECLA/FAO Group spent 6 months in all (October 1954 - April 1954) in El Salvador, afterwards taking all the material gathered to the Mexico office of ECLA, to carry out the analysis there.

II. ESTIMATE OF THE COST OF THE SURVEY

The following table gives the total approximate cost of the survey. A complete estimate of the total cost has been presented, including the salaries of certain permanent administrative personnel who were placed at the disposal of the ECLA/FAO Group during its stay in El Salvador.

	<u>Dollars</u>
1. Programming	
Preparation of the sample	1,750
Travel	<u>500</u>
	2,250
2. Field work	
Salaries and subsistence allowance of enumerators and chauffeur	10,980
Materials (fuel, stationery, etc.)	<u>1,100</u>
	12,080
3. Office work	
Salaries	2,940
Calculations, perforation and mechanical tabulation	2,760
Materials	<u>200</u>
	5,840
4. Direct supervision	12,400
5. Other expenditure, including travelling expenses of the ECLA/FAO Group, miscellaneous items and indirect expenditure	<u>4,430</u>
Total approximate cost	37,000

III. GLOSSARY OF SOME OF THE TERMS USED

<u>Berry</u>	The fruit of the coffee tree, which, when ripe, is called the fresh coffee berry; and when dry, the dry coffee berry.
<u>Cleaning of trunks</u>	Removal of moss and lichens from the trunk of the coffee tree.
<u>Clearing of ground</u>	Uprooting and removal of tall weeds, bushes, etc.
<u>Coffee mill</u>	Plant in which the coffee is processed for sale.
<u>Compost</u>	Organic manures based on fallen leaves, weeding residues, etc.
<u>Contour hedges</u>	Rows of plants sown between terraces along the contour lines.
<u>Contour terraces</u>	Terraces dug along the contour lines to protect the soil against erosion.
<u>Depulping</u>	Removal of the outer layer of the fresh coffee berry.
<u>Digging of planting holes</u>	Preparation of planting or replanting-holes for coffee trees or shade trees, into which organic manures are dug.
<u>Elimination of excess shoots</u>	Elimination of unproductive or superfluous shoots or buds from the coffee tree.
<u>Fertilizers</u>	Fertilizers of mineral origin.
<u>Green coffee</u>	The coffee bean after removal of all the outer coverings (also known as "clean coffee"). At this stage it is ready for roasting, and on the world market has been given the name of "green coffee" on account of its distinctive colour.
<u>"Izoteado"</u>	Planting of "izote" (Yuca) to form contour hedges.
<u>Mild grades</u>	Coffee of the <u>c.arabica</u> varieties, usually produced in coffee plantations where shade trees are grown, and subjected to the wet process in the mills.
<u>Nursery</u>	Nursery for both young coffee-trees and shade trees.
<u>Painting with lime</u>	Application of a lime solution to the trunk of the coffee trees.
<u>Parchment coffee</u>	The coffee berry when the outer layer has been removed. At this stage the coffee bean is enclosed in a thick covering known as "parchment".
<u>Picking</u>	Harvesting of the coffee berries.
<u>Replanting (or re-sowing)</u>	Replacement of either a coffee-tree or a shade tree by a new planting.

<u>Seedbed</u>	Plot where the coffee seeds germinate.
<u>Shade trees</u>	Groups of trees specially interplanted with the coffee-trees to provide them with shade.
<u>Sun-drying</u>	Partial drying of the coffee in the sun.
<u>Threshing</u>	Removal by the dry process of all the outer coverings of the coffee berry.
<u>Training</u>	The operation of temporarily bending or arching the trunk or branches of the coffee tree, so as to promote the growth of new shoots.
<u>Coffee Unwashed</u>	Green coffee obtained from the dry coffee berry.
<u>Washed coffee</u>	Parchment coffee or green coffee obtained from the fresh coffee berry.

IV. CONVERSION FACTORS USED IN THE STUDY

1. For fresh coffee berries

According to official estimates, the clean coffee content in a given weight of fresh coffee berries is 20 per cent. That is, a mill requires 500 kilogrammes of fresh coffee berries to obtain 100 kilogrammes of green coffee. Thus the extraction coefficient applied is 0.2000.

2. For parchment coffee

The clean coffee content usually assumed to exist in a given weight of parchment coffee is 83.3 per cent. That is, 120 kilogrammes of parchment coffee are required to obtain 100 kilogrammes of green coffee. The extraction coefficient utilized is therefore 0.8333.

3. For dry coffee berries

The clean coffee content in a given weight of dry coffee berries is 50 per cent. That is, to obtain 100 kilogrammes of green coffee 200 kilogrammes of dry coffee berries are required. In this case the extraction coefficient is 0.5000.

