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INTER-AMERICAN INSTITUTE OF AGRICULTURAL SCIENCES OF THE O.A.S.
Training and Research Center
Turrialba, Costa Rica

Report No. 53

REPORT ON COFFEE PRODUCTION IN ECUADOR AND RECOMMENDATIONS TO INCREASE YIELD AND IMPROVE QUALITY

by

PIERRE G. SYLVAIN
Senior Horticulturist
Resources for Development Program

This consultation service was rendered at the request of the United States Operation Mission to Ecuador, through the Andean Zone Office of the Inter-American Institute of Agricultural Sciences of the O.A.S.

Consultation Reports reflect the opinion of individual Consultant and do not necessarily reflect the official views of the Inter-American Institute of Agricultural Sciences.

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Report on Coffee Production in Ecuador and Recommendations to Increase Yield and Improve Quality

Pierre G. Sylvain

INTRODUCTION

In the past thirty years, coffee production has gained much greater importance in Ecuador, the annual exports of the commodity increasing from 160,000 bags to nearly 600,000. However, the drought last year has reduced production to the point that the country was not able to fill the quota assigned to it under the International Coffee Agreement. On the other hand, coffee quality is not of a very high standard and the price of the product on the world market is relatively low.

Considering the importance of the crop as a source of foreign exchange and as a factor in the diversification of the economy of the country, the Ministry of Agriculture of Ecuador is showing great concern in maintaining a satisfactory production of the commodity and in improving its quality.

The consulting services of Dr. Pierre G. Sylvain, Horticulturist of the Resources for Development Program were requested by USAID/Ecuador through the Regional Andean office of I.I.C.A. in order to review coffee production situation and assist the Ministry of Agriculture in development program for expanded research and extension activities on this crop.

To implement this request the Consultant stayed in Ecuador from June 14 to July 1st, 1965 traveling in the areas recommended by the Head of the "Programa de Fomento Cafetero". He visited coffee districts in the provinces of Manabi, Guayas, Los Ríos, El Oro, Loja, Tungurahua, Cañar, Pastiza and Napo. Unfortunately, due to the recent rains and the bad conditions of the roads, it was impossible to visit some of the districts located in the back country. For instance, efforts were spent to reach La Naranja on a mule but the trail was in such a state that even mules progressed only with the utmost difficulty.

Various discussions were held with a number of professionals including

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Ing. Jaime Alzamora, Under Secretary of Agriculture; J. Villafuerte, Head of the Agricultural Development Program; staff members of the "Departamento de Programación" of the Ministry of Agriculture; Freeman Smith; D.D. Mac Pherson; M. Myrick and N. D'Baca of the USAID Mission, all in Quito; staff members of the "Programa de Fomento Cafetero" and the Pichilingue Experimento Station in other parts of the country. Talks were also exchanged with local technicians, coffee producers and buyers in various areas. In Manta two exporting firms were visited.

The consultant wishes to thank all these people and others who have been of help in the fulfillment of his mission. For sake of brevity no attempt is made to list all names. A special mention should however be made to his travelling companions during some or all field trips: Ing. Sócrates Bermúdez, Head of the "Programa de Fomento Cafetero" and his collaborators, Ing. Francisco Sarmiento, Ing. Bolívar Mendoza and Ing. Ramón Rubio.

The work of the Consultant was also helped by reading various unpublished documents which were kindly communicated to him:

BERMUDEZ, SOCRATES. Informe sobre la producción de café en el Ecuador. Abril de 1965.

DEPARTAMENTO DE Suelos y Fertilizantes. Estación Experimental Tropical de Pichilingue. Informe Anual, 1964. 32 p.

MINISTERIO DE AGRICULTURA. Informe sobre los suelos de la Provincia de Manabi, 1965. 37 p. 1 mapa.

SUB PROGRAMA de Fomento Cafetero. Operación de la Planta de Lodana, 1965. 8 p.

SUB PROGRAMA de Fomento Cafetero. Plan de Trabajo para 1965. 5 p.

In this Report, the present situation of the coffee production in Ecuador and its problems will be first considered, then recommendations to improve the situation will be presented.

THE PROBLEM

1.- Trends in coffee exports

Coffee exports in Ecuador have increased substancially in the past twenty years. Data obtained from the Coffee Statistics

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annually published by the Pan American Coffee Bureau (11, 12, 13, 14, 15) show the following trends of exportable production of 60 Kg bags in five year averages.

Crop years July 1 to June 30	Annual average of exportable production
1945-46 to 1949-50	207,000
1950-51 to 1954-55	308,000
1955-56 to 1959-60	422,000

The average of the three crop years 1960-61 to 1962-63 showed another increase with an average exportable production of 550,000 bags. The situation therefore does not appear to be cause for alarm. However due to drought in the main producing areas the exportable production in 1963-64 did not reach the quota of just over 500,000 bags assigned to Ecuador under the International Coffee Agreement. This reduced production resulting in decrease of foreign exchange is of concern to the Government as it coincides with a decrease in banana exports.

2.- Low yields

The most serious problem of coffee production in Ecuador is the fact that yields are very low bringing only subsistence gains to growers which in general have only small acreages in cultivation. The other aspect of the problem is that better yields would allow for the use of a much lower acreage to obtain the same total production, making available for other crops a large part of the land where coffee is grown for the time being. The area of coffee in production is estimated at about 130,000 hectares for a production of about 600,000 bags.

This last figure is based upon exportation of 500,000 bags and estimated local consumption of 100,000 bags (4). Considering area and production the average yield may be calculated at 608 lb per hectare. Bermúdez in his report on coffee production in Ecuador gives indications of yield for various districts: 850 lb per hectare for the wetter part of South Manabi and 300 lb for the drier part; 1000 lb in Guayas; 900 lb in Los Ríos; 650 lb in Loja and El Oro. The data for Manabi and Guayas refer however to years with a normal rain fall. For instance the author mentions that after the drought of 1963 yields

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were reduced by half in the wetter part of South Manabi.

According to data published by Krug (9) for various countries, average yields of coffee in pound per hectare reached the following order in round numbers:

Brazil	880
Colombia	1,120
Costa Rica	1,450
El Salvador	1,450
Kenya	1,430
Mexico	840

In Hawaii, Cooil and Fukunaga (6) report a 10 year average of 98 cwt cherry per acre and that yields of 150 cwt per acre or more are frequently obtained on Kona farms. The first figure corresponds approximately to 4200 lb of market coffee per ha and the second to 6330 lb.

All these figures show that Ecuador has still a long way to go in coffee production efficiency.

This is a serious situation if one considers that many farms have only a very small coffee acreage and that in some areas like part of South Manabi farmers derive most of their income from their coffee holdings. According to data published by the Coffee Study Group (4) at the time of the Agricultural Census of 1954 there were in Ecuador in round numbers 19,000 farms having an average size of area planted to coffee of 0.8 ha; 9,000 of 1,5 ha and 8,000 of 2.4 ha. Even the largest farms numbering 1,163 had only 11.1 ha planted to coffee as an average. However the document mentions that in Manabi and Loja provinces, a considerable number of holdings were devoted exclusively to coffee cultivation.

Some people believe that small holdings result inevitably in low yields. This is not always true, part of the reason of the spread of coffee cultivation in the world is the fact that the crop lends itself to estate cultivation as well as small farm production. In fact the highest yields in the world are obtained in Hawaii on small holdings of 5 to 20 ha (9). Colombia which showed a yield of 1170 lb/ha in 1955/56 has mostly small holders, some that 362 of the 212,970 farms have coffee plots less than one hectare and an additional 58% have coffee plots between one and 10 ha. For the whole country the average size of plots planted to coffee in 3.2 ha. There are very few

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plantations of over 50 ha (4).

If Ecuador could reach the yields obtained in Colombia in 1955-56, the actual production could be obtained on 68,000 hectares releasing for other crops 62,000 hectares or about half the present acreage.

It is therefore imperative to consider the factors which cause low yields in Ecuador before devising any promotion program contemplating research, extension and credit.

3.- Factors limiting yields

a) Climate - Ecuador is probably the only country in the world where coffee is grown under such an array of climatic conditions, from semi arid (parts of Manabi) to continually humid (Puyo), from hot at practically sea level to cold at altituds over 2000 meters. As climatic requirements of various coffee species differ radically, it should be stated that in this Report the term coffee refers to Coffea arabica unless stated otherwise. We know that although the species may adapt itself to a number of environmental conditions there is an optimum climate under which one may expect good crops provided soil, variety and cultural practices are adequate. If the climate is not satisfactory, in many cases there is little which can be done to correct it whereas in others the practices necessary to counteract the situation may not be economically feasible. In many countries altitude is one of the most important criteria used to determine the best coffee districts. Soil considerations within these districts permit to point out the exact areas where the crop should be grown. Due to exceptional factors like the effect of the Humbold current in the Southern part of the country and the influence of the great chain of the Andes in several districts, there are many microclimates in Ecuador which make more difficult to base recommendations for land use upon altitude i.e. two sites at the same altitude and almost the same latitude may show sensible differences in temperature. Also in some areas there is a heavy cloudiness and the occurrence of mist called "garua" which reduces evapotranspiration during part of the dry season. On the other hand some of the soils have a high capacity of water absorption which enables the trees to better withstand long rainless periods. This has been stressed by Colmet Daage in his preliminary studies of the banana soils of Ecuador (5).

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Alegre (2) gives a good picture of the climates suited to Arabica coffea based upon studies of conditions prevailing in the main coffee belts of Ethiopia, the Congo, Colombia and Brazil. The author draws the following conclusions from his survey: an annual average temperature of about 20ºC oscilating between 18º and 21ºC appears to be optimum. An average superior to 23ºC or inferior to 16ºC during too long a time is harmful to the plant. The optimum rainfall seems to be within 1200 and 1800 mm distributed in two seasons. The trees begin to suffer when the precipitations of the driest quarter falls below 100 mm. The optimum average annual relative humidity is between 70 and 80 per cent.

It must be added that rainfall which largely determines the availability of water to the plant should be considered from several angles as its distribution within the year is of great importance as well as its total amount. In some instances direct, positive correlations has been found between rainfall and subsequent yields whereas in at least one instance negative correlation was established (18). Extensive rainfall may adversely affect plant behavior by its effect upon some physiological process (leaching of nutrients from leaves), upon soil conditions (especially availability of oxygen) and upon pathological organisms (incidence of fungous diseases).

Rainfall is not however the only factor to consider in a study of water relations as the moisture supply varies according to the evapotranspiration potential, itself dependent upon other climatic factors like temperature and wind. Soil conditions will affect also as mentioned above the water requirements some types absorbing or retaining moisture better than others.

In areas where coffee is usually prepared by the dry method, rainfall distribution is also of great importance to processing, due to the fact that an excess of atmospheric humidity after picking prevents rapid drying of the berries.

It is important to note that the majority of the coffee produced in Ecuador comes from areas which do not fit Alegre's description of an optimum coffee climate. For instance, a dry season of six months duration is quite common even in areas where the annual rainfall is relatively high. Also average annual temperatures reach 24ºC or more in several coffee districts. It is not therefore surprising that a number of problems occur and that the yields are generally low.

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It is interesting to note that in several instances coffee trees are seen with a satisfactory vegetative growth but with very little production. This seems to be due to drought or high temperatures occuring around blossoming time resulting in a high instance of aborted or "star flowers". These flowers do not produce fruits.

The influence of climate on the incidence of star flowers has been recognized for a long time. As early as 1934 Porteres (16) observed that under the conditions of Bingerville there were losses of 95% of the production of C. arabica due to star flowers. Under the same environment Robusta coffee showed normal flowering.

Porteres (17) demonstrated the effect of soil moisture upon the incidence of star flowers. After a period of 30 days without rain, he watered with a water pot series of plants of Arabica coffee applying varying quantities of water namely 0, 40, 100, 200, 400, 600, 800 and 1000 liters per plant corresponding to a rainfall of 0, 2, 5, 10, 20, 40 and 50 mm. He obtained a positive correlation between the percentage of star flowers and the quantity of water applied to the plant. From 57% in the controls the quantity of atrophy went down to 5% with an irrigation equivalent to 20 mm of rainfall and to nearly 0 with the application of larger amounts of water.

The effects of day and night temperatures on the incidence of star flowers were studied by Went (19) and Mes (10) at the Earhart Laboratory in California.

Went found that plants of C. arabica of the Red Bourbon variety produced many floral buds under temperatures of 23-26ºC (the first number refers to day temperatures and the second to night temperatures) but in general the buds developed into starflowers or dried up before reaching normal size, Plants submitted to the same day temperatures (23ºC) but to cooler nights (20 or 17ºC) produced many flower buds which developed normally and later produced fruits. Mes found that, at day temperatures of 30ºC and night temperatures of 24 ºC some of the flower buds dried up before development and the majority produced starflowers.

Although there is little study on the matter it is probable that drought and high temperatures have an additive effect upon the incidence of starflowers.

Although the Consultant did not have a chance to visit the coffee districts at blooming time to confirm this fact, it is probable that in the lower, warmer and drier areas the incidence of starflowers is the main limiting factor in yields. The problem is rather complex as data of mean annual temperatures are not as significant as the temperatures occuring at night at certain times of

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the year.

b) Soils - In the lower parts of the coffee belt there do not seem to occur generalized soil problems although some sites cannot be recommended from this point of view. In many spots pH is near neutrality as indicate data from the unpublished Report on Manabi soil and the Report of Hardy on the Riverine Belt soils of Ecuador (5). This may explain the common occurrence of Manganese deficiency symptoms seen on coffee trees on a number of areas. These were especially noticed in Cascol (Canton Pujan), San Javier and the road to La Naranja (Manabi Sur) and along the road from Santo Domingo de los Colorados to Quininde. Phosporus and Magnesium deficiency symptoms were seen in the Santo Domingo de los Colorados district. The Report of Hardy (8) and the unpublished Annual Report from the Soils and fertilizer department of Pichilingue Experiment Station indicate that Nitrogen deficiency was the main deficiency among the soils studied. Hardy found Phosphorus also generally deficient.

In the higher districts where steep slopes are common soil conditions are often a problem more difficult to solve as soil erosion has already occured or is more likely to occur due to terrain configuration. This is the case of many areas in El Oro and Loja provinces as well as around Balsapamba and Paltas.

c) Genetical factors - The common variety of arabica typica is known to be much less productive than selected types. Although occasional mutants susceptible to give good yields may probably be found in the country the genetical material generally grown is not conducive to sustain high production and does not present the characteristics to resistance to drought and high temperatures found in various parts of the coffee belt.

d) Cultural practices - The cultural practices used on many farms are certainly limiting yield. This is well known of the Staff on the coffee Program. Planting distances are often too great to allow maximum use of the land. In some areas weed control is not practiced as often as it should. Lack of a good pruning system results in trees without the necessary frame work to support a good crop and with an excess of improductive old wood. Defective shade control or the use of the improper species for shade decrease yield by preventing entrance of light necessary for adequate rates of photosynthesis.

e) Pests and Diseases - Although pests and diseases are not generally a major

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problem of coffee production in Ecuador for the time being, the matter should be of concern in some areas. The most common diseases is Koleroga caused by Pellicularia koleroga. This is seen at varying degrees of severity in most districts. American leaf spot caused by Mycena citricolor is serious only in a few places but may become very important if more coffee is grown in the wetter districts like Santo Domingo and the higher lands of the "Oriente". There is some concern about the occurrence of an insect recently discovered in Santa Rosa and identified as the false "broca", Stephanoderes seriacea. This insect which attacks various other plants besides coffee is not considered as serious pest in other countries. However its spread should be watched and the injuries that it may cause should be ascertained as the taxonomy of the genus being rather difficult it may be that another species more dangerous than the false broca is actually present. Specimens should be sent to an expert to confirm identification.

4.- Quality of Ecuadorean coffee

The term "coffee quality" is rather complex and includes a series or characteristics of a physical as well as of a chemical nature.

Two main factors govern coffee quality: 1) the inherent properties of the nature beans resulting from environment and genetical constitution; 2) the manner in which the beans are treated from picking to delivery on the market.

Quality is of course relative as according to personal taste the opinion may differ greatly. The practical way to gauge quality is the price obtained for the product.

According to data obtained from the Fedecame Bulletin of July 23, 1965, the spot price paid for Ecuadors was 43.50 cents per lb in comparison with 47.38 for Colombian "Mams", 45.25 for Costa Rican hard beans, 44.75 for high grown Salvadors, 45.13 for high grown Mexicans, 44, 75 for hard bean hand picked Peru. On the same date the Extra Superior Natural Ecuadors were quoted 38.00 per lb compared with 40.25 for the Talm Haiti and 42.13 for the Djimmas U.G.Q., all prepared by the dry methods.

Taking into consideration statistics of a whole year published by the Pan American Coffee Bureau (15) the average price for the washed Ecuador in 1963 was of 33.88 cents the lowest of all quotations given whereas Colombian "Mams" brought 39.55, Costa Rica hard bean 37.61, El Salvador high growh 36.11

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and Guatemala good washed 35.40. As for the coffee prepared by the dry method the highest price paid during the year was 33.00 in comparison with 35.00 for Haitian coffee and 36.38 for Djimmas U.G.Q.

Considering the fact that due to restriction imposed by the International Coffee Agreement only about 500,000 bags of Ecuadorean coffee can reach major channels of international trade it is obvious that if the country wishes to increase the foreign exchange obtained from sale of this product the quality has to be improved to bring better returns. If Ecuadorean washed coffee could at least reach the price quoted for the good Peruvians (which is far from being the highest on the market) this would mean a difference of 1.25 cents per lb. If the coffee prepared by the dry method reached at least the price paid for Haitian coffe this would mean a difference of 1.65 cents per lb. This could result in an increase in foreign exchange of at least a million dollars. Actually the increase would be much higher as Ecuadorean coffee might be then sold on some markets which pay more than the U.S. market for quality coffee.

5.- Factors affecting quality and market price

a) Inherent quality of the bean - Altitude is the most important factor concerned with inherent quality of the bean. Although the exact effect of altitude upon quality has not yet been well ascertained high grown coffees are considered better than low grown and bring generally a higher price on the market. The exact altitude limits affecting quality vary from country to country depending upon other environmental factors for instance the altitude needed to produce the "high grown" effect in Mexico may be much lower than in Colombia.

A recent study made by Acosta and Cleves (1) in Costa Rica is of great value to clarify this point. They found a high correlation between altitude and prices paid to coffee during the crop year 1963/64. Lowest grown coffee (around 375 m) received a price of 34 cents a lb; those grown around 700 mt, 36 cents, those grown around 1000 meters, 38 cents, those grown around 1100 meters, 40 cents, and the highest grown over 1425 m, 45 cents. The publication also gives the characteristics of the bean at each altitude.

The effect of altitude on quality is recognized in Ecuador as the Zaruma coffee, high grown, brings a better price on the local market. However, the concept of altitude in coffee growing is a little erroneus as people will speak of high grown coffee when referring to a plot may be only 400 meters high.

b) Processing methods - Processing methods have the greatest effect on

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quality as the best coffee in the world will be spoiled if improperly handled from picking the fruit to exporting the final product.

It is recognized in Ecuador that the wet method produces a coffee considered of better quality and bringing a higher price on the world market. Great effort have been spent in recent years to increase the percentage of washed coffee. Although no exact figure is available there are still substantial quantities of coffee prepared by the dry method, the "naturals" of the trade. No effort has been made to improve this latter type.

Green and red cherries are most often dried on the soil and are subject to pick an earthy flavor which no processing can subsequently eliminate. They are hulled by pounding with a pestle in a mortar.

The crucial point in washed coffee is the fermentation process which should be carried out with the necessary care. The practice of marketing partially dry coffee under the name of "oreado" is a factor susceptible to affect badly quality as excessively wet coffee will keep fermenting under conditions which may result in bad flavour.

c) Lack of grading - Coffee is usually marketed on the basis of grades of known quality. Grades are established according to size of beans, number of defects in a sample and cup testing. When a good system of grading is used it is easy to obtain a better price for high quality product. This has been shown to be the case for Costa Rican coffees. When there is no grading the tendency is to buy the product at the lowest price.

II RECOMMENDATIONS

1.- Determination of best areas for coffee production

Complete weather data are still lacking for most districts of Ecuador which means that even though we know climatic requirements for optimum coffee production it is hard to say exactly where in the country are found the best conditions to grow the crop. The number of metereological stations located in the coffee belt should be increased as soon as possible. In general terms the best coffee areas fall within the sub-tropical moist forest or the subtropical wet forest of Holdridge's classification. They have an average annual temperature of 24ºC to 18ºC and

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rainfall of 1000 to 2000 mm in the case of the first region and of 2000 to 4000 in the case of the second. These regions have been indicated in the Ecologic maps of the Guayas Basin (7). Of course, coffee even within these areas should preferably not be planted under the extreme conditions of temperature and rainfall.

In the lower part of the coffee belt, below 400 meters, where there are many micro-climates it is recommended that a survey be conducted at the time of the main flowerings to determine the percentaje of star flowers. This could easily be done marking about 3 branches on 20 to 30 trees picked at random and counting perfect and star flowers. Star flowers should be removed after the initial count as otherwise they might stay on the trees for a long time and be included in the next count. Efforts should be made to correlate the incidence of starflowers with average maximum and minimum night and day temperatures at the time of flowering and also with rainfall, cloudiness and atmospheric humidity. Areas showing more than 75% of perfect flowers during the main flowering could be considered climatically suitable.

In the case of the highest areas 800 to 1800 m the main concern should be soils. Coffee growing on the slope of the Andes, for instance in El Oro and Zamura provinces, should be encouraged only in areas where erosion control measure can be safely adopted. Steeper slopes should be left in forests or reafforested if bare of trees. No coffee plantings should be undertaken in areas where soil has been already completely eroded.

In the case of the Oriente and some areas of the Santo Domingo de los Colorados district, excess rain may be a limiting factor. It is doubtful that coffee can be grown commercially in areas where rainfall reaches around 4000 mm a year even if the soil is perfectly drained and still relatively fertile. Under such conditions disease control becomes such a problem that the cost of production may raise to the point that no margin of profit is left.

A great advantage in increasing production in areas of high altitude, the effect of altitude upon quality as a premium is generally paid for high grown well processed washed coffee.

Once determined the best coffee districts, government efforts in the form of extension, research and credit should be especially directed towards these areas. In marginal areas government efforts should tend to establish or increase diversification in the agriculture so that coffee growing be gradually

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replaced by a more profitable activity.

2.- Demonstration farms

In many areas the producer has never seen a well cared coffee farm. He believes for instance that production of the order of 500 lb per hectare is satisfactory whereas in other parts of the world yield of the order of 5000 lb per hectare are not unusual.

It is recommended that in the districts best suited to coffee production a series of small demonstration farms be established by the "Programa de Fomento Cafetero". These farms should be of the size most common in the area and would serve at the same time to carry out some simple tests. They should be at least self sustaining and normally would bring profits after the first commercial crop. Once in good production they should be turned over to private ownership so that the "Programa de Fomento Cafetero" could devote its activities to establishment of more plantings in other areas. In certain cases the farms could be located on private lands provided the owners would give full authority to the "Programa" for growing the crop.

In areas subject to relatively low light intensity caused by heavy cloudiness or mist ("garua") part of the coffee should be grown without shade and the necessary data taken to know which system is more advisable under the prevailing conditions.

3.- Variety test

Several good varieties have already been introduced in Ecuador and some of them seem to outyield the local types in most areas where they have been planted so far. Tests should be carried out in all good coffee districts and reliable yield data taken during at least six commercial crop years. The personal professional should be alert to find mutants or types introduced long time ago which may present desirable characteristics.

4.- Fertilizer tests

The results obtained at the Pichilingue Experiment Station show good responses to some fertilizer applications. Tests of the same nature should be repeated in the various coffee districts especially in the hilly areas where there seems to be more chance for soil fertility problems. There

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is little information in the world literature on the effect of Manganese application on coffee yield. Considering the widespread symptoms of deficiency of this element and the relative high pH of many of the soils it is suggested that some trials be undertaken with the application of the element in solution to the foliage as well as in solid form to the soil.

5.- Mulching and irrigation tests

In the drier part of the coffee belt the economic feasibility of mulch application should be studied. The beneficial effects of mulch application in dry areas have been demonstrated more than once. However the cost of such application is prohibitive in some places. Careful cost and returns analysis should reveal whether this practice would be economically advisable under the conditions of Ecuador taking into consideration such facts as fire hazards and growing the material to be used as mulch.

In areas where surface or subterranean waters is available in sufficient quantities, costs and returns of irrigation coffee should be considered. Costly practices like mulch and irrigation should only be resorted to when other yield factors are not limiting.

6.- Improvement of natural coffee

A number of years will elapse before all Ecuadorean coffees can be treated by the wet method. An improvement in the quality of coffee processed by the dry method should be therefore undertaken immediately. It is recommended that the same facilities given for the building of concrete platforms for drying washed coffee be extended to people using the dry method. This seems especially advisable by the fact that the same platforms might be used later on for washed coffee in case the producers would change their processing methods. The introduction and sale at cost of small compact and hullers is recommended. The possibility of having mobile hulling units mounted on trucks going from village to village for processing coffee at cost should be studied by the Program.

7.- Improvement of washed coffee

Processing of washed coffee may be carried

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out either by a large plant of great capacity, or by small processing units with limited capacity or again using small hand pulpers, coffee being fermented in baskets or small vats. Good coffee may be produced by any of these means as show the experience of the large "beneficios" of El Salvador or Costa Rica, of the numerous medium sized ones of Colombia and of the hand pulpers used by the 30.000 coffee growers of Kilimandiaro producing as an average a ton each of parchment coffee. It is however easier to control quality with large plants well administered. A large plant requires a volume of cherries important enough to allow it to run at capacity or near capacity. Several studies have been made on the failure to use efficiently the Lodano processing plant. Some factors like the distance of the coffee groves from the plant may have resulted in the difficulties met in its management. It seems however worthwhile to establish a modern processing plant in the heart of a large coffee district. It is suggested to consider as a site the area of South Manabí between San Javier and La Naranja. The actual road which is hardly transitable during the rainy season, even for mules, should be greatly improved to facilitate movement of men and goods. Such a plant could be established by the "Programa de Fomento Cafetero" and eventually leased or sold to a private concern. Through such a scheme, the Program would have finances and personal to establish later another plant elsewhere. If it is decided to abandon the Lodano operation for pulping and washing coffee the equipment might well be transferred to the suggested site.

The present system of setting up medium size "beneficios", financing the building of concrete platforms and selling at cost hand pulpers should be continued and expanded. Sale of coffee in the form of wet parchment or "oreado" should be discouraged and producers advised to dry their coffee thoroughly before marketing with the exception of areas where drying is very difficult due to weather conditions.

8.- Grading and Standardization

Most producing countries have adopted official grades for their coffee. Standardization is usually enforced by law. The "Programa de Fomento Cafetero" is now contemplating the drafting of the neccesary regulations. The FEDECAME countries to which belong Ecuador have given great emphasis to altitude in establishing grades based upon liquoring prop-

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erties as determined by cup tesing. It is recommended that this aspect be given great attention in the proposed regulations. Due to the existence already mentioned of a number of micro-climates the establishment of grades based upon altitudes will require the study of a great number of samples of coffee of different geographical origins. A team of expert testers could then determine the altitudes in which occurs differences important enough in body, flavor, or acidity to distinguish the grades.

It is recommended that these samples be taken to the next technical meeting of FEDECAME to receive the opinion of the experts of different countries which usually congregate for this purpose. As it is advisable to have different systems of classification for washed and natural coffee, it is also suggested to consider in the adoption of regulations, the standardization used in countries where coffee of both types are marketed in sizable quantities. Haiti, in the FEDECAME area, has probably the largest production of natural and an adequate system of grading, consideration should therefore be given to the experience obtained there in coffee marketing.

9.- Credit and Cooperatives

To help small growers improve their planting long term credit should be made available to them in the areas recognized as best suited to coffee production.

Credit should consider both growing needs (purchase of fertilizers, seedlings, etc.) and processing needs (purchase of pulpers, hullers, construction of drying platforms). In areas marginal for coffee, credit should be directed towards crop diversification.

Credit is often more effective when made available through cooperatives. Cooperatives seem to suit especially small coffee producers as shown by the success of this type of organization in Tanganyika and Jamaica. The extent of this movement in Tanganyika has already been mentioned. In Jamaica, whereas these organizations had only 3.500 members in 1951, the number reached about 45.000 in 1964. They owned 6 factories and processed nearly 40.000 boxes of coffee berries during the year (3).

10.- Socio-economic survey

It is important to assess the socio-economic problems related to the coffee industry, for instance the economic feasibility of various practices recommended by the agronomists. This is basic to any credit

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program. Surveys of this type have been successfully carried out in Colombia, El Salvador, and the State of Sao Paulo by joint missions from FAO and CEPAL. It is recommended that these organisms be approached to render the same services to Ecuador. If their services cannot be obtained another source of technical assistance should be sought to help local technicians to carry out the work.

11.- Technical assistance

Besides the need for technical assistance indicated in the previous paragraph, it is recommended that outside help be provided in the following fields:

a) Processing and grading to ensure rapid improvement of coffee quality. This would require 12 to 24 months of a Consultant having as counterpart the Specialist in Processing of the "Programa de Fomento Cafetero.

b) Coffee Research. Repeated visits to the "Programa de Fomento Cafetero". and to the Pichilingue Experiment Station would be needed to advise on research and to help to coordinate efforts in this direction. This might be available through the Coffee Program to be soon established in the Andean Zone of IICA.

12.- Training

Well trained personal both at the post-graduate and at the technician level is paramount to the success of all agricultural programs. It is recommended that the Processing specialist of the "Programa de Fomento Cafetero" be given the facilities.

a) to study coffee processing and grading in at least four countries including Colombia, Costa Rica, Haiti and Jamaica (with special emphasis on cooperatives in this latter country). Brazil is not mentioned as the incumbent has already spent a long time in this country to this end.

b) to attend the next meeting of FEDECAME cup testers.

c) to study the mechanisms of marketing of the New York Coffee Exchange, and the activities of the Pan American Coffee Board.

d) to visit one of two great importing roasting firms in the United States.

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The Consultant if requested would be glad to make arrangements for the suggested training.

It is also recommended that fellowships be given to improve the training of present or future leasers of the "Programa de Fomento Cafetero" in coffee culture and experimentation. These fellowships might include a first period of formal studies followed by visit to two or three countries where coffee production is more advanced.

For the preparation of technicians, the holding of a series of short courses for agricultural agents and people actually engaged in coffee production is recommended. These courses could be taught by local agronomists with the assistance of specialists contracted for a short period through AID or IICA.

SUMMARY

1.- Although coffee exports of Ecuador have substantially increased in the past twenty years, the country was unable in 1964 to face the quota assigned to it by the International Coffee Organization.

2.- Due to very low yields, a large acreage has to be devoted to this crop in order to produce the present quantities. This also results in a difficult financial situation for the small coffee producers who do not diversify the crops in their farms.

3.- The quality of Ecuador Coffee both washed and naturals leave much to be desired as shown by the prices obtained on the world market, which are low in comparison with the products from other places.

4.- Poor quality is largely due to processing methods. Moreover lack of grading does not allow for separation of best coffees from others and by this means receive the price they deserve.

5.- The following recommendations are presented:

a) Carry out a survey, at flowering time, in the lower part of the coffee belt to determine the districts best adapted to coffee production from the climatic point of view. Within these districts

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and those located at higher altitudes, soil conditions would determine areas where coffee should be grown and governmental efforts should be spent for this crop.

b) Establish small farms where best growing practices would be demonstrated and field tests carried out. These would include varieties, fertilizers, use of shade, mulching and irrigation. Records of costs and returns should be taken.

c) Improve natural coffee by extending credit for building of drying platforms and selling hand hullers at cost.

d) Improve washed coffees by establishing a modern large size beneficio in the middle of an important coffee district, discouraging the sale of coffee in the form of wet parchment ("oreado") and also putting on a large scale the action already taken by the "Programa de Fomento Cafetero" (establishment of medium size "beneficios", selling at cost of land pulpers, financing building of concrete platforms).

e) Enforce grading regulations based upon size of beans, number of defects, and organoleptic properties as determined by cup tests.

f) Extend more credit to growers to improve cultural practices and processing methods. This should be preferably done through cooperatives.

g) Undertake a socio-economic survey of the coffee industry with the assistance of experienced consultants.

h) Provide the service of an expert on processing and marketing during a period of one to two years and of an expert on production and research during several shorter periods.

i) Give a fellowship to the Processing Specialist of the "Programa de Fomento Cafetero" to observe coffee grading and processing in at least four key countries and to study the problems of marketing and sale promotion in the United States.

j) Give fellowships to present or future leaders of the Coffee Program to improve their training in the basic fields related to coffee production and research, and to familiarize them with similar programs carried out in key countries.

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