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Pan American Development Foundation

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PROCEEDINGS OF THE FIRST INTER-AMERICAN COCOA FORUM

PROMOTING COCOA PRODUCTION AND MARKETING

Organized by:

- Pan American Development Foundation (PADF)

In collaboration with:

- Inter-American Institute for Cooperation in Agriculture (IICA)
- Center for Tropical Agriculture Research and Education (CATIE)
- American Cocoa Research Institute (ACRI)
- U.S. Agency for International Development, Regional Office for Central America and Panama (USAID/ROCAP)

San José, Costa Rica
January 27 - 30, 1987

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P R E F A C E

For 25 years the Pan American Development Foundation has played a significant role in supporting low-income producers in Latin America and the Caribbean. We have promoted rural activities to generate new income sources for small-scale farmers and provide alternatives for traditional crops which suffer from volatile prices and import quotas.

Based on production trials of the Hershey Foods Corporation, a major U.S. chocolate manufacturer, and in cooperation with its demonstration farm in Belize, PADF has worked to help expand cocoa production extension technology and appropriate post-harvest management skills to increase the quantity and quality of cocoa production in five other countries.

Broadening interest across the Americas in farmer production of cocoa led PADF to initiate an Inter-American Cocoa Forum in Costa Rica, January 27-30, 1987. PADF, together with the Inter-American Institute for Cooperation in Agriculture (IICA), the Central American Tropical Agriculture and Research Institute (CATIE), and the American Cocoa Institute (ACRI), hosted the Forum.

The Inter-American Cocoa Forum brought representatives of the international chocolate industry, cocoa buyers and traders together, for the first time, with cocoa scientists, international research and funding institutions, international development agencies, and farmers' organizations. Over 160 participants explored cocoa tree selection and cultivation, productivity, disease and pest control, processing, market problems, and technical and economic prospects for the future.

These proceedings provide a wide-ranging survey of the various, sometimes competing, concerns of those involved in this world-wide industry. They will serve as a broad source of information for international agencies, traders, and manufacturers, private voluntary organizations, and agencies and farmers' organizations of the producing countries - indeed for all who are concerned with promoting peasant planting of cocoa and its intercrops as a viable cash crop and as an alternative to traditional tropical crops.

Marvin Weissman
Executive Director
Pan American Development Foundation

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ACKNOWLEDGMENTS

The beautiful countries of tropical America have suffered from inadequate sharing of experiences across economic, national, linguistic, disciplinary, and public/private institutional boundaries. Information exchange is essential to reduce isolation and avoid reinventing the wheel yet another time.

The meetings of the Inter-American Cocoa Forum, described in these proceedings, initiated and call for improved collaboration and information sharing on the production, post-harvest processing, and management of cocoa. We believe the Forum has served to accelerate the process of economizing on technical efforts and will speed the day for effective income improvements for farmers and foreign exchange earnings for cocoa exporting countries.

The Inter-American Cocoa Forum could not have been held without the collaboration and expertise of our co-hosts, IICA, CATIE, and ACRI. We wish to acknowledge their specific cooperative contributions:

IICA, Inter-American Institute for Agricultural Cooperation, shared in planning and provided invaluable hospitality and logistic support for the Forum in Costa Rica, including conference facilities, lunch arrangements, floor management, sound systems, interpretors, translation, document preparation, collation, and press coverage.

CATIE, Central American Tropical Agriculture Research and Training Center, provided expert consultation on speakers and the agenda, and hosted a full and informative field day with a superb exhibit of scientific efforts at its demonstration farm and cocoa laboratories.

ACRI, American Cocoa Research Institute of the U.S. Chocolate Manufacturers' Association, generously provided start-up financial support, contacts, and specialists whose expertise enriched the program and assured broad representation and high technical content.

We also here acknowledge assistance from many others who provided not only resource experts to the panels, but also encouragement and generous support for Forum organization and achievements, as follows:

AID, the U.S. Agency for International Development, through its Bureau for Latin America and the Caribbean (AID/LAC), helped guide initial and final plans and broadened participation from Latin America. ROCAP, AID Regional Office for Central America Programs, provided critical financial assistance. Various missions helped assure the presence of many participants from tropical countries concerned with cocoa.

IDB, the Inter-American Development Bank, supported early planning efforts and took part in this Forum, hospitably funding a reception and dinner for the inter-American representation.

Costa Rica's cocoa industry speakers, especially from Costa Rica Cocoa Products and El Gallito Industrial, shared the Central American industry's view, offered hot chocolate and a welcoming cocktail party.

The office of the OAS Representative to Costa Rica gave administrative assistance including two young conference room assistants who helped us resolve many problems.

Moderators and panelists shared knowledge and experience laced with a strong dose of pragmatism, adding to the Forum's high technical level.

And the representatives of associations, cooperatives, private voluntary organizations, cultivators, also industry, business, public and private banks, and international development organizations actively exchanged information and perspectives.

Invaluable financial support was received, not only from international and bilateral assistance organizations but also from ACRI (American Cocoa Research Institute), the Cocoa Merchants Association of America, Inc., the Griffin International Corporation, the Hershey Foods Corporation, M & M/Mars, Philipp Brothers, Inc., and TRI CAL, Inc., as well as the two Costa Rican firms, Costa Rica Cocoa Products (CRCP) and El Gallito Industrial.

It was remarkable to note the enthusiasm, intelligence, and contributive spirit of all Forum participants to the week-long plenary sessions and small meetings, field trips, and informal encounters. In the end, the participants were the heart and soul of the Forum which became a most unusual, "first" meeting vertically integrating an industry from low-income farmers in cocoa producing countries, through their organizations, scholars, governments and administrators, to international traders, economists, and manufacturers. It was an honor to help initiate this meeting and we look forward to its successor planned for the future.

Norberto Ambros
Forum Manager and
PADF Project Officer

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INTER-AMERICAN COCOA FORUM
January 27-30, 1987
San José, Costa Rica

PAN AMERICAN DEVELOPMENT
FOUNDATION (PADF), 1889 F St. N.W.
Washington, D.C. 20006, U.S.A.

RECOMMENDATIONS BY THE FORUM

WHEREAS:

a. Cocoa has traditionally been and is one of the products of economic and social importance for the countries of tropical America, because it generates employment, income for the producers and hard currency from exports;

b. It is necessary to look forward and validate the technology to increase cocoa production and cocoa yields, under the different agroecological conditions prevailing in Tropical America;

c. There are national and regional institutions involved in research and transmission of technology;

d. The producers have repeatedly expressed their interest in and need for more permanent support from the public, private and business sectors to improve cocoa quality, production levels, and fair income;

e. The entrepreneurs who market and process cocoa are interested in obtaining a product of better quality, in suitable quantity, and at adequate prices;

f. When considering future markets for processed cocoa beans and incomes, producers have serious concern;

g. The governments have shown interest in improving and increasing production and productivity levels through specific projects and programs;

h. The international and bilateral lending agencies finance and are willing to contribute to improvement of cocoa production and promotion of the product; and,

i. Despite the foregoing, progress has not been as intense as has been the case for other products.

THEREFORE THIS FORUM RECOMMENDS THAT:

1. Sensible and efficient mechanisms be established so that both the producing and the industrialized sectors intervene with better coordination, and actively develop these activities at the national and regional level;

2. Integration systems be reinforced, and information transfer and communication with producers be made effective;

3. PADF continue as leader in organizing American Forums and communication channels with involvement of the Latin American producers, technicians, marketers and processors;

4. An organization of cocoa producers be established, at the Latin American and Caribbean level, to open new consumer markets and at the same time to promote a publicity campaign among existing consumers regarding the food and caloric benefits contained in this product, so that not only industrialists will be involved promoting cocoa demand, and so as to coordinate action to limit the spread of pests and diseases within the region;

5. The Federación de Cacaoteros of Colombia be in charge of implementing the recommendation;

6. The industrial and processing sector, together with other agencies, study the decision to create an office to evaluate quality, aroma, etc. of cocoa of different origins, with the goal of assuring a premium price for better graded cocoas, and to contribute to general cocoa improvement;

7. The legally constituted institutions and agencies of small and medium-size cocoa producers be considered as priority areas and among those most suitable for receiving international credits, with the purpose of promoting their direct production and marketing; and,

8. New technologies be researched to improve the traditional post-harvest process (fermenting and drying), as these two phases impact importantly on the final quality of the product.

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INTER-AMERICAN COCOA FORUM
January 27-30, 1987
San José, Costa Rica

PAN AMERICAN DEVELOPMENT
FOUNDATION (PADF), 1889 F St. N.W.
Washington, D.C. 20006, U.S.A.

STATEMENT OF APPRECIATION BY THE PARTICIPANTS IN THE INTER-AMERICAN COCOA FORUM

The participants in the First Inter-American Cocoa Forum wish to express their appreciation to PADF and to the co-sponsors of the Forum for the opportunity granted to the representatives of several sectors and countries to obtain a wide range of information and technical opinions, and to establish valued contacts.

In addition, they wish to express thanks for the generous financial support that made possible the development of this First Inter-American Cocoa Forum, specifically from the "Instituto Americano para la Investigación del Cacao" (ACRI) and the Regional Office for Central America and Panama of the Agency for International Development (USAID/ROCAP).

They wish to specially express their appreciation for the planning help and assistance and institutional support provided by the Inter-American Institute for Cooperation in Agriculture (IICA) in its modern facilities here in Coronado, and by the Central American Center for Technical Research and Education (CATIE) in Turrialba.

They are aware that the Costa Rica cocoa industry and the Inter-American Development Bank (IDB) contributed to the excellent reception provided to this Forum.

They also express appreciation for the contributions from the chocolate and chemical enterprises which made this event possible.

Finally, they express their thanks to the Government and the people of Costa Rica, whose friendship and hospitality made the task easier and contributed to the success of the Forum.

SO IT IS AGREED IN San José, Costa Rica
Date: January 30, 1987

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INTER-AMERICAN COCOA FORUM
January 27-30, 1987
San Jose, Costa Rica

PAN AMERICAN DEVELOPMENT
Foundation (PADF) 1889 F St N.W.
Washington, D.C. 20006, U.S.A.

WHY COCOA?

(Original document: English)

B. K. Matlick

Representing the U.S. chocolate industry, the American Cocoa Research Institute, Hummingbird-Hershey, Ltd. in Belize, and specifically, Hershey Foods Corporation, I would like to welcome you to the Cocoa Forum to address the problems and, most importantly, the future of the production of cocoa in Central America and the Caribbean. I am not here today to document or evaluate what has happened in the past, this will be done by other speakers, but to give you my personal ideas of the potential for cocoa production in this region in the next twenty years.

Why Cocoa?

This forum will attempt to provide you with logical answers to this very important question. We hope to generate and renew your interest in this export crop for Central America and the Caribbean. We will provide you with information on pricing, sales, marketing, and shipping, in addition to many aspects of production. We hope that when you leave this conference and return to your work place, whether it be a cocoa farm, a cocoa buying office, or a prominent government position, you will have a better understanding of the problems, challenges and opportunities cocoa provides.

Criteria for the Selection of an Export Crop

To be considered as a potential export crop, cocoa must meet certain criteria:

1. Have a consistently available market
2. Provide jobs within the country
3. Provide high export value
4. Require minimum processing and storage
5. Environmental match - acceptable weather, soils, etc.
6. Efficient production system
7. Other requirements

I will deal with each of these; however, they will be discussed in more detail throughout the conference.

1. Market

There must be a year-round market for the crop and a price setting mechanism that is fair to both producer and user. I think you will learn in later sessions this week that the New York and London Cocoa Exchanges provide this service. I do not know of a bag of good quality cocoa in the past 20 years that has not been sold due to no available market. The role of the cocoa exchange, cocoa brokers, dealers, and middlemen will be explained and discussed in more depth later in the conference.

2. Jobs

Cocoa has traditionally been a small farmer crop that is very labor intensive. One person for each 2-5 acres of cocoa is very common, and the crop is entirely compatible with family labor. This has met the needs of most countries in the past. Although recently, the increased labor cost and management requirements for dealing with larger farms and large labor groups has created increased interest in labor saving equipment for mechanical spraying, fertilization, and pod breaking, in the foreseeable future, the crop will continue to be labor intensive.

3. Export Value

Cocoa continues to carry a relatively high value on a price/pound basis. Prices are in a range of $.85 U.S./pound to $1.00 U.S./pound which is high for a commodity when you compare it with sugar, oil palm, bananas, rice, etc. In the case of cocoa, the value in most countries returns to the small farmer rather than a large corporation. This contrasts with sugar, oil palm, and bananas which pay relatively low wages for farm labor. When cocoa prices do increase, the major portion of the increase goes to the farmer. A thousand metric tons of cocoa provides approximately $2 million U.S. in foreign exchange.

4. Processing and Storage

Cocoa does require a fermentation and drying process that can be done adequately by both the small farmer and large organizations such as cooperatives, private dealers, or government marketing boards. Therefore, it easily fits into the cultural and political style of most countries. Although this process is very critical in the production of high quality cocoa, it is relatively simple and inexpensive. After processing, cocoa is in the form of dry bean and can be stored on farm or in-country warehouses using inexpensive storage facilities and conditions. Under good storage conditions, dry beans can be maintained up to six months with minimum deterioration of quality.

5. Environment

Every country in Central America and most of the Caribbean has weather and soil conditions that meet the minimum requirements for cocoa. Weather, however, varies from country to country and within country. If you have any specific question in this area, contact the agriculture department in your country or the Cocoa Department at CATIE for more specific requirements and recommendations.

6. Production Systems

This is the area in which most Central American and Caribbean countries fail. Therefore, it is the one to which I have directed most of my attention.

In Central America and the Caribbean, actual production per area (pound/acre, kilogram/hectare) has not increased substantially in the last thirty years. In fact, yields in Trinidad, Grenada, and Venezuela in the 1920's probably exceeded today's yields. The introduction, however, of new hybrids and improved agricultural practices to control diseases, pests, shade, and nutrition has made dramatic increases possible. Hybrids available from CATIE for the past twenty years are capable of producing five (5) pounds of cocoa per tree per year under good conditions. Planted at standard recommended 10' x 10' spacing yields in excess of 2,000 pounds/acre should be possible. This is almost eight times the area's present average.

The major future challenge to the cocoa producers of Centra America and the Caribbean will be to utilize this technology and increase yields.

To illustrate in cost terms, the current cost of producing cocoa is approximately $.75 U.S./pound up to $1.25 U.S./pound. If producers utilized existing proven hybrids and proven agricultural practices and inputs, the unit cost could be lowered to $.50 to $.75 U.S./lb. or lower depending on location.

This opportunity is available to every cocoa producing country in Central America and the Caribbean. The recent International Cocoa Agreement pegged the low or intervening price for cocoa at $.86 U.S./lb. As you can see, at the current market price and current cost of production, the incentive to invest in new cocoa is low; however, at the cost of production, by using modern agricultural practices the investment incentive would be substantially increased.

I like to compare the production of cocoa with that of bananas. If we compared agricultural practices of bananas today with those of forty years ago, we would find that the production cost then would be much greater due to substantially lower yields.

If we use the same amount of technology in the production of cocoa that we have used in bananas, we may be able to produce cocoa even below $.50 U.S./lb.

Competition - The competition that each producer and each country represented here today faces is all of the other cocoa producers and countries in the world.

Malaysia currently is utilizing the most advanced technology in the production of cocoa and, as a result, is the world's lowest cost producer. If major efforts in Central America and the Caribbean are not made in the next few years to be cost competitive on a production basis, the cocoa will cease to become a viable export crop. Malaysia produced 1,000 metric tons of cocoa in 1970. In 1987, they expect to produce 150,000 metric tons --almost double what the entire Central American and Caribbean region produces. It has been stated that the best managed farms in Malaysia have costs of production as low as $.40 U.S./lb.

7. Other Requirements

A. Government Support - Extension

Every country that has developed or increased its cocoa production system based on small farmers in the past thirty years has been supported by a strong extension program. Additionally, it could be stated that most countries that have declined in cocoa production in the past thirty years have had a weak or no extension system. The extension can be either public or private but the government the primary responsibility to ensure that it is in place and functioning properly. The basic function of an extension system is to ensure that:

(1) Farmers have available the best possible planting material.
(2) Agricultural inputs such as fertilizer and chemicals are available at a reasonable price.
(3) Farmers receive and understand how to utilize agricultural inputs.

B. Government Support - Marketing

Governments have many different ways to structure their cocoa marketing program ranging from a government operated Marketing Board to a private enterprise system. There are many examples of how both systems can succeed or fail. It is only important that whatever system is used, it provide the highest possible portion of the World Cocoa Price to the producer.

SUMMARY

Central America and the Caribbean countries have the potential to produce cocoa competitively and realize significant benefit from it as an agricultural export crop.

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The major emphasis in the future must concentrate on utilizing existing technology to increase yields and lower production cost. This is absolutely necessary to be cost competitive with the Far East countries of Malaysia, Philippines, and Indonesia.

There are many areas that I have not discussed that I feel are equally important such as flavor, quality, high density planting, yields of 4,000/kg./ha. and others that I hope will encourage each of you to attend each and every session and to ask questions of the many participants.

Good luck and enjoy your conference.

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1st INTER-AMERICAN COCOA FORUM
January 27-30, 1987
San Jose, Costa Rica

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COCOA SITUATION IN THE TROPICAL AMERICAN COUNTRIES
(Original document: Spanish)

Jorge Soria

1. INTRODUCTION

Cocoa and its cultivation originated in tropical America and, until the end of the last century, almost all the cocoa consumed in the world came from this continent.

In contrast to various African countries (principally Ghana, Nigeria, Cameroon, Ivory Coast), which at the beginning of the Twentieth Century aggressively expanded planting, cocoa production in American countries, except Brazil, stagnated and even suffered decreases in production and area expansion. This is attributable to various factors: lack of official policies to support cocoa development, low level technology characterized by extractive management without adequate pruning, shade regulation, fertilizer use, and management and control of diseases and pests. However, the most serious factor which affected and continues to affect production efficiency has been the appearance and expansion of various serious diseases such as Monilia and Witches' Broom in South America during the second decade of this century and Black Pod Rot and Mal de Machete in later decades. Losses caused by these diseases exceed 50% of production when sanitary husbandry and disease control practices are not applied.

In spite of all these problems, cocoa cultivation has continued to be important for the tropical countries as one of the alternatives for efficient use of the humid tropical ecosystem, as a source of foreign exchange income, and employment for a large portion of rural producers.

2. PRODUCTION AND PERSPECTIVES

Table No. 1 shows an estimate of the present area, cocoa production of recent years (1984-85), average yields per ha/year of the last ten years of ten producing countries of Continental and Tropical America.

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TABLE No. 1

Actual area (1985), additional potential area,
production over recent years (1984-85), average yields of 10 years

Country	Actual Area (Ha)	Production 1984-85 (MT)	Av.Yield 10 years (MT)	Yield 1/2 to 10 yrs. Kg/ha/year	Potential Area (Ha)
Bolivia	9,000	2,620	1,600	350	-
Peru	8,849	4,000	4,000	-	80,000
Ecuador	269,931	128,199	68,520	255	25,000
Colombia	94,884	39,003	31,466	411	160,000
Venezuela	62,258	15,800	15,800	300	100,000
Panama	4,500	1,143	700	262	15,000
Costa Rica	9,725	3,411	5,931	100	269,060
Nicaragua	3,135 1/	391 2/	520	150	349,000 2/
Honduras	3,000	1,545	600	400	25,000
Guatemala	4,680	2,400	2,400	368	36,000

1/ Area in 1981
2/ Peralta-production and potential area in 1979

The countries with greatest area are Colombia, Ecuador, and Venezuela. The others have 3,000- 9,000 hectares cultivated, although they have extensive areas with ecological conditions suitable for expanding cocoa production. Among these, Colombia, Venezuela, Costa Rica, and Nicaragua stand out.

Productivity levels in general are low, compared with other countries. Colombia (411 kg/ha/year), Honduras (400 kg/ha), and Guatemala (368 - 576 kg/ha) have the greatest yields.

It is interesting to observe that the lowest average yields per hectare/year are those of the countries in which Monilia occurs, like Ecuador, Panama, Costa Rica, and Nicaragua. In Colombia the case is different, since Monilia is not present in all regions where cocoa is cultivated. In some inter-Andean valleys, particularly with altitudes up to 1,000 - 2,000 m above sea level, although Monilia is present, its damage is not as severe as at sea level, with high temperatures and relative humidity.

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3. FACTORS WHICH AFFECT PRODUCTION

3.1 Advanced age of plantations and traditional management systems

In all the countries, there are a high percentages of plantations with trees ranging between 40 and 60 years old which were planted with not improved material. On the other hand, their management has been of an almost extractive nature, without adequate technical practices of pruning, control of pests and diseases, fertilizers application, or shade regulation, and lacking in good drainage. Crop husbandry is traditional from colonial time, with little investment in technology.

It is interesting to emphasize that under the traditional system of cultivation, cocoa survives a long time and produces small harvests because cocoa is first a semi-domesticated plant, capable of surviving in conditions similar to its native habitat, under the shade of the jungle.

The traditional system is characterized by association of cocoa species with temporary shade plants at the beginning (banana, corn, yucca, pigeon peas, fig tree, etc.) and later with shade trees, particularly leguminous species such as Erythrinas, Inigas, Samaneas, Gliricidia sepium, Leucaenas, and fruit trees such as mango, avocado, citrus, sapota, and various wood species. The shade trees compete with the cocoa for nutrients and water but provide organic material which, by decompositing into the soil, produce recycling of nutrients from which the cocoa benefits principally by having superficial absorbent roots. This phenomenon sustains the life of cocoa tree and permits moderate cocoa production for many years, without application of nutrients.

3.2 High Disease Incidence

The countries of the American Continent undergo the greatest losses in their crops from diseases and not from insects, whereas in the African and Asiatic countries it is the opposite.

The losses from one or various diseases, on the whole, at times surpass 50% of the crop. In the countries in which Monilia and Witches' Broom occur, such as Ecuador, the losses from diseases, if not controlled, reach up to 50% and in Costa Rica up to 60%. Although information on Nicaragua and Panama is not available, their production indices must be highly influenced by the losses from Monilia.

Monilia is present in the majority of the inter-Andean valleys of Colombia, but not in the East zone. In Venezuela, it is only located in the zone south of Maracaibo Lake.

Dr. Carmen Suarez has reported that Monilia has spread to the East region of Ecuador, from where it could possibly spread to all countries of the Amazon valley, favored by existence of wild cocoa along the foothills of the Andes from Venezuela to Bolivia.

Witches' Broom occurs in the entire Amazon valley and affects the crops of Bolivia, Peru, Ecuador, and Colombia on their west coasts, Venezuela in the northeast region, reaching Trinidad and Tobago. It has not reached Central America, but there are reports of its presence in the Darien region in Panama. Damage caused in the affected countries is considerable.

Damages from P. palmivora are minor in the countries of South America, becoming sizable in the Central American isthmus, where, if not controlled, up to 25% of the production can be lost.

Other diseases such as Ceratocystis fimbriata, Diplodia cacao, Cartocium salmonicolor do not cause as serious damage as those previously mentioned.

The principal pests in the region are capsides which attack shoots and fruits, ants (Atta Sp.), leaf eating lepidopters, thrips which attack end shoots, steirostoma brevis, and others less significant. In general, losses caused by insects are less than those from diseases and are easier to control.

3.3 Little Use of Technology

In various research centers of the American countries, cultivars have been produced which are resistant to one or several of the diseases, also techniques for their management and control. Regrettably, there has been little effort by the authorities or interested groups to propagate the improved cultivars and to spread and adopt recommended cultural practices. It should be noted that in Colombia and Brazil, where there has been greater use of technology, production per hectare is greater.

3.4 Poor Agronomic Management of the Plantations

Lack of formation pruning gives rise to the prevailing situation of plantings of trees with various branches and shoots, very high trunks (at times up to 10 - 12 meters) which impede total harvesting of healthy and diseased pods. These pods remain as a source of infestation, making any control effort difficult.

These plantations, if young, should be rehabilitated, pruning to reduce the tree height. In the case of the very old

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plantations, they should be renovated with improved material, tolerant to the principal diseases and with a good yield capacity.

Experiments were carried out by Ecuador's Experimental Station of Pichilingue in the Vinces region (ecological zone of the dry tropical forest), with clones and hybrids of high production and tolerance to Witches' Broom and/or Monilia. These show, with 14 years of data, that, in spite of the presence of Monilia and Witches' Broom, the plots which were well maintained and had supplementary irrigation in 2-3 dry months, had yields equivalent to 744 - 1,200 kg/ha/year with clones and 1,060 - 1,381 kg/ha year with hybrids. These results demonstrate that efforts to renovate old, non producing plantations with improved material and adequate technical management give excellent economic results.

Other important agronomic management techniques not generally practiced are fertilizer application and shade regulation. Cocoa production falls with excess and lack of shade if fertilizers are not applied.

The results of the experiments mentioned for Vinces-Ecuador are also influenced by application of supplementary irrigation in the dry periods (2-3 months). They show that irrigation in these climatic conditions is effective in the increase of production, accompanied by good pruning management, frequent harvests (every 7-15 days depending on the peaks of harvest and rain), and removal of diseased pods and leaving them in the soil.

In very humid areas, drainage is generally deficient which, together with excess shade, permits the maintenance of a high relative humidity which favors the development of diseases.

3.5 Deficiencies in the post-harvest handling of the bean

Since the intermediaries, who market cocoa at farm levels, generally do not pay better prices for well fermented and dried cocoa, most producers do not ferment or they do it partially, which influences the quality of the product. This irregularity in the exported product influences the prices and the stability of the demand of the external market and the manufacturers. It is necessary for governments to regulate and establish mechanisms for quality control.

4. ECONOMIC FACTORS

4.1 Price of the Product

Prices received by the producer are an important factor for his decisions on investments in application of technology.

Regrettably, the producer is the one who least benefits from periods of good international market prices and is most adversely affected by low prices.

It has been estimated that cocoa cultivation is profitable as long as the price the producer receives for 100 pounds does not go below the equivalent of US$100.

4.2 Lack of capital and credit for use of technology

The large majority of the cocoa production in tropical America comes from small farms (less than 10 ha) and average farms (11-50 ha). These producers, particularly the small ones, lack their own capital and have little access to credit from official and private banks. They cannot fulfill the requirements for credit, since many do not possess their land, they do not have sufficient guarantees, and the conditions of credit are not adequate in terms and interest for a perennial crop like cocoa.

In recent years, some international financing institutions (AID, BID, BIRF) have granted credit to various countries for cocoa development programs.

5. INSTITUTIONAL FACTORS

5.1 Lack of political decisions and resources to support implementation of programs and plans for cocoa development. This has resulted in the slow momentum observed in the entire region of adoption of new technologies to promote substantial changes in the production and productivity of the countries, with the exception of Brazil.

5.2 As a consequence of not assigning official or private resources for cocoa development, research to resolve problems and the technical assistance to transfer technologies do not have sufficient technical personnel skilled with the crop to properly attend to its needs.

It should be emphasized, however, that some countries and experimental centers have maintained, although with limitations, important cocoa research activities. Those deserving mention follow:

a) In Ecuador, the INIAP Experimental Station in Pichilingue, province of Los Rios, conducts research on epidemiology, management, and tolerances to Monilia, Witches' Broom, and Mal de Machete. There are also projects on genetic improvement and agronomic management of the crop.

b) Colombia's ICA is doing research in 6 different geographical regions on control and management of diseases including Monilia, agronomical practices, and genetic improvement.

c) FANAIAP of Venezuela maintains the Caucagua Experimental Station in Miranda state, with studies on genetic improvement, control and management of Witches' Broom, insect control, and quality improvement.

d) CATIE in Turrialba, Costa Rica, carries out studies on genetic improvement for resistance to Monilia, Black Pod Rot, and Ceratocystis, high yields and quality, and management practices for diseases (particularly Monilia), and agronomic practices.

e) The University of Costa Rica supports CATIE Monilia studies.

f) In Honduras in 1985, FHIA (Honduran Foundation of Agricultural Research) initiated a cocoa research program with emphasis on control of diseases and pests.

g) In Guatemala, Los Brillantes Experimental Station of DIGESA carries out tests on selection and evaluation of cultivars, plant propagation, and control of diseases and pests.

The following countries have, although in limited form, specific assistance for cocoa:

Ecuador, the National Cocoa Program.

Colombia, the National Federation of Cocoa Growers.

In other countries, the local extension service, if it exists, has the job of attending to cocoa as well as other crops.

5.3 <u>Lack of Personnel Training Programs</u>

To carry out good research, technical assistance, and credit programs, people well trained in cocoa are needed. In general, there is a lack of training courses at the country and international levels.

CATIE offers some cocoa courses annually, principally for extension technicians from Central America, Panamá and Dominican Republic. It would be suitable and necessary to look for support and financing to establish high level courses to train researchers and extension workers from all countries interested in the development of the crop. Institutions like CATIE, IICA, or the FAO could organize these events with support from external financial institutions and the interested countries.

6. CONCLUSIONS

6.1 Cocoa cultivation is economically and socially important for tropical American countries, as a source of foreign currency, as an income generator, to provide employment to a good portion of the farmers of the tropics, and as one of the most appropriate crops for ecological management of the humid tropics.

6.2 Cocoa production and productivity are generally low because of:

6.2.1 Disease losses, especially Witches' Broom, Monilia, Black Pod Rot, and Ceratocystis fimbriata.

6.2.2 There is a high proportion of old plantings, over 40 years old, planted with unimproved stock and maintained with purely extractive methods without using modern technology. About 50% of plantations are esdtimated to be in this condition and require renewal.

6.2.3 Even younger plantations are generally managed with little technology. Opportune pruning for form and maintenance is not applied, fertilizers are hardly used, and there is poor disease management.

6.3 In general, countries of tropical America do not produce cocoa of uniform quality for reasons of poor post-harvest management of fermentation and incomplete or defective drying.

6.4 Transfer of technology is insufficient or non-existent.

6.5 Adoption of technology is limited by low prices paid to the producer and lack of lines of credit adjusted to the socio-economic conditions of the producer.

6.6 Political decisions of governments are lacking to effectively support more dynamic and productive development of cocoa.

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COCOA SITUATION IN THE CARIBBEAN

By: Glenn Trout

History of Caribbean Cocoa Production

When the Europeans discovered and explored the Americas, they found that the seeds of a tropical tree (Theobromo cacao) were highly prized as human food. Dried cocoa "beans" were so valuable they were used as coins. Europeans did not adopt the use as money, but did find merit in their use as the base for a drink. Chocolate became used in other forms, becoming so popular that demand led to expanded cultivation in the Americas. During the 18th and 19th centuries, tropical America, where cocoa and its cultivation originated, supplied virtually all the world's supply of cocoa beans.

However, massive plantings in Africa soon established it as the principal world supplier. For a time, shortly after the beginning of the 20th century, Africa supplied 80% of world production, and it still supplies over half. Ghana, Nigeria, Ivory Coast, and the Cameroons emerged, along with Brazil, as the major producers.

Production in the American countries, Brazil excepted, became stagnant and even decreased, as a result of inadequate extractive management, lack of official support, and widespread crop neglect. Caribbean production increased slightly in the early 1900s, but its relative position has fallen from 6% of world supply at the beginning of this century to its present share of 3%, out of the 35% of world supply which currently is grown in the Americas.

Despite lack of incentive and technological support in the Caribbean, cocoa cultivation has continued to be important as an alternative for efficient use of the humid, tropical ecosystem, generating foreign exchange and income, and providing remunerative employment for a large proportion of rural producers. Cocoa cultivation is recognized as particularly attractive as it constitutes a "renewable resource" unlike the mining of bauxite and pumping of crude oil.

By far the largest cocoa producer in the Caribbean is the Dominican Republic with 40,000 metric tons per year from about 100,000 hectares of land cultivated in cocoa. Jamaica and Grenada are multi-million pound producers annually. Trinidad was at one time the leader with peak production of 75 million pounds per year.

In addition, three minor producers emerged among the English-speaking states of the Caribbean: Dominica and St. Lucia have averaged 113 metric tons of exports per year, and St. Vincent about 10 metric tons. Haiti's production has risen over 50 years but has stagnated at about 3,000 metric tons per year.

The countries of the Caribbean have benefited from cocoa research and development which was centered in Trinidad. All have used generally similar plant material and production systems. Several have benefited from a premium price for fine flavor quality. This premium could be held or increased if good post-harvest handling of adequate quantities is assured.

Factors Which Affect Production

The primary factor in achieving profitable production is the planting of improved stock that performs well on the site. Cocoa trees achieve optimum performance at the age of six to eight years. They have an economic life of 20 to 30 years.

In all producing countries of the Caribbean, a high percentage of cocoa plantings were planted with material which was not "improved". Planting consists now of trees, many of which are between 40 and 80 years old. Tree management was done in almost extractive form, without adequate pruning, without technical control of pests and diseases, application of fertilizers, shade regulation, or good drainage.

It should be emphasized that under traditional systems of cultivation, cocoa survives a long time and continues to produce small harvests. As a semi-domesticated plant, it can survive in conditions similar to its native habitat, under the shade of the jungle.

The traditional cocoa cultivation system is characterized by an association of cocoa trees with temporary shade plants at the beginning (banana, corn, yucca, pigeon peas, fig tree, etc.), and later with shade trees, particularly leguminous species such as Erythrina, Inga, Samanea, Gliricidia sepium, Leucaena, and fruit trees such as mango, avocado, citrus, sapota, and various wood-producing species. The shade trees compete with the cocoa for nutrients and water, but provide organic material which, upon decomposition, allows a recycling of nutrients from which the cocoa benefits.

Such cultivation permits tree survival and moderate cocoa production for many years without application of nutrients. Good management is essential for profitable cocoa production.

Prospects for improving production in the Caribbean depend largely upon convincing those involved that improved cultivation policies are worthwhile and can be successful. The depressed state of the sugar industry and the very competitive petroleum and bauxite markets make it imperative that cocoa production be improved, accelerated and expanded. Soils and climate for cocoa production in many countries of the Caribbean are quite satisfactory. There is some loss due to Black Pod disease, but the region is free from Monilia. Witches' Broom disease occurs only in Grenada and Trinidad/Tobago, losses have been kept to a moderate level by using varieties that resist their strain of the Witches Broom fongus. St. Vincent has only recently identified limited Witches Broom infection. There are losses due to pests such as rats, squirrels, beetles, etc.

It has been dramatically demonstrated in Malaysia that skillful use of existing technology can result in high yield (1,000 to 2,000 lb/acre) at low cost (US$0.30 to $0.50 per pound). Malaysia has increased production from 1,000 metric tons 1965/66 to 17,000 metric tons in 1975/76, and to 130,000 metric tons in 1985/86. Similar success has been achieved in Brazil over the same period of time.

In the Caribbean, with satisfactory climate, excellent soils, ample supply of labor, and a moderate level of loss due to diseases and pests, expansion of cocoa production is not only feasible but producers have the possibility of approaching or equaling the success achieved in Malaysia and Brazil.

The lack of formation pruning has given rise to the prevailing situation of plantings of cocoa trees in producing countries of the Caribbean characterized by various stems, including very high trunks (at times up to 10-12 meters) which impede harvesting of healthy pods and revoval of diseased pods. Diseased pods remaining on the trees are sources of inoculum, making disease control difficult. Such plantations should be rehabilitated.

Rehabilitation of young plantations requires that trees be pruned to reduce the height of the plants. Very old plantations can be renovated by replanting with plants having capacity for high yield plus improved the resistance to the principal diseases.

Renovation of old, low-producing plantations by using improved material and adequate technical management has been demonstrated to give excellent economic results. Experiments with clones and hybrids with capacity for high production and with resistance to Witches' Broom and/or monilia were conducted by the Experimental Station of Pichilingue, Ecuador, in the Vinces region (ecological zone of the dry tropical forest.) The conclusions, drawn from 14 years of data, show that, in spite of the presence of Monilia and Witches Broom, plots which were well maintained and which had supplementary irrigation during the two to three dry months, achieved yields equivalent to between 744 to 1,200 kg/ha/yr with clones, and between 1,060 to 1,381 kg/ha/yr with hybrids.

Other important aspects of agronomic management which are not generally practiced in the Caribbean, particularly by small holders, are fertilizer application and shade regulation. Cocoa reduces its production with either excess or lack of shade if fertilization is not administered. A program of reduced shade and adequate fertilization must also include good insect control to prevent damage to the leaves.

The Vinces experiments also show that application of supplementary irrigation during long dry periods effectively increases production, when accompanied by good pruning management and frequent harvests (every 7 to 15 days depending on peaks of harvest and rain), and the removal of the diseased pods.

In very humid areas, drainage is generally deficient. Poor drainage and excess shade results in high relative humidity which favors the development of diseases.

Improvements in the Post-Harvest Handling of the Bean (Fermentation, Drying, and Grading)

Since the intermediaries who market cocoa at farm levels generally do not recognize or pay better prices for well fermented cocoa, the majority of the producers do not properly ferment their beans. The resulting irregularity in the quality of the exported product influences the price and stability of demand from the external market.

Each cocoa exporting country requires an institution to regulate and establish mechanisms for quality control.

Economic Factors

Prices received by producers affect their investment decisions relating to the application of technologies. Regrettably, the farmer is the link in the production chain which least benefits from periods of good international market prices and is most affected by low prices. It has been estimated that cocoa as a crop is profitable as long as the world market price for 100 pounds does not go below the equivalent of US$100; the farm-gate price for fermented dried product should be at least 70% of the New York/London price.

The greater part of tropical America's cocoa production comes from small and average-sized farms without access to investment capital. Small-scale producers lack their own capital and cannot fulfill the requirements for credit from official and private banks when they do not own the land, do not have sufficient guarantees, and face credit conditions which are inadequate in terms and interest rates necessary to establish a perennial crop.

In recent years, some international financing institutions (AID, IDB, IBRD) have granted credit to various countries for cocoa development programs.

Institutional Factors

Lack of political decisions and resources to support implementation of programs and plans for cocoa development is common. This has resulted in the slow momentum across the entire region towards adoption of the new technologies which are required to promote substantial changes in cocoa production and productivity of the countries of the Americas, with the exception of Brazil.

Lack of significant public sector support has reduced research and transfer of technology. The natural consequence has been a general lack and loss over recent decades of resident experts with knowledge and technical skills. To stem the decline in local technical capabilities in the region and reverse the trend will require funding and skilled effort for several years.

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In many Caribbean countries, the local extension service - if it exists - has the job of attending to cocoa as well as other crops.

In order to conduct good research, technical assistance, and credit programs, people are needed who are well trained in cocoa. In general, there is a lack of training courses at national (individual countries) and international levels. In Central America, however, CATIE offers some cocoa courses annually, principally for extension technicians from Central America, Panama, and the Dominican Republic. CATIE and UWI experts provide some research and training guidance to countries of the Caribbean.

It is recognized that some Caribbean experimental centers have maintained, although with limitations, important cocoa research activities. Efforts in the Dominican Republic, Jamaica, and Trinidad provide valuable support for the growers. The cocoa research center in Trinidad is well known for its long history of basic research, and has one of the most complete cocoa germ plasm pools in the world.

Recommendations

Make the governments aware of the importance of cocoa as a source of foreign currency, as a generator of income and employment for the rural producer, and as an efficient alternative for the good use of the low and humid areas of the tropics.

Promote and finance training of Caribbean cocoa researchers and extension workers. Seek support and financing to train researchers and extension workers from countries interested in development of the crop. Institutions such as CATIE, IICA, or the FAO could organize such training with the support of external financial institutions and the interested countries.

Promote the renovation of cocoa plantations with cultivors which are resistant or tolerant to the most dangerous diseases.

Introduce more technical management, particularly by pruning, shade regulation, fertilization, and drainage.

Encourage and support efforts to make production more competitive with other crops. Pursue especially mechanization, where appropriate, of application of fertilizer, spraying, and post-harvest handling.

Establish better mechanisms for control of bean quality through adequate practices for fermentation, drying, and storage.

Have governments establish lines of credit adequate for the type of crop system and for the small and average producer.

Develop economic use of cocoa tree by-products for additional income. Basic research has been done on cocoa pod processing and uses, and it is time to optimize economic use with emphasis in feeding poultry and animals.

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WILD COCOA PLANTS IN AMAZONIA AND CRIOLLOS IN CENTRAL AMERICA AND MEXICO

(Original document: Spanish)

Jorge Soria

Many published articles have reported the presence of native cacao. The records of explorers from colonial times, and also the records of botanists who have collected specimens of Theobroma in different places, show that the largest population of native wild cocoa is found in the Amazon basin.

Some reports of wild cocoa in Central America and Mexico have been held in doubt as to whether they refer to native plants or whether the plants are relics or descendants from earlier man-made plantings. Evidence of early human habitation is found in some of these places.

In Central America, where the Indians engaged in agriculture, cocoa was a domesticated plant. In the Amazon, on the other hand, the situation was very different. The Amazon Indians even today neither cultivate cocoa nor use the beans. It is anthropological evidence that they had no interest in consuming the seeds in the form of chocolate. They used the pulp for food but there is no evidence they ever cultivated the plant.

Indigenous human populations of the Amazon basin have domesticated other species of Theobroma such as cupuazú (Theobroma grandiflora) which is used, especially in Brazil, but also in other countries of the Amazon area, to make a refreshing and delicious drink.

Existence of native cocoa in the Amazonian forests and in forests of northern South America, especially in British and French Guyana, was known from various reports made in the years from 1650-1700. These reports described a series of cocoas found in the forest with characteristics relatively similar to the cocoas of the northern part of its natural distribution in Brazil, which are Amelonado types.

Populations of native cocoa similar to Amelonado were also found in the Orinocco forests. The Spanish took cocoa from these types for their plantings in the colonies, after they had discovered that the Criollos brought from Central America were very susceptible to diseases. These Amelonado and Criollo types, brought together in these early attempts at cultivation, were the origin, via natural crossings, of the Trinitario group of cultivars still in use in various tropical American countries.

Some of the first accounts of native cocoa in the Amazon basin came from Brazilian botanists, Duque in particular, who described the ocurrence of native cocoa in extensive areas. In the 1930s the Imperial College of Tropical Agriculture, Trinidad led expeditions into the Amazon basin in a search of resistance to Witches' Broom disease, and Dr. Pound reported the occurrence of native cocoa in additional areas of the basin as a result of this search.

If you study the history of the evolution of cocoa cultivation you will note that up to 1900, America was the principal source of cocoa beans. Since then African production has increased, and by 1920 Africa definitely was the world's principal producer.

American production was declining rapidly due to the ravages of two diseases (Monilia and Witches' Broom) which cut back production of the biggest cocoa producers in South America: Ecuador, Venezuela and Trinidad.

In the decade 1920-30 the Imperial College of Tropical Agriculture had on its staff a group of researchers working on different aspects of cocoa cultivation. They found that all their Trinitario population and their introductions from other neighboring areas were susceptible to Witches' Broom. The botanists' accounts of the existence of wild native cocoa indicated moreover that these wild native populations were also attacked by Witches' Broom. Then the geneticists, particularly Dr. Harland and Dr. Pound, suggested that in the places where cocoa was indigenous along with its diseases and pests, there, in the normal evolutionary process, mutations could be expected to have occurred which favored development of resistance to some of those diseases and pests. Therefore, an expedition was organized to search for resistance to Witches' Broom, and Dr. Pound, starting at Belem, travelled the length of the Amazon as far as Iquitos, Peru. Pound visited various tributary rivers in Brazil, Peru, Colombia, and Ecuador making collections of wild material. Part of the seeds obtained were sent to Trinidad where they were planted and today form part of the famous collection at Marper Farm where collections for study of Witches' Broom have been brought together.

In a second expedition Pound visited more to the north of where he had visited before, entering via Colombia, and collected specimens especially along the rivers Putumayo, Napo, and Caquetá. Part of the material he collected was left in Palmira, Colombia, where the SPA series clones originated, and part of the material was carried to Trinidad.

Dr. Pound's expeditions showed that there is great variability in cocoa populations from one place to another. This led Pound and Cheesman to propose a theory with regard to genetic diversity and variability of native cocoa. Based on the recorded variations found during their expeditions, they proposed that the center of greatest variability of morphological characteristics, especially those of the fruit and the seed, was

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in the triangle formed by the rivers Caquetá, Putumayo, and Napo. They proposed that, in agreement with the principle of Vavilov, this center of greatest diversity is related to the center of origin of the species, which could be located in this same region. Their proposal is based on the fact that the most diverse types of fruits are found in this location: some very much like Criollo, which is called Mountain Criollo, large Amelonados like the Cacao Nacional of Ecuador, Angoletas similar to the Parinari clones which they had collected in Perú, and other types of Amelonados from other areas.

Years later other expeditions were made. I participated in three of these, with groups of Brazilians, visiting some areas not visited by Pound and other areas not visited by the Trinidad group.

There along the tributaries south of the Amazon and in Brazilian territory we found fruit types which in certain aspects varied slightly from those described by Pound. Populations predominated with smaller fruits but of the Angoleta type, and other types more like the Scavina clones, with a difference in that the apical part of the fruit has a mammilary form.

In the north part of Amazonas, especially in the section of Obidos, we found typical Amelonados similar to the variety Común which grows in Bahía, and identifical to the Amelonados grown in Africa.

In the Jari river area there is a series of variants that look like the Marañon variety of Brazil, the fruit of which is a fat and large Angoleta type.

Along the tributaries of the north of the state of Pará are large populations of Calabacillo type cocoa presumed to be the base from which Brazilians took one of the varieties currently grown. This type is found especially in the south part of Bahía, under the name of Pará and Parazinho. The rest of the population of cocoa in Bahía is Amelonado Común. One can sometimes make presumptions or assume the origins of the forms in cultivation from the place where similar forms still occur in the native populations. If you read some of my articles about varieties of cocoa, you will find that I propose that the population of Común of Bahía could have come from Obidos. Obidos is near Amazonas, is very accessible, and it would have been relatively easier to take seeds from Obidos to Bahía than to take them from Central America.

But returning to the idea of studying the distribution of these populations in the wild, one finds that evolution in these groups has a very interesting relationship with the hydrographic situation (flood levels, currents, seasons, etc.), a point that may affect every population. Thus in certain river valleys dispersion of the species could have been greatly affected by transport of fruits by water as well as through actions of animals and birds.

In every river valley there may exist a central main cocoa type--a dominant type in fruit form as well as in characteristics of flowers, leaves and the point of the fruit. This helps the researcher to separate populations of different origins and thus to better direct the work of plant improvement.

Now, what conclusions can we draw in order to view the distribution of native cocoa, regarding its evolution as a species?

First, for me all cocoa types belong to a single species. There is a tendency for central types, when found at the far edges of their natural dispersion from the river valleys of their presumed origins, thus having some degree of geographic separation, to show specialization in some characteristics. But these variants have not developed genetic barriers that impede interchanges of genes with other types in the species. On the contrary it is noted that crosses between Amazon types (Forasteros) and Criollos give very vigorous hybrids. The production of hybrids and use of hybrids' vigor is one of the most successful means for genetic improvement-- genetic changes in the crop to make it better suit man's needs.

There are other theories about the evolution of cocoa. Some specialists maintain that there are two centers of origin: the Central American center for origin of the Criollos of Central America and Mexico, and the center in Amazonia for the Forasteros.

For example, Jorge Mora, a Costa Rican, says in support of a center of origin in Central America, that the evidence is less affected by the absence of native populations than by evidence that domestication, without any doubt, took place in this region. This is supported by the presence of a group of Criollos with uniform characteristics for fruits, color of seeds and susceptibility to diseases.

Pound and Cheesman have theorized that the Criollos had their origin in the north part of Amazonia --that Criollo material was moved by Indians into the south of Colombia and from there moved to Lake Maracaibo and to the north of Venezuela, where it was planted eventually by the Spaniards. For this reason the authors designate Colombian Criollos, Venezuelan Criollos, and Criollos-Trinitarios. Now, with the historical evidence and comparative morphology, I believe these Criollos were brought from Central America and Mexico.

When the Spanish started to plant cocoa for sale to European markets, they planted Criollo cocoa which they clearly identified. Later, when cocoa appeared which was not Criollo, they called them Forasteros (from the Spanish word for foreigner or stranger) and these came from the Amazon forests.

I have seen at Pichilingue material collected by the latest expeditions made by groups of Ecuadorians in the forests of the Napo River zone. There are plants in the collection with characteristics of an almost pure Criollo type with white seeds (white cotyledons).

If we accept the principle of Vavilov that the center of greatest diversity relates to the center of origin, I will have to refer not only to fruit characteristics but to other characteristics as well. A more important fact is that the triangle of the Napo, Putumayo, and Caquetá rivers also has the greatest concentration of alleles for incompatibility.

Now it is important to analyze the influence that incompatibility has in evolution, dispersion, and distribution of the species.

The allelic situation is one of self-compatibility and S1 to S5 on the chromosome are the alleles for incompatibility. They are all concentrated in the area that corresponds to the centers of diversity.

If the species carried only self-compatible genotypes, its dispersion from the center into new territories should proceed fairly easily. This could happen for example if a squirrel, a parrot, or some other animal that eats cocoa seeds, would carry seeds to its nest, or if a fruit falls into the water and comes to rest on land far away, germinates and, if it is self-compatible, produces seeds and further disperses the species.

If it is self-incompatible the new tree can have no seed production and can not disperse the species. Self-incompatibility is the characteristic that its own pollen cannot fertilize its own ovule. Therefore self-compatibility conveys the advantage of easy dispersion of the species, and the map shows clearly that the areas farthest from the center of diversity have a greater proportion of self-compatibles. On the other hand, any isolated self-incompatible individual can't produce seeds and it is at the end of its journey; its role in dispersion of the species is at an end.

But what advantages might self-incompatibility have for a species? If it were entirely a disadvantageous characteristic it would surely have been eliminated through natural selection long ago. The advantage of it is that with self-incompatibility, in order to have descendants there has to be crossing with plants of a different genotype, thus producing more variability. With greater variability there is a larger base from which to make selections by natural means and through man's intervention.

The concentration of self-incompatibles in this area (the center of origin) indicates that this is in fact the area where the species has existed for the longest time and thus has had time to accumulate more mutations and consequently increase variability within the species.

Now comes the question from you as to how to explain the existence of the Criollos, a well-defined group in Central America, when we have the formidable barrier of the Andes. We must recall that the Mayas in Central America cultivated cocoa, whereas the indigenous peoples in South America did not.

What I want to say is not that the Mayas or peoples of Central America went to South America to get seeds and carry them across the Andes. To cross the Andes even today on good roads takes more than a day. In those earlier times two or three months would not have been long enough. Cocoa seeds would have survived at most two weeks even with any special care they might possibly have received. Thus for cocoa to have been moved by man from Amazonia to the west coast of South America would indeed have been difficult, even if there had been trade between the Central American Indians and those of the north part of South America. Furthermore, cocoa was not cultivated on the coast of South America in pre-colonial times. The first place it was cultivated in the area was on the coast of Ecuador, but starting only as recently as 1700.

Cacao Nacional of Ecuador could have been carried from Amazonas to the west coast of Ecuador after it had become a business to plant cocoa starting in 1700. A more probable origin of Ecuador's Cacao Nacional would be fruits brought from Gualaquiza or Mendez transferred via Loja or Cuenca. Wild types similar to Cacao Nacional are to be found there today.

The probable origin of Central American Criollo cocoa can be explained by relating it to the advances and spread of the species before the formation of the Andes at the beginning of the Quaternary. One of the extremes of the advances of natural distribution, a population carrying various recessive genes (white seed color, susceptibilities to diseases, autocompatibilities), could have remained isolated far away from the Andes and could have been domesticated by man in those regions (the Mayas possibly).

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PANEL I

COCOA PROSPECTS/PROJECTIONS
(Original document: English)

Dick O'Connell, President of the American Cocoa Research Institute and the Chocolate Manufacturers Association, presented the point of view of cocoa consumers and manufacturers regarding the production (levels and quality) of cocoa in the Americas. He acknowledged the critical importance of demand on price and therefore production decisions. With a view to raising U.S. per capita demand for cocoa (such as towards 10 kg compared to 7.7 kg currently). CMA has sponsored research designed to change consumers' adverse perceptions of cocoa's impact on nutrition, diet and health.

Dr. Mario Amin, economist at CEPLAC/Brazil, presented an analysis of influences identifiable in the major shifts in world market contributions over 20 recent years by the five major producing countries. Low increases in annual world production, coupled with low price elasticity, raises the specter of production increases causing dramatic reductions in cocoa sale price. While such price reduction could marginally increase consumption, it could be economically disastrous for producing (developing) countries. Population increases appear inadequate to greatly increase demand and provide significant upward impulse to prices. Dr. Amin urged producing countries to develop capacity for current assessment of cocoa demand by the importing countries as a way to minimize losses due to changes in the market. He called on industrialized countries to work to open their markets.

A much more optimistic demand projection was presented by Ernesto Ruiz, Sr., Costa Rican entrepreneur and President of CAAP. He anticipated new chocolate technologies, improved economies in developing countries, and earnings from exports of cocoa by-products. To move toward a 15% demand increase in 15 years, he urged renewed focus on quality control, concentration on flavor beans, and improved processing to achieve a high standard chocolate and cocoa butter product. Such steps, he said, would help restore cocoa production to its relative importance at the time Columbus discovered the Americas.

The US Agricultural Attache to Costa Rica and Panama, Max Bowser, explained historic reasons why the United States has not been a signatory to the International Cocoa Agreement, and why the January 1987 Agreement, though with improved conditions, may also not be signed by the U.S. He projected expanded cocoa production in 1986-87, increasing cocoa stocks, and therefore a likely further decline in the average annual world price, although less of a decline than in recent years.

Mr. Marthurin Gbetiboro, World Bank cocoa analyst, speaking at a later session, ascribed several major producing countries' production increases to a cocoa price boom combined with higher yielding hybrid varieties. Recent large increases in demand in industrial countries, and recovery of stocks, are factors contributing to the projection of declining prices in rural terms to 1990 after which, with output adjusting to such low prices, real price estimates rise to $1,810/ton in the year 2000.

Questions from the floor reflected both the optimistic and the more pessimistic views of supply-demand impact on world price. Study by CEPLAC/Brazil of possible substantial expansion of cocoa production areas was viewed with alarm by some speakers, who also observed that the world buffer stock is hardly a guarantee of sustained market prices. The existence of mini-markets for quality or flavor cocoa, with special prices, was also recognized.

The renovation of existing, sometimes old, trees was cited as a rapid method of expanding yields and incomes, as in Grenada, but planting of new stock tolerant of diseases and pests, together with envolving phytosanitary measures, was also agreed to be an essential complementary step. Such renovation must be designed to meet varying local conditions. The effective organization of producers should be encouraged to maximize returns to the farmers. Government policy support is needed in many of our countries to support such efforts.

The session appeared to agree that there is need for supporting policies by producing countries, not only in the area of improving efficiencies in cocoa production, but also to assure informed marketing, responsive to changing world demand. It applauded industrialized countries' efforts to further expand cocoa consumption internally and to open up new markets (Japan, Russia, China, and developing countries).

Phoebe Lansdale
Rapporteur

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PANEL I

COCOA PROSPECTS/PROJECTIONS - THE CONSUMER'S VIEWPOINT
(Original document: English)

Richard O'Connell

Economists, when talking about a commodity, lean heavily on what they call "demand". Since I am not an economist, I can choose my own language for demand: I call it "preference".

The entire growth, demand, and selectivity of chocolate and cocoa products rests on the one word "preference".

I use the word preference because consumers must prefer chocolate and cocoa products over other products if growth, demand, and increasing consumption are to occur throughout the world.

My principal function as moderator is to set the stage for the panelists who discuss cocoa prices, projections, futures and production.

But in order to do this most effectively, let me briefly discuss information on consumer attitudes in the United States towards chocolate and cocoa.

The Chocolate Manufacturers Association and the National Confectioners Association have both conducted nationwide consumer surveys of the opinions held by U.S. consumers.

This isn't to say that consumer attitudes found in the U.S. will be the same worldwide, but many consumer trends, or fads, if you will, often begin in the U.S. and spread worldwide. However, this is not an ironclad premise, and there are many variations on what consumers prefer and what they do.

Per capita consumption of confectionery in the U.S. is about 19 pounds (7.7 kilograms), with about 10 to 11 pounds of it being chocolate. Assuming that a chocolate bar is about one-third chocolate liquor and cocoa butter, per capita consumption of cocoa beans is in the 3.0 to 3.5 pound per capita range, or from 1.2 to 1.4 kilograms per capita.

Throughout the first five years of the 1980's chocolate consumption grew at a rate of four to five percent per year. Consumption is plateauing in the U.S. and new strategies must be developed if consumption is to grow and reach anywhere near European levels. European consumption is well above U.S. consumption, with confectionery consumption at the 13-14 kilogram level in Switzerland, nearly twice that of the U.S.

But acceptance of confectionery is growing in the U.S., as elsewhere. Many health authorities for years have encouraged consumers to limit their consumption of chocolate and cocoa because of the belief that they caused dental caries, acne, hyperactivity, obesity, inhibited calcium absorption, and even contributed significantly to peoples' allergies.

Research largely undertaken by the Chocolate Manufacturers Association, has dispelled these myths. Doctors, dentists, dieticians, educators and the news media are saying good things about chocolate and cocoa.

Before we become too euphoric about our progress, there are other myths we must overcome. For example, our consumer surveys show that:

- More than 3 out of 4 respondents believed chocolate contains more sugar than is good for them or their families.

- More than half agreed chocolate has little if any nutritional benefit.

- Nearly half the women surveyed reported frequent feelings of guilt after eating chocolate.

- Weight loss and calorie concerns were cited most often as the source of the guilty feelings.

- More than six in ten believe a chocolate bar contains more sugar than a can of soda or cup of fruited yogurt. (In reality, a serving of regular soda or fruited yogurt has as much as three and a half times more sugar than a one ounce bar.)

- Almost 3 out of 4 respondents either overestimated or had no idea of the number of calories in a vending-machine sized chocolate bar.

This is a quick summary from the consumer's standpoint, and by this I mean those who actually eat the product, and not the normal cocoa industry definition of "consumer", meaning those who buy the beans from the producer.

Now we come to the part of the program where we will discuss the various issues of prospects and projections which deal with world prices and the world market as viewed by various experts in the industry.

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INTER-AMERICAN COCOA FORUM
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San José, Costa Rica

Pan American Development Foundation
Washington, D.C.

PANEL I

COCOA PROSPECTS/PROJECTIONS

COCOA MARKET: THE NEXT FIFTEEN YEARS

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Summary

1. World cocoa production is expected to grow on average at about 1.7% p.a. to reach 2.5 million tons by the year 2000. However, the period 1990-95 should be characterized by a lower production growth rate because of the projected lower prices during the late 1980s. Production growth over the entire period from 1985 to 2000 will be dependent mainly upon the performance of three major producing countries: Côte d'Ivoire, Brazil and Ghana.

2. The production potential of Côte d'Ivoire is still subject to wide differences of opinion between official Ivorian and private international sources. However, given the current comparative advantage of cocoa farming over alternative export crops and assuming a moderate rate of new plantings over the next 15 years, Ivorian production is expected to increase at 1.6% p.a. from 1985 to 2000. Côte d'Ivoire's cocoa production could pass the 600,000 tons mark as early as 1988.

3. In terms of total land area available for cocoa cultivation, Brazil offers the most promising potential with the Amazon project. However, actual plantings will depend upon world prices and investment incentives. The effectiveness of the new economic program in combating inflation and introducing interest rate policy reform will be important. Under the assumption that the new plantings rate of the past will be cut back over the next 10 years or so, Brazil's cocoa production will only increase at 1.5% p.a. from 1985 to 2000. Due to its rehabilitation program, cocoa production in Ghana is expected to reverse its declining trend which started in the early 1970s. Indonesia, a new producer, is expected to become an increasingly-important producer with a projected capacity of over 100,000 tons by 2000.

4. After numerous sessions and lengthy debates, the Fourth International Cocoa Agreement (ICCO) has finally been concluded between producers and consumers. One major new feature of the current agreement, as compared to the previous ICCO that expired in 1984, is the participation of Côte d'Ivoire--the largest producer. The largest consumer, the United States, has not joined.

5. Over the long run, in the face of the projected supply-induced relatively low real prices and the growing general distrust of commodity agreements in the wake of the tin crisis and coffee quota negotiation difficulties, it is assumed that the cocoa market will operate without binding ICCAs. 1/

1/ This means that in future agreements price provisions will closely reflect the long-run unregulated market situation. In this respect it is assumed that producers will have to be more conciliatory and accept lower intervention prices than they would have liked, although the increased financial resources of the Organization would enable it to defend a higher Lower Intervention Price (LIP).

6. In the next two years at least, prices are projected to stay at relatively low levels, hovering in real terms around 185¢/kg. Prices should increase in the early 1990s as a result of the ensuing reduction in the rate of new plantings. However, there still is the possibility of further price declines over that period--depending on the magnitude of adjustment by high-cost producers and the policy response of government-controlled marketing institutions.

Introduction

7. It is a privilege to talk before this international forum of experts and decision-makers of the world cocoa economy and on behalf of my organization, I would like to express gratitude to the Pan American Development Foundation for providing us with this opportunity. The theme of the conference is promoting cocoa production and marketing and we have been requested to discuss the status and prospects for the world cocoa market. I must say at the outset, that various international organizations and private businesses perhaps present at this forum are similarly involved in market prospect assessments. You should look upon our forecasts as only one input into your own assessment of the future market situation.

8. Our assessment of the world market in the medium to long term is carried out within the framework of global economic model described in one of our publications as well as some internal working papers that I will be glad to make available. 1/

Cocoa Supply Demand and Price Outlook

9. Given the 10 minute presentation and 10 page constraints, I will only highlight the main conclusions of the supply, demand and price outlook that resulted from our recent review of the world market.

Supply Outlook

10. Production increases in recent years in several major producing countries such as Brazil, Côte d'Ivoire and Malaysia were due to large-scale new plantings, which in turn were in response to the cocoa price boom in the late 1970s. Since most new plantings were of the higher-yielding hybrid variety, especially in Brazil, Malaysia and to a lesser extent in Côte d'Ivoire, world output response was exceptionally high: 1.7 million tons in 1981/82 and 1.9 million tons in 1984/85--up from 1.3 million tons in 1976/77. In countries such as Cameroon or Côte d'Ivoire, where the largest share of new plantings during the late 1970s was of traditional varieties, production in the short to medium run will be affected as these trees take about 10-12 years to reach the maximum of their yield curve. However, the outlook for the next 15 years will depend mainly on the policy adjustment response in the major producing countries and the ability of new entrants to sustain production at the anticipated low real prices.

1/ World Bank Commodity Paper No. 8.

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11. The other consideration to be taken into account in assessing supply outlook for individual countries is the fact that, although real producers' price is a dominant factor influencing investment decisions in most cocoa producing countries, for price-induced supply response to be sustainable, other factors such as institutional and organisational obstacles ought to be addressed.

12. The main contributor to the increase in supply during the next decade will be Côte d'Ivoire. The new plantings of the late 1970s, especially of the hybrid type encouraged by SATMACI and supported by research institutions such as IRCC (Institut Recherche du Café et Cacao), in addition to the increase in producers' price, resulted in overachieving production targets as early as the mid-1980s. In 1985, Côte d'Ivoire produced 552,000; the target for that year as stated by the Planning Ministry was only 450,000 tons. It is clear from this performance by Ivorian farmers that the future supply response in Côte d'Ivoire could be even more potent than anticipated. The country has announced an output goal of 500,000 tons. Most observers believe, however, that Côte d'Ivoire could produce over 600,000 tons by 1990 and over 700,000 tons by the year 2000 if the current momentum is kept. Cocoa producers' prices were increased 14% in nominal terms between 1984 and 1985--from CFAF 350/kg to CFAF 400/kg. Although this increase translates into only modest gains in real terms, and despite the stated government policy to alter the relative coffee-cocoa terms of trade in favor of the former, cocoa will remain the most profitable cash crop for the Ivorian forest farmers in terms of both return to land and labor. If cocoa production growth in Côte d'Ivoire were to be less than forecast, it would be as a result of limited land availability--especially in the South and Southwest where more than 50% of new plantings from 1980 to 1985 have taken place--because of competition from annual crops such as rainfed rice. However, production growth could be faster than anticipated through the successful adoption of densification methods, as these are still not widespread among traditional farmers. Significantly lower cocoa production growth could develop if other crops, such as coffee, are made more attractive. If world cocoa prices fall to very low levels, subsidies to farmers (direct or in the form of extension services) could well be reduced and impact negatively on production. Bearing these qualifications in mind, cocoa production in Côte d'Ivoire is anticipated to rise from 552,000 tons to 705,000 tons between 1985 and 2000, which represents a 1.6% p.a. growth rate. Although it is assumed that there will be no major natural disasters such as drought and brush fires or unusually good growing conditions during the projection period, it has to be borne in mind that such phenomena have historically made the pod yield index vary in the range +25 to -14 with respect to the normal weather yield.

13. Over the last 50 years only two unusually large losses of cocoa area have been recorded in Côte d'Ivoire. The first major production fall was during the World War II period and the other was in 1982-83 after an estimated 30,000 ha were destroyed by brush fires and a severe drought. It is assumed, therefore, that the projected production figures could vary in a range of ±15% of the reported forecast.

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14. Brazil's cocoa orchard is the youngest of the traditional major producers. It is estimated that about one-half of the cocoa trees planted in Bahia as of 1984/85 are 15 years or younger, with 15% less than 5 years old and 41% less than 10 years old.

15. Given that the yield of hybrid cocoa, (which constitutes 40% of total Brazilian cocoa trees), stays at its peak for about 12 years, there is still room for production increases due to increasing yields. The ambitious planting program of the early 1980s has been revised downwards in recent years as a result of a more realistic assessment of world demand trends. The PROCACAU program is likely to be further scaled down as the recent and forthcoming period of low prices impacts on producers' returns. In the last three years, production has been affected by the spread of fungus diseases (black pod and Witches' Broom), especially in the Amazon area where an ambitious 100,000 ha area expansion program was planned. However, there is the possibility that if the country's recent comprehensive economic restoration results in lower inflation and lower interest rates, higher investment growth in cocoa could take place in the next five years. At the same time, there is also a concern that the loss of financial autonomy and political strength of the cocoa development authority, CEPLAC, might result in reduced services to farmers and less expansion of the cocoa program.

16. Brazil has the most potential to increase the cocoa supply despite the fact that its production pattern is the least predictable of the major producers. Brazil is still expected to continue to be the second leading producer of cocoa, with production reaching 520,000 tons by the year 2000 under the assumption of a more modest expansion program.

17. Ghana has recently shown signs of the long-awaited recovery with production in 1986 having reached 215,000 tons, which is more than 35% higher than the 1983/84 trough. The positive effect of a successful rehabilitation program combined with an increased deterrence to smuggling have contributed to short term recovery of the Ghana cocoa industry. Similar to the preceding season, the current crop year has started off with impressive purchase activity. Crop purchases in the first quarter of the 1986/87 marketing year are at least 20,000 tons more than in the same period the previous season. Crop activities of the current and previous two seasons are compared in Table 1. If the momentum of current crop activity is maintained, barring adverse climatic conditions the 1986/87 output could reach 230,000 tons. Therefore, we project Ghana's production to stay within the range 220-235,000 tons until 1988 before starting to increase markedly with the contribution of the trees rehabilitated in 1986 and 1987. The relatively lower real prices received during that period will somewhat dampen the impact of the rehabilitation results; but the current move of the Ghana Cocoa Board towards more efficient operations is likely to translate into better incentives for cocoa farmers. Thus the projected 3.2% production growth is sustainable. Although an annual growth of 7% (as suggested by other country specialists) is feasible given Ghana's undisputable resources and know-how in cocoa farming, a more modest production increase forecast will be retained until the progress of the rehabilitation program is further evaluated. The long-run projection for Ghana's production is about 240,000 tons in 1990 and 280,000 tons by the turn

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TABLE 1: GHANA MAIN CROP
('000 tons)

WEEK ENDING	1986/87	1985/86	1984/85
January 1	168	143	129
December 25	162	135	117
December 18	156	131	107

Source: Derived from General Cocoa Newsletters.

of the century. However, with good domestic policies, Ghana has the potential to reach 360,000 tons by 1995 and stabilize at that level.

18. Nigeria's cocoa production performance has been erratic and generally poor during the last five years. There were signs of a further decline earlier last season because of adverse growing conditions and inadequate institutional support. Many crop forecasters (including ourselves) were indeed expecting Nigerian output to reach a 15-year low in 1985/86 with only 110,000 tons--down from 151,000 tons in 1984/85. Preliminary estimates for 1985/86, however, indicate 120,000 tons, a slight improvement over most earlier predictions, partly because of the timely inception of a new cocoa marketing policy. Under the former producers' pricing system, it was estimated that cocoa farmers received much less for cocoa than for food crops (at the same time, the Nigerian Cocoa Marketing Board was guaranteeing a producers' price higher than the CIF New York price--presumably in compensation for the overvaluation of its currency). The situation was untenable from a public finance point of view and the government announced the cessation of federal marketing board activities as of June 1986. While it is still premature to judge the efficiency of the alternative marketing structure, scattered reports tend to point towards a better producers' price environment. The only negative result of the current reforms seems to be the de facto relaxation of bean quality control standards.

19. If the recent cocoa marketing policy and macroeconomic reforms are sustained, cocoa production in Nigeria may be prevented from further erosion. Nigeria production is therefore projected to be around 160,000 tons in year 2000--representing no growth from the 1982/83 figure.

20. Cocoa production in Cameroon remained stable at around 120,000 tons from 1980 to 1982; it fell to 106,000 tons in 1984 before recovering to 120,000 tons in 1985 and falling again slightly to 118,000 in 1986. If a renovation program is not implemented, Cameroon will cease to be among the 5 leading producers of cocoa by the year 2000, with production less than 100,000 tons. With moderate replanting, Cameroon could maintain current production

growth and produce around 130,000 tons by 1995 and reach 160,000 tons by the year 2000. The project of the Centre Sud, where 60% of cocoa is produced, is a timely and well-targeted operation designed to restore the aged cocoa orchard.

21. Since a major rehabilitation program has not yet been seriously undertaken, the current forecasts for Cameroon cocoa production are based on behavior of the past 20 years. Thus production will decline at a annual rate of 1.6% from 1985 to 2000 mainly because of the age of the present population of cocoa trees.

22. Malaysia is expected to continue to increase production, though at a lower rate than the average of the last 15 years. Although production costs are low because of interplanting with coconut, there are signs of agricultural labor shortages in the Sabah region that might adversely affect production of cocoa. Malaysia could produce as much as 190,000 tons by 1990 and 217,000 tons by the year 2000. The Malaysian intention not to participate in the prospective 1986 ICCO is an indication of their willingness to expand without undue binding from an international agreement.

23. Ecuador is not expected to increase cocoa production substantially over the next decade. In 1985, only 6% of the total productive area in 1985 was planted to higher yielding hybrid varieties, and recent new plantings of even the traditional cocoa tree specie have been rather limited. Output should remain in the range of 90-100,000 tons until 1990 and then increase to 113,000 tons by the year 2000. It is to be noted that Ecuador's production is among the most subject to yearly variations due to climatic variability and pest outbreaks. Thus, actual production could be 5% higher or 15% lower than predicted over the forecast period.

24. The production capacity of the major producers can be easily seen by reference to the tree stock data reported in Table 2.

25. Among the new entrants in the cocoa market, Indonesia seems to be the most promising with production capacity forecast to reach 100,000 tons by the year 2000. Colombia, contemplating diversification of its coffee-based agricultural economy, has for long been a contender among the marginal producers of cocoa, but output seems likely to stabilize at around 40,000 tons. The relative profitability of coffee vis-a-vis cocoa in Colombia and the short-run outlook for both commodities suggests that there may not be substantial new plantings of cocoa in Colombia over the next five years. Thus, production will most probably stagnate around 40-43,000 tons during the forecast period.

26. The prospects for world cocoa output in the next 15 years will depend crucially on pricing policy adjustments and supply response during the next 3 years of expected low prices. Profit margins for government marketing institutions will decrease and they might well reduce services to farmers. Under this scenario, production growth will lose some momentum in the late 1990s as a result of decreased new plantings of the late 1980s to early 1990s. Cocoa will remain an attractive crop in most countries even at the forecast low prices, since prices in real terms will still be higher than estimated production costs. Especially in the event the ICCA were effectively capable of defending

TABLE 2: TREE STOCKS IN MAJOR PRODUCING COUNTRIES, AS OF 1984/85

YEAR OF PLANTING	CÔTE D'IVOIRE	GHANA	CAMEROON	BRAZIL	ECUADOR	MALAYSIA /A
	('000 HECTARES)					
TRADITIONAL						
BEFORE 1969/70	520	742.6	288	347.2	179.5	-
1969/70	35	12.6	8	0.1	0.2	-
1970/71	30	11.2	8	0.2	5.1	-
1971/72	22	9.9	6	0.2	8.7	-
1972/73	19	6.5	15	0.2	8.1	-
1973/74	25	6.8	6	0.3	18.0	-
1974/75	53	5.3	7	0.6	5.4	-
1975/76	46	5.1	8	-	2.3	-
1976/77	47	3.8	8	-	1.8	-
1977/78	62	2.5	15	-	12.6	-
1978/79	40	0.3	11	-	9.0	-
1979/80	51	-	9	-	9.0	-
1980/81	50	-	7	-	6.5	-
1981/82	65	-	6	-	2.2	-
1982/83	50	-	3	-	0.5	-
1983/84	40		4		3.5	
1984/85	15		3		3.0	
SUB-TOTAL	1170.0	806.6	412	348.8	282.0	-
HYBRID						
BEFORE 1969/70	-	0.8	-	5.4	3.6	-
1969/70	1	0.9	-	2.2	0.2	6.8 /B
1970/71	2	0.6	-	2.8	0.3	4.6
1971/72	7	0.6	-	4.1	0.3	5.5
1972/73	8	1.1	-	6.3	0.9	4.5
1973/74	9	2.9	1	9.6	1.4	4.8
1974/75	13	6.4	1	13.7	1.9	3.3
1975/76	16	9.0	1	15.8	2.4	5.1
1976/77	20	14.1	2	18.5	1.4	8.8
1977/78	21	14.2	2	28.0	1.4	12.7
1978/79	22	14.3	3	37.3	1.4	32.3
1979/80	22	10.7	3	44.9	1.4	34.9
1980/81	19	5.2	3	56.3	1.4	29.8
1981/82	6	5.6	4	48.5	1.4	21.3
1982/83	6	4.4	5	30.0	0.5	15.0
1983/84	8	8.3	6	15.0	3.2	10.3
1984/85	10	10.0	7	15.0	3.7	8.4
SUB-TOTAL	190	110.3	38	342.2	26.8	233.0
GRAND TOTAL	1360	916.9	450	691.0	308.8	233.0

/A DATA ON CALENDAR YEAR BASIS.
/B BEFORE 1970.

SOURCE: ICCO, PAST CURRENT AND PROSPECTIVE DEVELOPMENTS IN THE WORLD COCOA ECONOMY: A STATISTICAL ASSESSMENT, FEBRUARY 1986.

a floor price, many projects in the pipeline in South Asia and Latin America would be carried out.

27. An interesting scenario to consider is the privatization of government marketing boards and less reliance being placed on export taxes for government revenues. Countries which typically have a relatively high level of implicit taxation of producers (Ghana with npc=0.20, Cameroon with npc=0.60) 1/ will increase production and world prices will fall. Countries where producers are already receiving a large share of the FOB price, either because of less interventionist pricing policies (Brazil) or because of relatively lower implicit taxation (Côte d'Ivoire, with npc=0.80), or again because of overvalued exchange rates leading producers' price being higher than CIF cocoa prices (Nigeria), production growth will be forced to decrease. Even production prospects for the high achievers such as Malaysia and the newcomer Indonesia would have to be scaled down.

Demand Outlook

28. The important development on the demand side is the recent large increase in consumption by industrial countries. Indeed, apparent consumption by these countries increased 5.5% p.a. between 1982 and 1984, compared with 0.7% p.a. over the period 1970-84. This consumption upsurge was most manifest in North America with an increase of 15% from 1982 to 1983 and 11% in 1984. The increase appears to be not only a result of the low prices experienced in the early 1980s but also a consequence of a shift in demand, induced by changes in tastes and population composition in some traditional markets. The income effect also partly explains the rise in consumption in these markets, as most major consuming countries have experienced higher per capita GDP growth rates since 1982. Chocolate confectionery sales have risen by at least 3.5% over the past 2 years in most OECD countries, with the United States (25% of world demand) having the largest increase (4.5%). From 1983 to 1985 prices recovered slightly in spite of better supply conditions than in the previous two years. The price recovery was caused essentially by increased world consumption and replenishing of stocks. In the United States, the period 1982-84 has witnessed an unprecedented rise in imports of luxury chocolate from Europe. Two reasons appear to account for this increase: one is the high value of the dollar during that period; the other one that needs further scrutiny, is the alleged effect of the baby boomers. The baby boom generation now accounts for one-third of the US population, or about 75 million in 1985. The consumption pattern of this segment of the population reveals, as it is shown in many surveys, a relatively high fondness for the sweet and dark candy. One recent study reports that 9% of US consumers eat candy every day, 47% on a weekly basis, 31% on a monthly basis; whereas only 10% eat candy less than once a month and 3% not at all. If this trend continues, growth in consumption for cocoa for North America could be around 2% p.a. until 1995, mostly under the impact of an increasing share of chocolate-loving baby boomers in the adult population. Beyond 1995, price increases and changing population

1/ npc - nominal protection coefficient.

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composition should slightly dampen demand and North American consumption could grow at a rate of 1.2% p.a. from 1985 to 2000.

29. Demand prospects for Western Europe should not differ from the historical pattern. Consumption should grow at its historical rate of 1% p.a. from 1985 to 2000.

30. Following the slight decrease in consumption during the period 1970-84, due to the high prices of the mid- to late-1970s, consumption in the CPEs is projected to grow at 2.2% p.a. from 1985 until 2000. Since prices are forecast to stay relatively low, especially over the first half of the period of interest, the only factors that could negatively influence demand from the CPEs would be their income and foreign reserves performance.

31. The high-price period of the late 1970s gave impetus to cocoa product substitution in many chocolate confections in favor of non-cocoa fats (NCFs) such as palm oil, soybean oil and other lauric oils. The outlook for these NCFs indicates that their prices should remain rather depressed in the next five years at least, spelling even more severe competition for cocoa butter than in the past. The United Kingdom, where the use of NCFs in chocolate confectionery is the most liberal, has initiated legislation for consideration by the other EEC members according to which as much as 5% NCF could be used in chocolate. The legislation, if not already defeated, is expected to face intense criticism from other EEC partners, especially France, which suggested that the British-backed confectionery with more than 5% NCF be called "vegolate" instead of chocolate. Unofficial estimates of the market taken by NCFs vary between 75,000 and 100,000 tons.

32. Cocoa demand prospects will also be greatly influenced by the performance of developing countries. With typically high income elasticity and high price elasticity of demand, cocoa consumption in these countries is expected to grow at 2% p.a. until the turn of the century, unless there is a sharp price increase during the period. The major contributor in the developing country market will be Asia with a projected 5% p.a. consumption growth. In the Asian market, there is great uncertainty about China which might become an increasingly important consumer before the year 2000.

Price Outlook

33. Cocoa prices in the short run are expected to remain near to their present low level. The supply recovery from the drought-induced shortage years led to a 62,000 ton market surplus in 1984/85. In addition to this supply/demand imbalance, the level of prices in the short run will be influenced by the perceived strength of the prospective ICCA to defend its price band. Since our projected prices hover around the may-buy level, and given the existence of financial resources to increase buffer stocks, there will be the temptation to trigger purchasing operations. Ultimately, producers would certainly consider the costs of keeping additional stocks and consumers might push for a downward revision of the price band to better reflect market conditions in that event. Thus, it is expected that buffer stock operations will be minor and our projections closely reflect unregulated market prices.

From a level of $2,090/ton in 1986, nominal cocoa prices could drop to $2,000/ton in 1989. The cocoa market is likely to continue to be characterized by oversupply and prices below $2,000/ton in real terms until at least 1990.

34. In real terms, prices are expected to decline consistently from 1986, to reach their lowest level of $1,660/ton by 1990. With output and capacity adjusting to these low prices in such countries as Brazil, real prices should increase progressively to $1,810/ton in the year 2000.

35. With producers' prices in Brazil and Malaysia more in line with world prices than in Côte d'Ivoire, the former countries are likely to reduce production growth more than the latter. Prices beyond 1990 would also be influenced greatly by the production level and market behavior of Côte d'Ivoire which should by then capture about 40% of the bean export market. Given the possibility of Côte d'Ivoire exercising market power and the announced threat of a net reduction of production capacity to 500,000 tons, two alternative cases were investigated (see Table 3). These cases, hypothetical as they are, represent the two extreme production goals Côte d'Ivoire could follow over the next 15 years and were formulated from discussions with regional staff. The scenarios are presented only to provide a qualitative assessment of the prospective impact of Côte d'Ivoire on the world cocoa market. In the low case scenario, there are production deficits after 1995, and prices rise in real terms from 230¢/kg in 1995 to 254¢/kg in the year 2000. In the high production scenario, Ivorian production increases to about 950,000 tons and world prices fall to 127¢/kg in 1990, then increase to 178¢/kg by the year 2000 in constant dollar terms.

Trade Outlook

36. The traditional structure of cocoa trade, with raw beans exported by cocoa producing countries to consuming countries of the Northern Hemisphere, has undergone substantial changes with the increased downstream processing in producing countries.

37. Global figures of grindings and trade show significant increases. However, global figures mask an even more spectacular evolutionary pattern of grindings and products trade that deserve due acknowledgement.

38. Among all bean-producing countries, Brazil has definitely made the most outstanding progress in grindings and exports of cocoa products. Brazil has become a leading exporter of cocoa butter ranking second behind the Netherlands. In 1983, Brazil exported 31,000 metric tons of cocoa butter, and 35,000 metric tons of cocoa powder/cake.

39. In the middle of this century, only 11% of cocoa produced was ground by producing countries Later, grindings from these countries increased steadily to 34% in 1978/79 and are still increasing. Since 1977/78, almost all cocoa paste sold on international markets has come from bean-producing nations. The proportions of cocoa butter and powder/cake have followed a similar evolution although on a smaller scale. (Table 4)

TABLE 3: COCOA PRICES AND WORLD OUTPUT UNDER TWO EXTREME CÔTE D'IVOIRE PRODUCTION TARGETS

LOW SCENARIO

YEAR	ICCO DAILY PRICE (¢/kg)	MUV	ICCO PRICE DEFLATED /A (¢/kg)	CÔTE D'IVOIRE PRODUCTION ('000 tons)	WORLD PRODUCTION ('000 tons)
1986	209	107.1	195	542	2005
1987	210	114.4	183	520	2012
1988	216	122.2	177	535	2103
1989	231	130.8	176	530	2179
1990	259	140.0	185	500	2162
1995	393	170.5	230	500	2232
2000	528	207.4	254	500	2355

HIGH SCENARIO

YEAR	ICCO DAILY PRICE (¢/kg)	MUV	ICCO PRICE DEFLATED /A (¢/kg)	CÔTE D'IVOIRE PRODUCTION ('000 tons)	WORLD PRODUCTION ('000 tons)
1986	181	107.1	169	599	2062
1987	178	114.4	155	651	2141
1988	176	122.2	144	706	2265
1989	174	130.8	133	767	2395
1990	178	140.0	127	832	2463
1995	251	170.5	147	919	2569
2000	370	207.4	178	949	2640

MUV = MANUFACTURING UNIT VALUE INDEX.

/A 1985 CONSTANT DOLLARS

SOURCE: WORLD BANK, ECONOMIC ANALYSIS AND PROJECTIONS DEPARTMENT.

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TABLE 4: COCOA GRINDINGS AND PRODUCT EXPORTS FROM BEAN-PRODUCING COUNTRIES AS A PERCENTAGE OF WORLD TOTAL

		EXPORTS		
	GRINDINGS	COCOA PASTE	COCOA BUTTER	COCOA CAKE
1948/52	11		35	
1958/62	16		39	20
1968/72	21	57	53	30
1973/77	25	86	49	39
1977/78	32	92	48	48
1978/79	34	95	48	48
1979/80	33	93	46	46

SOURCE: EPDCS.

40. Cocoa product trade by developing countries is expected to grow because of the following changing trade practices:

i. Smaller manufacturers in industrial countries prefer to buy (instead of grinding their own) intermediate product requirements in order to have better control over the quantity of input used. Indeed, grinding cocoa beans for cocoa butter, to be used subsequently for chocolate manufacturing, may yield an unwanted amount of cocoa powder which is avoided if the manufacturer imports the specific product quantity needed.

ii. On the supply side, recent studies (ICCO, UN, World Bank), seem to suggest that there are potential gains in processing some--but not all--cocoa products. Since many cocoa producing countries have been contemplating the processing of cocoa beans to increase domestic value-added, there exist favorable prospects for increased exports, particularly if capital requirements are met.

Methodology Used in Projections

41. World production and apparent consumption are estimated from an econometric model. On the supply side of the model, the production capacity of major cocoa bean exporters is estimated from yields and area planted data. Actual production is estimated using capacity as one of the independent variables.

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42. Consumption is computed as the sum of cocoa bean grindings and net imports of cocoa products in bean equivalents. The conversion factors are: 1.33 for cocoa butter, 1.25 for cocoa liquor, 1.11 for cocoa powder and 0.50 for chocolate products. The demand functions assume constant price elasticities for Western Europe and North America. In developing countries and Eastern Europe, a linear demand function is hypothesized because of the luxury good connotation attached to cocoa consumption.

43. Import demand functions for beans were estimated for North America and Western Europe. It is assumed that importers minimize their net expenditures on cocoa by selecting between origins and by assessing the relative profitability of grinding beans versus importing the product. Thus a ratio of bean imports to consumption was regressed on the bean-to-product price ratio and the ratio of unit value of exports from the two main suppliers of each regional market.

44. Cocoa has been shown to be one of the most exchange rate sensitive of all internationally traded agricultural commodities. Its exchange rate price elasticity is around 0.8--meaning that a 10% appreciation of the US dollar will induce an 8% decrease in the dollar price of cocoa beans, ceretis paribus. This influence of the depreciating US currency became very obvious during the last half of 1985, when prices stayed relatively firm in a generally-admitted excess supply situation.

45. The strengthening of the dollar in the period 1982-84 partly explains the recent rise in chocolate product imports by the United States from Europe. Another factor was the fact that European candy makers buy sugar--which constitutes close to 50% of the ingredients in chocolate confectionaries--at prices closer to free market prices, and therefore had a competitive edge over their US counterparts. US imports of candies rose by more than 43% in 1985, compared with only 3% and 14% in 1981 and 1982, respectively. As a result, the ratio of imported to US domestic consumption more than doubled from 3.3% to 7.3% during the period 1980-85.

46. Another macro economic variable that significantly affects cocoa prices is the industrial growth in OECD countries. It is estimated that an extra 1% growth in industrial output in these countries improves cocoa prices by at least 4%. Borrowing from this finding, we have based our short-run forecasts partly on the cyclical behavior of the food, beverages and tobacco output index in OECD countries.

47. Interest rates did not seem to significantly affect the price of cocoa. This could be due to the limited storability of the beans.

Validation and Forecast Performance of Current Model

48. The following tables report historical cocoa prices and our present price forecast (Table 5) and our forecast errors over the period 1983-86 (Table 6).

TABLE 5: COCOA BEANS - PRICES /A 1950-85 (ACTUAL)
AND 1986-2000 (PROJECTED)

	¢/KG			¢/KG
	CURRENT $	1985 CONSTANT $		CURRENT $*
		MUV /B	US GNP /C	
ACTUAL				
1950	63	266		
1951	70	257		
1952	70	245		
1953	68	242	265	
1954	116	427	450	
1955	79	287	310	
1956	57	201	211	
1957	64	219	227	
1958	88	294	306	
1959	73	248	247	
1960	59	197	198	
1961	49	159	162	
1962	46	149	150	45
1963	55	182	178	48
1964	51	163	160	50
1965	37	117	114	38
1966	52	160	156	41
1967	60	183	175	54
1968	72	222	202	60
1969	90	265	240	78
1970	68	186	170	76
1971	54	140	129	63
1972	64	154	149	57
1973	113	234	247	84
1974	156	265	313	133
1975	125	191	229	140
1976	205	308	357	150
1977	379	520	624	280
1978	340	406	523	312
1979	329	347	465	327
1980	260	250	337	263
1981	208	199	245	175
1982	174	168	193	157
1983	212	211	227	162
1984	240	242	248	204
1985	225	225	225	195 /D
PROJECTED				
1986	209	185	203	171
1987	204	180	195	172
1988	202	171	179	172
1989	200	167	168	193
1990	200	166	161	195
1995	246	171	162	262
2000	310	181	167	351

* DEVELOPING COUNTRIES' EXPORT UNIT VALUE.

/A ANNUAL AVERAGE ICCO DAILY PRICES.
/B DEFLATED BY MANUFACTURING UNIT VALUE (MUV) INDEX.
/C DEFLATED BY US GNP DEFLATOR.
/D PROJECTED.

SOURCE: ICCO SECRETARIAT AND FAO TRADE YEARBOOK (ACTUAL); WORLD BANK, ECONOMIC ANALYSIS AND PROJECTIONS DEPARTMENT (PROJECTED).

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TABLE 6: SHORT TERM COCOA PRICE FORECASTING PERFORMANCE

YEAR OF FORECAST	TARGETED YEAR	ACTUAL	CURRENT MODEL FORECAST	%FE
	1983			
1983 (I)		212	186	12.3
(II)			204	3.8
	1984			
1983 (II)			220	8.3
1984 (I)		240	246	-2.5
(II)			246	-2.5
	1985			
1983 (I)			183	19.0
(II)			212	6.2
1984 (I)			230	-1.8
(II)			235	-4.0
1985 (I)		226	208	8.0
(II)			215	4.9
	1986			
1985 (I)			205	0.9
(II)			200	3.5
1986 (I)		207	206	0.4
(II)			209	-0.9

SOURCE: ACTUAL: ICCO

NOTES:

(I) FORECAST MADE IN JANUARY OF THE CURRENT YEAR.
(II) FORECAST MADE IN JULY OF THE CURRENT YEAR.
(-) OVERESTIMATION.
FE FORECAST ERROR IN PERCENTAGE TERMS.

vq

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PANEL I
COCOA PROSPECTS/PROJECTIONS

COMPETITIVENESS OF THE WORLD'S COCOA EXPORT MARKET, A MARKET SHARE ANALYSIS

Mario Miguel Amin*

INTRODUCTION

Cocoa bean exports represent a very important source of revenue for Brazil, Ghana, Nigeria, Ivory Coast, and Cameroon. These five countries are the major suppliers of cocoa, making an average annual contribution of about 75% to total world output.

When analyzing the world's cocoa export and import situation, three important key points must be considered. One relates to the destination of cocoa exports, a second to shifts in individual total market shares that have occurred during the past twenty years, and the third to the great instability shown by cocoa prices.

Trading Channels

The cocoa market is formed by a very small group of important suppliers and buyers. This small group of trading countries forms what is termed an oligopoly-oligopsony market system. For the major cocoa producers, such a highly concentrated market represents a very important test of their ability to define the right export policies and to establish promotional programs that should permit them to remain fully competitive in the international markets.

However, this behavior does not seem to have been followed by many of the major producers. An analysis of the trading channels used during the last twenty years shows a great part of the countries engaged in sales efforts that were extremely dependent upon selected "traditional market centers".

This dependency appears to have created a certain negligence over the years on the part of the government exporting agencies, in keeping in close touch with world market conditions, particularly with demand trends, for their own economic advantage. In view of the great need to obtain external resources to finance economic and social programs, revenue losses resulting from this negligence are completely unacceptable.

Individual Total Market-Shares

During the period 1962 to 1981, there was no "significant real increase" in world cocoa exports. Total cocoa bean exports in 1962 were around 1,035 millions tons. By 1972 this volume had increased to 1,253 millions tons, but dropped to 1,238 million tons in 1981, which means that exports had increased by only 200 thousand tons (Table 1).

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Table 1. Major Producers Cocoa Bean Exports and Share in World Market, 1962-81. (ton.)

Year	World	Brazil	%	Camar.	%	Ghana	%	Nigeria	%	Iv.C.	%	Others	%
1962	1035300	53340	5.15	66259	6.39	427979	41.33	197773	19.10	101018	9.75	188931	18.24
1963	1037200	68685	6.62	79599	7.67	411056	39.63	177408	17.10	99728	9.61	203724	19.64
1964	1046200	74710	7.14	78699	7.52	387626	37.05	199975	19.11	124261	11.87	180929	17.29
1965	1235400	91966	7.44	77800	6.29	501916	40.62	195992	15.86	126489	10.23	241317	19.53
1966	1179000	112498	9.54	54590	4.63	397867	33.74	192009	16.28	124289	10.54	297747	25.25
1967	1109700	114351	10.36	69808	6.32	334928	30.34	248181	22.48	105166	9.52	231266	20.95
1968	1075600	75815	7.04	65617	6.10	332079	31.17	208882	19.42	121465	11.29	268542	24.96
1969	1012800	119575	11.46	73824	7.07	308637	29.59	173605	16.64	118909	11.40	248250	23.80
1970	1109100	119768	10.97	76857	6.92	367362	33.12	195908	17.66	143231	12.91	205974	18.57
1971	1215000	119071	9.80	79890	6.57	314245	25.86	271737	22.36	146939	12.09	283118	23.30
1972	1253600	102254	8.15	81598	6.50	412240	32.88	227532	18.15	159367	12.71	270609	21.58
1973	1171000	82774	7.06	86500	7.38	421000	36.04	213897	18.26	142900	12.20	222809	19.02
1974	1148020	129932	11.31	83349	7.26	312785	27.24	160377	13.96	176927	15.41	284650	24.79
1975	1172560	176628	15.06	65738	5.60	320885	27.36	170681	14.55	172562	14.71	266066	22.69
1976	1167860	131430	11.25	61542	5.26	325555	27.87	229912	19.68	191487	16.39	227934	19.51
1977	999600	102027	10.20	47706	4.77	249084	24.91	164217	16.42	170842	17.09	265724	26.58
1978	1055230	129535	12.27	66453	6.29	207043	19.62	209169	19.82	254386	24.10	188644	17.87
1979	998320	162260	16.25	72897	7.30	218560	21.89	113032	11.32	204594	20.49	223977	22.73
1980	1042510	128078	12.28	89236	8.55	199961	19.18	133861	12.84	238889	22.91	252485	24.21
1981	1238650	116100	9.37	96648	7.80	140385	11.33	108960	8.79	456921	36.88	319636	25.80
Tot.	22326650	2210797	9.90	1474610	6.60	6595493	29.54	3793108	16.98	3380290	15.14	4875352	21.83

Source: FAO and ICCO, Cocoa Statistics, 1962-1983.

This apparent lack of growth capacity in the exports of cocoa beans was due to the fact that, during the 1962 to 1981 period, the production and marketing structure of cocoa was undergoing what can be called a "shifting of positions".

During that period, individual total market shares suffered dramatic changes. For example, in 1962, Ghana supplied 41.4% of the world's total consumption. By 1981, this had dropped to 11.3%. On the other hand, Ivory Coast increased from 9.8% to 36.9%. Nigeria, which in 1962 supplied 19.1% of the total market dropped by 1981 to a low 8.8%. Brazil, over the same period, increased exports from 5% to about 10%. The cocoa market was not showing, at the time, a "general expanding situation".

These shifts in the individual market shares, when analysed within the context of occasional changes of the world's agricultural production patterns, can be viewed as normal. However, these changes have a very important social and economic significance, due to the production and consumption trends which are expected to take place in the international cocoa market system.

Price Instability

Cocoa has been generally considered to have the most unstable prices of all the export commodities. Two factors influence the behavior of cocoa prices. One is related to the influence of changeable climatic conditions occurring in major producing areas on the determination of the price level. The second has to do with the low price-elasticity of cocoa.

Future Trends

As a result of internal pressures to obtain additional funds to finance their development programs, several cocoa producing countries have expressed the intention of bringing new areas into production, as well as planning programs directed at increasing productivity by rapid renovation of old plantations. At the same time, new countries have chosen cocoa production as an important economic export alternative, as is the case of Malaysia. This means that, over the next five to seven years, a substantial increase in world cocoa exports can be expected.

According to recent estimates presented by the World Bank, cocoa consumption is expected to increase between 1.4 and 1.9 percent over the next few years. However, the main concern here is not with the percentage increase in consumption, but with the "nature of the demand" for cocoa beans. Is there a market available for all this additional production?

Several studies have shown that demand for cocoa is very inelastic (1, 2, 3). That is, in order to have a very significant increase in the quantity demanded, it is necessary for consuming centers to have substantial increase in income or for producers' prices to be considerably decreased.

As the world economic situation stands to-day, it appears that neither of these options will have, in the short term, real chance of contributing significantly to increased consumption of cocoa. Slow economic growth in many of the industrialized countries seems to be the main factor preventing world consumption from having a very stimulating effect. On the other hand, as all major cocoa producing countries are dependent on earning additional revenue, lower prices do not seem to be the most realistic alternative way of marketing larger supplies.

The problem could be stated simply in this way: if the international cocoa market had difficulty absorbing excess supplies at the time when the export market was going through a "shift in the positions" and not showing "real growth", if it was then necessary to create a buffer-stock to prevent prices from dropping, what can be expected in the years ahead, as plans are being made in the producing areas to increase cocoa production still further and there are no signs of a proportionally larger increase in demand?

In this context, the shifts in the individual total market shares of Brazil, Ghana, Nigeria, Ivory Coast and Cameroon that occurred during the 1962-1981 period have great economic significance.

Analysis of the factors responsible for these changes, and the relative contribution of each factor, helps determine the export performance of a country. A way to categorize quantitatively the factors that affected the export positions of the five major producing countries during the 1962 to 1981 period is application of a technique called Market-Share Analysis.

Knowledge of this information has a two-fold importance. Firstly, it serves as the basis for determining a country's success in formulating and implementing correct export policies. Secondly, given expected increases in supply, as well as a slow-growing demand for cocoa, the results serve to assess the required adjustments in export programs to improve a country's competitive position and to reduce revenue losses.

The objective of this study is to analyze the competitiveness of Brazil, Ghana, Nigeria, Ivory Coast and Cameroon cocoa export markets during the 1962-1981 period, using the market-share technique.

An analysis of cocoa bean exports helps not only verify the existence and causes of any possible distortion in the allocation process of the product in the world market, but permits rapid identification of the best export alternatives to be followed by the producing countries as a way to attain the best individual export growth.

THEORETICAL FRAMEWORK

Area of Analysis

As a result of the high degree of geographical concentration in cocoa export and import activities, the number of countries included in the study is relatively small. The group of major exporters is formed by Brazil, Ghana, Ivory Coast, Nigeria, and Cameroon. These countries account for more than three-fourths of the world's cocoa exports. Importing countries include the United States, Federal Republic of Germany, France, Japan, Italy, Netherlands,

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Soviet Union, United Kingdom and Spain. These, during the 1962-81 period, imported over three-fourths of total world production. Thus, the study considered the most important exporters and importers within the selected time period.

Data

The data covering the 1962-81 period were collected from the Cocoa Statistics of the Food and Agriculture Organization (FAO), and from the Quarterly Bulletin of Cocoa Statistics of the International Cocoa Organization (ICCO).

Market-Share Analysis

The basic purposes of the market-share analysis technique are to determine the factors responsible for change in a country's total export share during a given period, and to analyze this change. The change, either loss or gain, can be identified by the separate participation of three effects: the size of market effect, the distribution effect, and the competitive effect.

The size of the market effect refers to a change in exports which are due to an increase or decrease in the size of the total world market. The distribution effect may be defined as the export loss or gain as a result of a change in relative importance in individual importing markets. The competitive effect is related to change in market-share caused by a country's ability or inability to maintain a competitive position on individual markets.

Selection of Time Periods

An important part of the market-share model is the selection of time periods for the analysis. The appropriate choice of years is completely arbitrary. However, it is necessary that a selected time period should represent the economic situation as closely as possible. The 1962 to 1981 period was considered long enough to include any particular changes in the country's individual total market shares resulting from the export policies.

After selecting the time period, a necessary step for applying the market-share technique is definition of a base period for statistical comparisons. The 1962-81 period was divided in four groups of five years each, as follows: Period I (1961-66), Period II (1967-71), Period III (1972-1976) and Period IV (1977-81).

In order to give the study a better frame for comparing different situations, and at the same time to check whether there was any particular trend in the participation of each one of the effects over the years, two base periods, Period I and Period III, were selected. In this way, Period II, III, and IV were compared to Period I, and Period IV was compared to Period III.

RESULTS OF THE MARKET-SHARE ANALYSIS

The market-share technique allows determination of fluctuations in the export position of the five major cocoa producers during the 1962-81 period, arising from changes in total size of the market, distribution patterns, and competitive behavior of each country as related to the main competitors.

The favorable or unfavorable results of those effects are simply a reflection of a country's export programs and policies formulated and implemented within the general context of the international cocoa market.

A summarized version of the whole market-share analysis is presented in Table 2. The results show some well defined differences in the structural (size of the market and distribution effects) and competitive position of each country.

Size of Market Effects

The positive or negative participation of this effect relates directly to the growth of world cocoa trade. Regardless of the base period used, Period IV (1977-81) can be considered as showing the worst export performance of the countries as a result of changing world market conditions. All the countries had a negative effect during this period.

This period was characterized by a substantial decrease in world cocoa imports. Total world imports of cocoa bean in 1977-81 were about 35,000 and 115,000 tons below the 1962-66 and 1972-76 levels. This significantly affected the export opportunities of the all countries, but especially Ivory Coast and Brazil which at the time were sharply increasing their cocoa supplies. Aggregate cocoa export losses due to a reduced world market during the 1977-81 period were 32,000 and 91,000 tons. These figures represent a very important warning in view of the projected increases in the world cocoa output over the next few years.

One point to observe is the incredible increase in the relative participation of the market effect in Period IV as the base period was changed. Ivory Coast went from a low of 2.4% to a high 13.1%. Nigeria and Brazil had the highest relative increases from 14.7% and 4.5% to 35.9% and 23.6% respectively. Ghana rose from 5.5% to 22.5%, while Cameroon increased from 11.1% to 20.6%.

These relative losses in exports are of considerable significance, since it is known that, during the 1962 to 1971 period, the world cocoa market was going through what can called as a "major producing adjustment process". That is, the former large producers, Ghana and Nigeria, gave up their places to the new rising stars of the moment, Ivory Coast and Brazil. From 1971 to 1981 the market found its own "equilibrium point". Thereafter, new trends in the world production process and export market shares seem to be in the making.

What does this all mean?. It means that any major future increase in the supply of cocoa beans must be matched by an equal or proportionally greater increase in demand in order to prevent the international cocoa prices from facing a severe drop. This could represent potentially difficult times for producers in the years ahead.

Distribution Effect

This effect shows, better than the other two, a country's capacity to accompany the world's market conditions. Given the fact that the relative importance of individual importing markets changes over time, export agencies must develop the necessary tools to register any shifts in the importers' demand behavior to avoid major revenue losses.

It is evident from the world's cocoa bean market-share analysis that there is a lack of well organized mechanisms, on the part of the major producers, to occasionally verify whether world trade is expanding, or to check for growing market centers, or even to observe regional difference in potential markets. In general, all countries show a larger number of periods in which the distribution effect had a negative participation (Table 2). This means that the countries were unable to maintain the same market shares in individual importing markets as in the base periods.

In the case of Brazil, for instance, export losses in Period IV due to the distribution effect amounted to 7.5% when compared to 1962-66 and 21.8% when compared to 1972-76. Nigeria's negative distribution effect in all the periods showed that export efforts were mainly concentrated in low growing import markets, or in markets which grew less than the world average.

Ivory Coast is the only country during the 1977-81 period to succeed in making excellent use of the world market conditions to improve its individual market shares in some consuming centers. In the 1972-76 period, for example, Ivory Coast participated with 16.1% and 10.5% of the total cocoa beans imports of the Netherlands and the United States. By 1977-81, these figures had jumped to an all time high of 25.7% and 30.1%. This increase was mainly at the expense of Brazil and Ghana whose individual export shares to these countries dropped substantially.

Absolute and relative losses due to the distribution effect are certainly lower than those which occurred as a consequence of the occasional reduced size of the market. However, it is important to emphasize that, even though they are numerically lower, their economic significance, is much greater.

Results provided by distribution effect analysis show that, as a result of the highly concentrated trading market, the major exporters developed a strong dependency on certain "traditional markets" for a great part of their exports. This appears to have made them become, over the years, a little unconcerned about the changing structural conditions of demand for cocoa. This in fact is a very serious situation, since lack of knowledge about "real world market" conditions definitely harms not only their marketing options, but weakens their bargaining power at any decision making conference.

Competitive Effect

Market-share analysis privides an excellent opportunity to gain good insight about the "competitiveness" performance by Brazil, Ghana, Nigeria, Ivory Coast and Cameroon. Inclusion of all the major producers permits evaluation of a country's performance instead of against the total market, against principal competitors.

Table 2. Components of Major Producers Cocoa Bean Export Losses, 1962-81. (ton.).

	Brazil		Ghana		Nigeria		Ivory Coast		Cameroon	
PERIOD II 67-71/62-66										
Total Effect	29076	100.00%	-93197	100.00%	27034	100.00%	12001	100,00%	-4190	100,00%
- Size of Market Effect	191	0.66%	1007	0.69%	456	1.05%	272	0,32%	183	0.59%
- Distribution Effect	1366	4.57%	24900	17.17%	-8119	18.76%	48702	56,66%	13104	42,61%
- Competitive Effect	27519	94.65%	-119104	82.13%	34695	80.18%	-36973	43,01%	-17514	56,79%
PERIOD III 72-76/62-66										
Total Effect	44017	100.00%	-66596	100.00%	7850	100.00%	53507	100,00%	-1644	100,00%
- Size of Market Effect	5549	12.61%	29267	14.34%	13256	41.15%	7905	9,15%	5313	43,30%
- Distribution Effect	639	1.45%	39454	19.34%	-12182	37.82%	-16417	19,01%	-4827	39,34%
- Competitive Effect	37829	85.94%	-135317	66.32%	6776	21.03%	62019	71,[illegible]3%	-2129	17,35%
PERIOD IV 77-81/62-66										
Total Effect	48763	100.00%	-222279	100.00%	-46783	100.00%	149985	100,00%	-2801	100,00%
- Size of Market Effect	-2897	4.51%	-15280	5.59%	-6921	14.79%	-4136	2,45%	-2780	20,18%
- Distribution Effect	-4824	7.51%	25555	9.35%	-3779	7.99%	-5100	3,03%	5489	39,84%
- Competitive Effect	56484	87.97%	-232554	85.06%	-36123	77.21%	159222	94,51%	-5509	39,97%
PERIOD IV 77-81/72-76										
Total Effect	4746	100.00%	-155683	100.00%	-54633	100.00%	96477	100,00%	-1157	100,00%
- Size of Market Effect	-12216	23.60%	-35152	22.58%	-19647	35.96%	-16504	12,74%	-7413	46,42%
- Distribution Effect	-11294	21.82%	-13412	8.61%	-6841	12.52%	15616	12,06%	7405	46,37%
- Competitive Effect	28256	54.58%	-107119	68.81%	-28145	51.52%	97366	75,19%	-1149	7,20%

Source: (5).

Regardless of the base period used, this competitive effect analysis accounted for most of the relative changes in world cocoa exports. The results practically separated the countries in three groups, one composed of Brazil and Ivory Coast which showed a positive competitive effect in all the periods, a second group formed only by Nigeria which shows a variable participation of effect, and finally a group showing Ghana and Cameroon with a very poor competitive performance.

For Brazil and Ivory Coast, the competitive effect represented during the 1977-81 period 87.9% and 94.6% of the total effect when compared to the 1962-66 base period. When the 1972-76 base period is used, a significant decline in the country's relative participation can be observed and the effect was responsible for only 54.5% and 75.0% of the total exports.

Ghana, Nigeria and Cameroon had an adverse total effect due to extremely high negative participation of the competitive effect. Ghana, for example, in 1977-81 was 232,000 tons below the 1962-66 level and 107,000 tons below the 1972-76 level. In the case of Nigeria and Cameroon, the competitive components accounted for a combined loss of 47,000 tons with respect to the first period and 39,000 tons with respect to the second base period.

Factors behind the losses are not very easy to determine, once the competitiveness behavior of a country is the result of a simultaneous interaction of forces whose identification requires a very special analysis. The results, however, serve as a preliminary step to show the competitive strength of each individual producing country within the international cocoa marketing system.

CONCLUSIONS

The market-share analysis provided the analytical framework to check into some of the causes underlying severe shifts in the individual total market shares of Brazil, Ghana, Nigeria, Ivory Coast and Cameroon during the 1962 to 1981 period.

Results revealed the following conclusions. The competitive effect accounts for the strong position of Brazil and Ivory Coast cocoa bean exports with regard to the main consuming centers. In the case of Ghana, Cameroon and Nigeria, the competitive effect is the main factor behind their deteriorating export position.

The size of the world market has a definite influence on a country's capacity to export additional supplies. Given the fact that some increase in cocoa production is expected in the future and that demand for the product does not show signs of expanding very rapidly, it is possible that difficult times may appear in the countries export programs.

An important point that is apparent from the market-share model relates to losses that major producers have as a result of not following closely the changing demand conditions in individual importing countries. This problem could be reduced or eliminated by simply performing occasional statistical studies of world market conditions.

Results of market-share analysis, of course, are sensitive to the choice of the years included. However, the two base periods used in this model help to demonstrate that the cocoa bean export market does not operate in the most efficient way. Gains could be increased or losses reduced if export agencies were interested in following a more realistic trading system in order to improve their competitive positions.

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PAN AMERICAN DEVELOPMENT
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PANEL I

OVERVIEW AND PROSPECTS FOR COCOA

VIEWPOINT OF COSTA RICA AND CENTRAL AMERICA ON COCOA PRICE AND DEMAND

(Original document: Spanish)

Ernesto Ruiz Avilés

As seen by Costa Rica and Central America, world consumption of cocoa during the thirty years 1950-1980 has practically doubled, reaching 1,466,000 tons. During the last decade, consumption practically stagnated, but starting in 1980 through the year 2000 prospects are very good. A well founded forecast states that there will be an increase of 55% in consumption or 830,000 tons. The forecast is mainly based on the stability of the world economy, which has notably recovered starting in 1985.

World demand is estimated for the year 2000 at 2,295,000 tons.

Demand Concentration

See attached Annex 1.

Position of Cocoa in the Region and Perspectives in the Central American and Caribbean Region

There is a well-based hope that the International Agreement for Cocoa, IICO, just ratified, would keep control over prices and maintain relative stability. It should be pointed out that within the Agreement, countries producing 10,000 tons or less are not subject to a quota. Also producers of Flavour Beans are not subject to restrictions.

In Central America, cocoa production has been relatively stagnant. In Costa Rica, particularly due to the presence of Moniliasis, plantations in the Atlantic Region were practically abandoned, reducing production considerably to 2,000 tons per year. Now, it has very slowly recovered, reaching approximately 4,000 TM per year. In other countries of Central America and Panama the situation is stable: Guatemala between 1,000 and 1,500 tons per year, El Salvador with 500 tons, Honduras with 1,000 tons per year, demonstrating that, through adequate promotion projects and financing, cocoa production has been maintained but only in an irregular and defensive manner.

However, starting in 1985 there seems to be a possibility for a cocoa "boom". This is due in part to development programs and better spread of technical assistance, which permits a forecast that in Costa Rica, which has over 65,000 ha of soils suitable for cocoa, it can be expected that, with the help of the State Bank, international organizations and private sector, there will be projects being developed for 1987 of an estimated 10,000 ha. However, in the Atlantic Region, Costa Rica's traditional cocoa region, there has not been a dynamic thrust for organization and rehabilitation of old plantations. We point out that the Atlantic Region has a history of much experience and practice in cocoa cultivation since the establishment of plantations by the United Fruit Co. long ago.

The production situation may be described as follows: until now cocoa has been handled practically as a wild plant with yields of only 250 lbs. per acre, equivalent to 600 pounds per hectare (1 ha equals 2,47 acres). Based on studies for a new phase in cocoa culture using high technology properly applied, it is possible to reach a potential of 2,000 lbs. per acre under optimum conditions and commercial production of 1 MT (2200 lbs) of cocoa per ha.

Regional Perspectives

Industry in the U.S. has shown a real interest in cocoa production in those countries favored by the Caribbean Basin Initiative. The production of the CBI countries, Mexico excluded, is approximately 55,000 tons, of which the Dominican Republic produces about 40,000 tons. If we compare these numbers with the world production of 1.85 million tons, we see that the CBI region is a small percentage of the total.

With projects now in progress, it can be expected that there will quickly be a doubling of producing areas in the Caribbean Basin. This can easily be achieved by reactivation and renovation of old plantings, proper administration, control of pests and diseases, pruning and fertilization. A well-administered system of production, including training of farmers and workers in control of pests and diseases and in the relationship of these problems to weather conditions, is crucial for success of the projects now operating.

Coming back to the subject of prices and demand, a recent study of the Caribbean Basin Initiative shows that cocoa prices may fluctuate in between $2,000 per TM and $1,900 with gradual increases up to the level of $2,400 in the next decade.

Studies show that with modern techniques a cocoa plantation needs an investment of about $5,000 per hectare (approximately $2,200 per acre) during a period of three years when the plantation starts to yield 14 to 20 quintales per hectare, then "in order" to be converted into a venture suitable for investment.

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Market Potential for the CBI Countries

The United States is using between 400,000 and 500,000 TM of cocoa per year and there is great interest that the countries of Central America and the Caribbean be the main suppliers of the U.S. industry for reasons of geographical location, reduced costs of ocean shipping and shipping frequencies to all North American ports. From the Caribbean to Florida sea freight time is 48 hours, and for Philadelphia and New York a maximum of 10 days. On the other hand, what has happened in the past is that due to the production instability, North American factories have not had the proper guaranteed supply of the product, with the exception of the Dominican Republic. However its main product, Variedad sanchez, is not what the market desires, i.e.: new plantations which are expected to produce a better quality bean.

There is interest on the part of the U.S. industry to have an assured supply from the CBI countries. Good cooperation in the technical field has been attained and AID especially has been assisting cocoa programs with studies and missions by technicians. For example, this Forum also represents a combined effort of AID and the private sector.

Regarding this matter, I wish to express my appreciation to a distinguished participant, Mr. B.K. Matlick, Director of the Agribusiness Department of Hershey Food Corp., especially for his comment regarding Costa Rica that reads:

> "....My observations during this trip confirm my feeling that Costa Rica could be a country of high yield and quality in cocoa production. Costa Rica may not be in the short term and probably in the medium term either a significant factor in the world production of cocoa; however, it may be an important factor within the country. Concentration on high yields reduces unitary costs which will produce a profit for the producers. This has been shown to be true in banana production and coffee. Then, the same success obtained in those crops may be applied to cocoa. To attain this, communications must be improved, technology has to be adequately transferred, there is a need for agencies with creative imagination to grant the credit that will be available to the farmers, and administrative management for the farms must be utilized".
>
> "All these basic ingredients are present in this country and, hence, to obtain these resources, both human and financial, a long-term projection with adequate plans is the key to the future development of the cocoa industry in Costa Rica...."

We fully share these ideas. The other matter which is very important to point out is that cocoa quality and proper post-harvest treatment of cocoa beans for the market must be based on the following considerations:

The market for fine cocoa flavor vs. based grade cocoa

Following the study of Consultant G.A.R. Wood, cocoa traditionally referred to as of fine flavor is produced in some countries from Criollo trees or from hybrids made by crosses between Criollos and Foraster type cocoa. This wide group of hybrids usually is referred to as Trinitario cocoa.

This consideration about a specific type of fine cocoa is somewhat like classification of coffee as so-called "other Milds". It is well known that Colombia has established a world class of coffee with a price premium due to its excellent quality, just as the best coffee of Costa Rica has an excellent premium price in the European markets. In cocoa, the same happens, with a difference in that the producing countries have not paid enough attention to this important aspect of production, concentra- tion on the quality required for mixes in the production of fine choco- late.

Today, the world supply of cocoa with fine flavor is estimated at 100,000 tons, compared to total production of 1,520,000 tons, or 6,6%. Wood states that the countries in the Caribbean and Central America should concentrate efforts on the adequate and well studied production of Fine Flavor Cocoa Beans.

Annex No. 2 in three tables provides historical production details for traditional cocoa producing countries. It is interesting to note that at the beginning of this century there was an important production of these cocoas and that there has been a permanent deterioration down to a minimum production of 23,000 tons reached in 1984. What is the reason? Now in the decade of the 1990's it is time to return to the famous Trinitario cocoas to produce chocolate of highest quality.

The Caribbean Basin countries feel that development of these varieties could mean an advantage to the countries, achieving a quality cocoa for which each day there is more demand related to development of the chocolate industry. It is important to distinguish two basic products: cocoa to produce chocolate, and cocoa needed only to extract cocoa butter. These are two absolutely different things. The problem of our time is cocoa quality. We have made a presentation of comments on how to increase cocoa production, but it is not enough just to obtain high yields from the trees. The whole process must be adequate to produce standard quality and in amounts adequate for the chocolate industry.

A study by J. L. Terink of Dézaan BV Company shows there are two main cocoa bean uses that require suitable quality from the world's cocoa crop. Those studies show that one-third of the world's cocoa production is processed into chocolate liquor for direct use in manufacture of chocolate, and two-thirds is made into chocolate liquor from which cocoa butter and cocoa cake (and cocoa powder) are made. Usually, most of this extracted cocoa butter is then used as an ingredient in chocolate manufacture. Thus the industry needs more cocoa butter (approximately twice as much) than is present in chocolate liquor proper. Furthermore, with milk chocolate, which requires a smaller amount of liquor, the ratio is

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approximately 3 to 1 and the cocoa butter added represents about 75 percent of all the cocoa butter present in the product. The worry about the cocoa quality was signaled in a book published by FAO (Doct. No. 60 of Agricultural Studies, by T.A. Rohan, FAO Consultant, Rome, 1963) about the processing of premium cocoa for the market. This document, with more than 200 pages, deals only with the harvest and treatment of the beans after the cocoa has been cut from the tree.

It is a long way from the tree to the manufacture of chocolate and, hence, the present world problem, besides production may well be standardization and quality of cocoa. As has been stated, few have dealt with this, because what is called "bulk cocoa" is used for the extraction of fat, which is 75% of world production. It is evident that there is a continuing concern about the growing shortage in the cocoa world of adequate quality.

In October of last year, a group of investigators of M & M Company, including Dr. David McNair, Research Director of the Department of Chocolate of M & M, toured through Central American and the Caribbean and pointed out the great worry of the new U.S. industry for cocoa quality is that it is now confronted by massive production from Malaysia, which was a surprise. Because Malaysia learned to produce cocoa but did not learn to process it, Malaysian beans have a very high degree of acidity and are not well recommended for manufacturing chocolate. Dr. Silvio Crespo was invited by the Costa Rican Cocoa Products Co. S.A., for a symposium on cocoa held at the Hotel Corobici in December 1985. In his book called "Cocoa Beans Today", he covers all the cocoa qualities and analysis with photos which are very clear, and made a quality analysis for each type of every region in the world. On the other hand, in the same document, Dr. Silvio Crespo talked about the equation which we learned during the above-mentioned seminar. Cocoa must be taken care of for quality from the cutting of the pod through fermentation, drying and classification.

Ing. Alfredo Paredes submitted the following data at the Seminar in San José, Costa Rica:

1000 ripe pods produce 40 kg. of dried cocoa

1000 half ripe pods produce 36 kg. of dried cocoa

1000 green pods produce 32 kg of dried cocoa

Here we clearly see the profitability of cutting cocoa fruit at the proper ripe stage. This will have a direct beneficial effect not only on yield of the plantation, but also in attaining a standard quality for the market, which sooner or later will be preferred by those who manufacture chocolate.

In the study by Dr. Crespo all possible samples of cocoa and all producing regions are analyzed. He concludes that it is difficult for the

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manufacturer of chocolate today to select the proper cocoa of the quality needed for manufacture of fine chocolate, chocolate coatings and other related products.

Since Cristopher Columbus arrived in the New World and the Spaniards drank chocolate in the Court of Montezuma, cocoa has followed a long road. This has been true for Costa Rica in particular, a country which, since the XVI Century, has been producing cocoa in the Llanuras de Matina. In this Forum I wish to recall the statement made by the Minister of Agriculture who said: "Costa Rica, as described by the Tourism Institute, is the complete country" because God has provided us with fertile lands in flat country, coastal areas and highlands where one of the best coffees of the world is produced. Just as coffee is our grain of gold, we think that cocoa must be the golden bean for Costa Rica in the low lands of the coastal area and become for us the fountain of wealth to surpass even the present status of the coffee industry."

I hope that all the participants to this Forum will enjoy the hospitality of Costa Rica and will be able to appreciate the kindness of our country.

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ANNEX 1

DEMAND CONCENTRATION

TABLE 1. DEVELOPMENT OF SEMIS TRADING 1950 TO 2000

	1950/52	1960/62	1970/72	1978/80	1990	2000
	Cocoa Bean Grindings ('000 tonnes of cocoa bean equivalent)					
W. Europe	349	476	542	532	614	655
E. Europe	21	85	217	205	270	330
N. America	275	253	295	166	157	160
L. America*	84	147	177	336	460	550
Africa*	1	16	36	23	29	30
Singapore	0	0	3	9	50	80
Other Asia*	4	11	18	33	135	190
Oceania	10	14	18	15	16	20
World Total	757	1,026	1,453	1,466	1,941	2,295
Importing Regions	656	844	1,111	950	1,136	1,275
Exporting Regions*	101	182	343	516	805	1,020
- Share World Total	13.3%	17.7%	23.6%	35.2%	41.5%	44.4%
	Total Bean Equivalent Consumption					
W. Europe	336	431	517	576	693	777
E. Europe	21	86	231	225	299	385
N. America	293	319	408	357	448	493
L. America	75	118	115	155	235	280
Africa	9	19	89	53	107	142
Japan	2	21	46	37	59	73
Singapore	0	0	2	3	8	12
Other Asia	6	14	22	34	63	101
Oceania	14	18	24	24	29	32
World Total	757	1,026	1,453	1,466	1,941	2,295
	Semis Exports (Imports) in '000 tonnes Bean Equivalent					
W. Europe	13	45	25	(45)	(80)	(122)
E. Europe	0	(1)	(14)	(20)	(29)	(55)
N. America	(18)	(66)	(113)	(191)	(291)	(333)
L. America	9	29	62	181	225	270
Africa	3	6	59	93	103	138
Japan	0	(5)	(11)	(14)	(30)	(43)
Singapore	0	0	2	6	42	68
Other Asia	(2)	(3)	(4)	(1)	72	89
Oceania	(4)	(4)	(6)	(9)	(13)	(12)
World Total	0	0	0	0	0	0

ANNEX 2

Table 1. Production of Cocoa from Traditional "Fine Flavour" Countries

Country	Production (Thousand Metric Tons) 1908/9	1930/31	1982/83
Venezuela	16	16	18
Ecuador	32	14	60
Trinidad	23	27	3
Grenada	5	4	2
Jamaica	3	3	4
Sri Lanka	4	4	2
Indonesia	2	2	9
Samoa	—	1	2
Others	2	1	—
	87	72	100
Total world production	212	532	1520
Fine Flavour producers as % of total	41%	13.5%	6.6%

Source: Gill & Duffus—Cocoa Statistics May 1983

Table 2. Prices on the Hamburg Market
(in marks for 50 kilograms net: 1 mark = 1s.)

	Sept. 20, 1930	Sept. 22, 1928	1901-1905 (average figures for these years combined)
I. Fine sorts:			
Venezuela, Maracaibo	125-135	75-125	81/6-118
Venezuela, Puerto Cabello	75-95		62-98
Java	85-135	—	54-82
Ceylon (Plantation)	75-85	—	—
Samoa	68-82	—	
Ecuador, Arriba	68-74	62-72	65-78
Ecuador, Caraquez	66	61/6-62/6	
Ecuador, Machala	64	60-61	
Venezuela, Caracas-Carupano	52-65	—	—
Trinidad	46/6	58-62	62-73
Grenada	46-46/6	—	58-64
Nicaragua	42-46	—	—
II. Ordinary sorts:			
Bahia	33-36/6	54/6-58	54-59
Costa Rica	33-36	—	—
Dominican Republic ("Samana Sanchez")	—	57-58	51-54
San Thome	30-35/6	56-57/6	49-58
Congo	28-34/6	—	—
Fernando Po	33-34	—	—
Cameroon	31-33	52-55	54-60
Accra	28-31/6	55/6-58	50-53
Lagos	29-30	—	—
Haiti	25-28	—	—

Source: Van Hall, C.J.J. 1932 Cacao 2nd ed. Macmillan.

Table 3. Estimated Supply of Fine Flavour Cocoas 1984

	Thousand Tonnes
Ecuador*	5
Trinidad	2
Grenada	2.5
Jamaica	2.5
Other West Indies	.5
Indonesia*	5
Samoa	.5
Sri Lanka	.5
Papua New Guinea*	5
	23.5

*A proportion of the total production of these countries has been assessed as fine flavour.

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PANEL II

PRODUCTIVITY FACTORS

A. RESEARCH AND EXTENSION
(Original document: English)

Dr. Soria stressed the importance of research and extension in the rehabilitation of cocoa. Latin America is fortunate that research to identify suitable genetic resources began early in its history of production, and that we have a rich source of genetic material to draw from. Breeding and selection was done for both yield and disease resistance characteristics. However, in most cases, research has overtaken extension, causing a gap between the growth of technology and field application. This lag between research and extension is probably an important limiting factor that has delayed the production programme. Some of these new technologies were presented in the papers that followed.

Pablo Buritica of ICA Colombia, gave an overview of his country's rehabilitation effort in the presence of Witches' Broom and Monilia, and the search for new areas for cocoa production. In the traditional areas where, up to 1970 most cocoa was grown, yields were around 1,000 kg/ha. Reduced coffee prices and disease pressures encouraged the substitution of coffee with cocoa in some areas of highland up to 1,200M above sea level where production of 1,500 to 2,00 kg/ha has been obtained. Growth is slow, but disease incidence is low. Similarly, with irrigation, cocoa can be grown in drier areas to escape the high humidity which favors diseases. With necessary management practices, cocoa can be cultivated on many poor soils with high aluminum content.

The importance of the interaction of man, environment and the cocoa tree in the establishment of any agronomic crop was stressed by Dr. Gustavo Enriquez, CATIE Cocoa Research Program Director. The success of any cocoa improvement scheme depends on breeding, extension and the receptivity of the farmer.

Propagation methods in the past have included asexual vegetative reproduction, still practiced in some countries. It has the disadvantages of requiring large quantities of plant material for propagation and skilled and trained labour. It results in a genetic uniformity of stands which could be devastated by diseases, and the plants have a shape that restricts movement through the field. On the other hand, this is the only method that yields true copies of the parent plant.

Vegetative propagation is being replaced by hybrid seed technology, which also has its pros and cons. This method of propagation does not require specialized skills, and is easier to follow. However, the progenies do not all have the characteristics of the parents. Low yields may result from incompatibility, which may be overcome by planting mixed genotypes. Furthermore, progenies are quite variable because of the segregation of genes controlling the difference characteristics of the cocoa plant.

Hybrid seed can be produced on a large scale by establishing clonal gardens with incompatible and self-compatible clones and harvesting only seeds from the self-incompatible parents. Small quantities of seed can be produced by hand pollination. Hybrid seed has the advantage of being easy to transport and, if carefully controlled, free of the danger of disease transmittal. The resulting mixture of genotypes reduces the danger of complete crop elimination by an outbreak of diseases, as may occur with single clones.

Newer systems of plant propagation under investigation are microcuttings, meristem propagation, embryo culture, and cell or plant tissue culture. These methods have not yet proved successful for many technical reasons, principally because the genetic constitution of cocoa is not clear.

Dr. Robert Fulton, ACRI Cocoa Advisor, gave his views on disease control using the cocoa tree as a hypothetical profit centre. By applying the proper inputs in the form of a complete programme package of technology, important cost savings and maximum efficiency could be obtained. Trained teams are required to develop plans for control on the farm, for field sanitation, for survey and detection of "hot spots" of disease and pest outbreak and for economic control of diseases and pests with appropriate biocidal chemicals aimed at proper targets and at the right time. Many control programmes fail due to insufficient data about the causal agent and ineffective application of agrochemicals. Four conditions were outlined to obtain effective control: short trees, good drainage, regular pruning for plant health, and weed control.

Answers to questions from the floor indicated the widespread occurrence of Monilia in all climatic zones, although there may be some moderating effect in coastal regions, probably due to salts in the atmosphere. Wind also influences the dissemination of spores, disease being more prevalent in sheltered areas. In unprotected areas, the humidity is a controlling factor. Monilia can be effectively controlled by fungicides but removal of diseased pods in a cooperative effort across an affected region is economically more effective and has resulted in an 18% increase in production over fungicidal control. A similar response to wind was noted with Witches' Broom, for which the only effective means of control is Broom removal at least twice yearly. Black Pod Rot control can be carried out with copper fungicides, which can be rendered more effective by the addition of "mancozeb" to the tank mix. Various copper formulations were being tested against the various strains of Phytophthora. In every case with Black Pod disease, effective application programmes are the most economical means of disease control.

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There appeared to be some concern about the performance of hybrids in a hybrid mix. One way of guarding against the presence of large numbers of low quality individuals in a plantation is to plant in excess and cut out the bad performers later. Such a technique would not adversely affect the variability desired in the population. Low yielders are a consequence of incompatibility inherent in the hybrid process. It can be compensated for by providing a mixture of different hybrids to assure a high proportion of high-yielding hybrids in a mix. Crosses are generally made after selecting of various high-performing materials, but, there is no means of predicting the characters of the individual progenies. Evaluation of the commercially desired characters of hybrids is beirg carried out. There is some fear that Forastero crosses will provoke flavor deterioration.

Alex Lόpez
Rapporteur

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PANEL II

PRODUCTIVITY FACTORS

A. RESEARCH AND EXTENSION

NEW FRONTIERS FOR COCOA CULTIVATION

Pablo Buritica Céspedes

Introduction

Cocoa cultivation has traditionally developed in flat areas, with alluvial soil, deep, chemically rich, and a climate with a high rainfall (2 to 4 m/year), an average temperature of 28°C and elevations below 800 m.a.s.l. These characteristics are stated in most of the documents which promote cultivation of cocoa.

However, during the most recent years, for various reasons the cultivation has moved towards zones that do not fit this model. However, success has been significant. In this paper we intend to show those tendencies and their technological strategies. Only Colombian cases are herein presented, but it is likely there are parallels in other countries.

Characteristics of Cocoa Development Before 1970

First of all, keeping in mind the Indian traditions, the following areas were expanded: in the Pacific Coast, the Tumaco zone; in the Caribbean region, the zone of Sierra Nevada de Santa Marta; in the region of the Inter-Andean valleys, the Upper Magdalena; and in the region of Orinoquia and Amazonia, the piedmont zones, just to mention a few examples. In later years, as a result of the identification of the cultivation needs, this was expanded to the areas of alluvial valleys such as the Cauca Valley, Urabá, and the low lands of the Occidental, Central and Oriental mountain ranges. This happened because those zones are considered as class A soil and they were given priority for colonization. As it is known, cocoa is a cultivation useful in colonization, among other things, because it allows "Pancoger" agriculture, the beans once dried can be kept and sold in suitable times, when profitability is high. But plantations were made applying technology that, in view of present knowledge, was inadequate or ignored factors which negatively affected production such as diseases. For that reason, cultivations have been changed to other crops, which in those soils were comparatively more profitable, using as a base a cocoa production of 100-200 kg/ha. In the Cauca Valley, cocoa was replaced by sugar cane, in the Magdalena and Urabá by banana cultivations, in the foothills by coffee, and so on. Recently, the same phenomenon has been observed elsewhere. In Ecuador they are eradicating non-productive cocoa to plant soybean and sorghum.

Cocoa Development After 1970

Return to the primary zones

After cultivation out of the rich zones achieved only low productivity, research made possible a resumption of cultivation in those zones through optimization of productive resources, especially, management capability. Better knowledge of the cultivation potential, management of technogical limitations, especially diseases and, in general, thorough application of high technology practices have resulted in today's average production of over one ton per hectare. Government incentives, such as taxes, credit, etc., have been factors that permitted cocoa cultivation to compete sucessfully with other cultivations that were considered high-yielding. Thus has been destroyed the idea that it was a mistake to have planted cocoa in these zones.

Cocoa and Elevations

Since the arrival of the coffee rust disease in Brazil and coffee over-production in the country, the Federation of Coffee Producers started a diversification program which, as part of the strategy, included cocoa cultivation. This program started to develop cocoa in the coffee zones. The success was such that the coffee farmers started to apply coffee technology to cocoa, so that they obtained average production of over 1500 kg/ha and it is not unusual to find farms with average production of over 2000 kg/ha. However, they have carried cocoa to elevations up to 1.200 m.a.s.l. It is important to point out that the topography of those zones is highly rugged. As a permanent tree crop cocoa cultivation has many benefits for these rugged areas since it provides some of the same benefits in soil and water conservation and environmental protection as are provided by reforestation.

Cocoa, when cultivated in higher elevations, presents slow growth characteristics. This allows more trees per hectare. Disease incidence is lower, as cycles are longer, and management is much easier than in low lands.

In the Andean zone there are big areas in between 800 and 1200 m.a.s.l. that could be incorporated to cocoa production.

Cocoa in Dry Zones

As was mentioned before, cocoa has always been associated with the humid tropics. In zones with rainfall above 4 meters per year, where Moniliasis and Witches Broom are present, economic production of cocoa encounters great restrictions on commercial plantations, due to the intensive use of labor for control. It does not happen this way with small farmers who use family labor.

Looking for zones where control of Moniliasis and Witches' Broom would either be of no consequence or of easy management, producers have moved cocoa cultivation to areas of low rainfall: 1-1.5 m per year. For those zones, it has been necessary to establish two strategies: one, to introduce irrigation for this cultivation, and second, to plan shade design to avoid direct exposure of the plant to the sun's rays. Several zones in the Huila and the banana area of the Magdalena are typical of this situation.

Cocoa produced in those zones is of optimum quality and the healthy condition of the growth has improved to a point where diseases are not present. Given a good level of shade, entomological problems are not important.

Cocoa in Chemically Poor Soil

To analyze these new frontiers, two soil types should be considered: saturated and non-saturated with aluminum.

The first case is present in the zone of Lebrija, in Santander, where there are acid soils (when there is soil) and chemically poor. This zone produces a great quantity of chicken manure. Cocoa trees are planted in holes of big dimensions and conditioned with chicken manure and other organic material mixed with soil. Later, a regular chemical fertilization plan is followed. Productions of 1000-1500 kg/ha have been obtained.

The second case is represented by the medium and high plains of the Llanos Orientales. There are soils of excellent physical properties, but chemically poor, in addition to having high saturation of aluminum. At first in these zones, forests in corridors were utilized, enriching the soil with residues from the cattle corrals. Plant development is slow and requires regular chemical fertilization, but production is between 800 to 1000 kg/ha.

Conclusions

From the view given here it could be thought that cocoa could be grown in any zone below 1200 m.a.s.l., in a strict sense. This statement is true only if the cocoa tree is considered, but in the countries where there are biotic problems like diseases (Moniliasis, Witches' Broom and Black Pod), there are economic limitations for control of those problems. Then, zones of high rainfall (4 m/year) are therefore eliminated. For the balance of the zone cultivation of cocoa is feasible.

Keeping in mind that the South American continent is crossed by mountain ranges or cordilleras (with the exception of Brazil) there are zones of moderate climate and with elevations and climate which allow the

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planting of cocoa. In those zones, there is the highest population density and traditional cultivations, like corn and beans, present productivity problems; besides, in some countries those are the coca producing zones. Cocoa cultivation is then a desirable economic alternative.

In the development of countries with tropical conditions, there are in dry zones more and more irrigation projects. Generally it is considered that rice is a monopoly cultivation for the irrigation districts. When rice and cocoa profitability are compared, and when the secondary benefits from cocoa cultivations (firewood, bananas, fruits, etc.) are considered, the possibility is seen that water may be more efficiently used to irrigate cocoa than rice. There are then many advantages in including cocoa as a crop for the irrigated zones.

Finally, in the poor soil zones, simple encouragement of chemical fertilization would open new frontiers for cocoa growth.

We are facing a product which is a development alternative for Latin America.

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PANEL II

PRODUCTIVITY FACTORS

A. RESEARCH AND EXTENSION

RESEARCH RESULTS: PROPAGATION, MICRO-PROPAGATION AND PROSPECTS
(Original document: Spanish)

G.A. Enríquez

Within the key factors of cocoa production, environmental factors such as temperature and rainfall distribution are the ones that determine adequate areas for growing cocoa in the low humid tropical zone. This zone has other restrictions, as well, like soil fertility, gradient, drainage, physical characteristics, etc., which reduce land use even more. Also important, within these areas, is the competition from other crops, which have similar requirements to those of cocoa.

Another very important factor in production is man, which will not be analyzed on this occasion.

The third important factor is the cocoa plant, whose origin is well known by all and is localized in the zone of High Amazonas in South America; however, it is in the South zone of Mesoamerica that it was domesticated and given a utilitarian use. This domestication seems to have been long ago, although its growth expansion is very limited.

Presently, large scale development programs must be supported by broad knowledge of the plant and the availability of a sufficient quantity of suitable material to satisfy the requirements of the project.

Today, there are many types of materials with excellent propagation potential such as seeds, plants of rooted cuttings, buds and scions. Material for asexual reproduction have undoubtedly been the basis for research programs, for clonal seed gardens and for preserving genetic diversity in germplasm banks.

Asexual propagation methods have played an important role in the development of model farms with high yield, like a few we all know in each one of our countries. However, due to many factors, its use has been restricted to only a few places and presently it is not used as a means for large-scale development of cocoa. Among the factors of why it is of so little use we could mention the following: a) limited material available for reproduction; b) special installations required for its production; c) the need for highly specialized personnel; d) intensive use of labor; e) the risk of having genetically uniform material which can be affected by diseases like "Mal de Machete", caused by Ceratocystis fimbriata, and other diseases; f) it cannot be easily adapted to the production systems generally used by farmers in cocoa areas, and g) the plants are difficult to handle in the field because of typical growth habits of rooted cuttings, and when farmers seek to change the tree form through pruning, production is significantly delayed.

Most of the countries that have tried these clonal materials in their development failed in their intent and had to look for another method that of the hybrid seed, with which we have seen spectacular developments in the Ivory Coast, Malaysia, Brazil and other American countries.

In the past, the farmers selected their own seeds from the best trees on their own property or from their neighbors. This is the slowest but most effective improvement method which cocoa-producing countries have used in their long history of cultivating this crop.

With clonal selections carried out in the first decades of this century, and with the formation of germplasm banks and gardens for asexual reproduction, farmers started to sow cocoa seeds of those clones giving better results than the "common seed" they had been using. This was especially true when the pods were taken from clonal collections, where there was high possibility of crosses between cultivars with high combining ability, general or specific, but there was no consistency in the results, due to the fact that pollenization was not controlled.

During the 1930's, Trinidad started to look for material resistant to Witches' Broom and as a result of that research, the sowing of hybrids was initiated in the mid-century to be tested against the disease. Soon the researchers realized that the "clonal seed" or seeds produced from open pollenation was not as good as seeds from some of the controlled pollenations, some of which had shown very high yield precocity and good agronomic characteristics.

During the last 40 years agricultural experiment stations have planted hybrids produced from parent clones promising different characteristics. The characteristics most often chosen are: a) resistance to diseases, b) seed size, c) quality, d) broad adaptability and, e) high rusticity. In each country, results have been very promising and it has been possible to select a number of hybrids suitable to the needs of the farmers in each region or country.

Some hybrids have had wide adaptation and they have been adopted by several countries for their development programs.

Among the inconveniences that have been found within these planting materials are: a) incompatibility problems, which are solved by using a mix of different crosses with a wide range of factors to assure compatibility and crossing between the seedling plants and b) wide variation between or among plants of a single cross or family. This situation results in having to retain the low-producing trees for a rather long period of time until they can be identified and eliminated or replaced.

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During the last few years the experimental stations have tried to select hybrids as uniform as possible and with few low yield trees, which strongly reduces the % of selected crosses to be passed on to the farmers. One way to solve this inconvenience has been to plant between 1,500 and 2,000 plants per hectare (between 5 and 6 m^2 per plant) with the purpose of eliminating the less desirable plants, allowing an adequate final population, with very precocious production and high yield. The pattern for these plantations both for cocoa and for shade has required some small adjustments to the circumstances.

Commercially, it is possible to obtain the hybrid seeds through several methods: a) for those countries where the development plans are ample, like Brazil, the Ivory Coast, to mention just a few, it has been required to have large seed production gardens, in which,taking advantage of the incompatibility of some parents, it is possible to obtain adequate combinations. However, under those conditions, the number of crosses is low and the pattern of the garden should be carefully studied. It is also very important to keep the plantations isolated for the purpose of avoiding contamination with pollen from other cocoa types, and b) for less-developed countries, as is the case for most of Central America and the Caribbean, the seeds may be produced by hand pollenation, which guarantees the cross and also increases their number. This substantially improves the elimination of the problem of incompatibility or the development of a disease epiphytotic, which can put an end to a very uniform plantation, as happened some years ago with the Clementina Farm in Ecuador, whose disastrous effects were known all over the cocoa world.

If genetic purity is to be guaranteed, it is necessary to cover the two flowers before they open. This step greatly increases the cost of the seed due to the work involved in the preparation of the materials. If the studies are genetic ones, it is necessary to do it, even if it is a little more expensive.

The practical method to prepare seeds for the farmer does not require covering both flowers, but rather making sure that every open flower is eliminated the afternoon before pollenation. If, at the same time, an abundant pollenation is made, with 2 or 3 rubs with the stamens, the maximum percentage of contamination found is 5%, which does not commercially affect the mixing of the hybrids.

The new methods for sending the seeds and the speed of commercial interchange or transportation facilities have permitted the transport of certified hybrid seeds to practically any place in the world, with a very high germination percentage, provided certain aspects of normal seed handling are carried out, such as the material in which it is sent, and the keeping of temperatures more of less constant between 15 and 20°C. Cocoa seeds are very sensitive at temperatures below 10°C and above 40°C, and seeds are killed in a relatively short time.

One restriction of free movement of these genetic materials is the possibility of carrying diseases with the seed. However, it is known that very few diseases are transmitted through the seed, such as some viruses and Witches' Broom, caused by *Crinipellis perniciosa*, for which

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there is some evidence of transmission. In this case, what should be done is to avoid transporting seeds or genetic material from places where those diseases are prevalent, to places free of them. There is no scientific evidence of the possibility of carrying other diseases through the transport of certified seeds. What is really required is to completely eliminate the carrying of pods from one area to another.

To transport seeds and plants from a place where viruses or Witches' Broom are present, it is required that they go through a quarantine station, like the one at Barbados, Miami or Kew in Great Britain. These small plants from seeds or clonal materials should be observed for some time in their final destination, by qualified personnel, for any symptoms of disease.

During the last decades, work has been intensified to obtain cocoa plants through reproduction in vitro. Success in this work will favor the propagation of large quantities of plants with known genotypes.

The results of those methods are not yet known. Perhaps the most important problem is the fact that only a few researchers have been making an effort to solve the problems that those methodologies have presented.

The reproduction of micro-cuttings could be utilized, as is done with other cultivars (coffee, potato, etc.), that guarantees genetic purity and absence of diseases. However, very little has been so far developed with this system, since the presence of substances in the media have prevented its development in a practical way. Frequent washing of the material and the presence of an absorbent material and adsorbents, have produced a notable improvement; however, there is not yet a practical known method to insure a clonal reproduction in massive form.

The in vitro development of embryos, which normally would not have developed with or without the cotyledon, has permitted obtaining plants which otherwise could not grow and has permitted the development of little haploid plants to a certain age. These plants with only one genome have been utilized to obtain more uniform diploid plants through the use of colchicine. These plants could serve to obtain more uniform hybrids and help overcome the problem of great variability of the interclonal hybrids, as those obtained today. This plant to plant variability has been one of the controversial points for their direct use by farmers. However, more basic research is needed, because the diploid plants so obtained have shown in their descendants a certain segregation which raises doubts about their genetic uniformity and their direct use will take more time, until their characteristics are carefully studied.

The development of "meristems" and their multiplication by in vitro methods has not had much success, mainly due to the media contamination; however, if a quick and practical methodology could be obtained, it would be one of the most efficient methods to free the material from fungus or virus diseases. Plant reproduction in large quantities would be simpler, which would help crop improvement and genetic material interchange among countries.

The development of unfertilized ovules and the development of tissues from pollen grains would permit the improvement programs to speed up the practical work. To this must be added the possibility of making crosses in vitro and massive multiplication of these materials.

At present there are many problems with the normal development of tissues or cells of some cocoa parts, especially cotyledon cells. Even when some growth has been obtained, its genetic constitution does not seem to be similar to the original, as the obtained products (oils) of this group of cells does not have the same characteristics as the original material. In this case, it could be that the problem is in the genetic constitution of cocoa, which has been discussed on various occasions in cocoa conferences, but which has not yet received the needed attention. This problem is that of the possible polyploidia of cocoa. This is a priority area for research. Clarification of the polyploid question will help to explain results encountered by most researchers who are working in vitro with tissues or with cells of other organs of the cocoa plant.

The lack of development of embryos or little plants or embryos of cells of different origin may originate in the disorder of the polyploids in their reproductive cells. This condition has already been observed by several scientists for many years. If events taking place at the level of cellular reproduction were better understood I am sure scientists soon would take additional steps to make it easier to propagate cocoa through in vitro methods, and then surely would be able to have cellular fusion of haploids and diploids, and be much closer to being able to transfer characteristics from one clone or cultivar to another or from other species of Theobroma or even from genus Herrania. The resulting benefit would be the ability to transfer disease resistance and characteristics for bean quality and desirable agronomic performance.

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PANEL II

PRODUCTIVITY FACTORS

A. RESEARCH AND EXTENSION

PEST MANAGEMENT IN COCOA

(Original document: English)

Robert H. Fulton

The quiet time bomb that can affect today's cocoa plans and projects is that of technological change. In pest management (disease, insect, weed) we already know that certain basic in-puts will resolve problem X or Y, but in most cases we are shackled by attitudes, myths, and in specific cases, lack of hard economic facts. To be successful we must not only accept this impending technological change, but help to implement such change. In pest management there are several basic areas which we can use as guidelines for thought, planning and action to weld together inexpensive and successful management programs.

The Tree, the Profit Center

For years cocoa growers and researcher alike have focused their attention on planting densities and pod numbers with little agronomic interest in hedgerow/trellis concepts or tree shaping and height for efficiency in such practices as spraying, sanitation or harvesting. The world's tree fruit industries have completed this "turn-around". It was simply critical to their survival so they could stay competitive in today's world markets.

In harmony with this needed and hoped for "New Thrust" in cocoa will be pod production - not the plain mechanics of pod numbers, but the profit factor of bean weight to pod/husk ratios. Four to six pods per one-pound yield of dry bean is more profitable than using 10 to 20 pods to reach the same marketable goal, for riding in the balance on this theme of efficient production are such economic savers as reduced spraying cost and the plain logistics of harvesting.

The Program Package Concept

The Program Package Concept is our long term strategy in rhythm with the hedge-row/tree shape theme. The package concept is the "nuts and bolts" of the operation. There are required input units at each level or growth state of the operation. For example:

a. soil analysis, drainage profiles, and mapping;

b. flexible labor forces for installing drains, pruning, weed management;

c. followed by efficient, trained teams for field sanitation, pest survey/monitoring to fine-tune the overall spray program block by block or farm by farm. Remember, each farm area has its own personality profile.

Chemical Usage, the Target Approach

Chemicals for agriculture are used to produce an economic benefit. Their use in cocoa, especially for disease management, has not been outstanding. Explanations for these shortcomings strike at (1) the hydrophobic surface properties of the basic targets - the pods and young flushes, with (2) the next key being the need for fungicide formulations that are not only compatible with these target surfaces but which are highly biocidal and tenacious as well. In layman's language, a blend of chemicals that, when transformed into spray droplets, won't bounce off the targets but will spread and stick during rain-water flow patterns and give good protection. In the past zero attention has been given to the hydrophobic nature of the disease-prone cocoa pods and flushes. So, today we are designing formulations to fit this cocoa need.

Remember, however, for chemical input systems to be effective, what do we need? We need short trees, effective drainage systems and timed sanitation sweeps. Importantly, each field practice, harmonized with the tree and season, becomes more and more "accumulative" with time. This in turn will demonstrate the desired economic return required for growth and rehabilitation of the cocoa industry.

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PANEL II

PRODUCTIVITY FACTORS

A. RESEARCH AND EXTENSION

Observations by Dr. Jorge Soria
(Original Document: Spanish)

The contributions we have heard have brought a series of interesting ideas to those who are involved in any way with cultivation of cacao.

Dr. Buritica's report for example tells us that we have at times preached too positively that the optimum climatic conditions for cacao are to be found in the humid tropical areas. He has pointed out that some of the disease problems, especially those which can't be easily managed as controlled in the very humid tropics, may be evaded by extending somewhat the traditional ecological cultural limits, going for example into drier zones, provided irrigation is available, or by going into higher altitudes.

An example of better management of Moniliasis is evident in Costa Rica. In Turrialba, which is at higher altitude than La Sola, the incidence of Moniliasis is much less, possible the result of a difference in average temperature or some other factor.

Likewise in Moniliasis-affected areas there are advantages for its control to be had by planting in zones that have a dry season rather than planting in the extremely humid zones.

Dr. Buritica also mentioned the very interesting fact that in areas affected by Moniliasis high production can still be obtained by following a good program of plantation management and he demonstrated this with data and slides.

In relation to Dr. Enriquez's presentation, perhaps the only thing I can add is that those of us who have worked in the field of genetic improvement have a very clear view that both types of improved planting material, vegetatively propagated clones and hybrids, can give good production and also tolerance of diseases. The choice of which type planting material to use depends on one of the factors that Dr. Enriquez mentioned: who is going to manage the planting? The man and the economic parameters under which the plantation is to be established and managed must be the deciding factors.

As for the clones, it is certain that the matter of genetic uniformity must be considered. Nevertheless this isn't really all that limiting since plantings can be made with mix- tures of clones. The clonal mix also will give a range of variability as will the hybrids. Also the clones must be well managed and one must know the degree of their incompatibilities in order not to create clonal plantings whose yield will be affected by these incompatibilities.

With regard to hybrids, Dr. Enríquez made very clear statements. We know that the hybrids segregate and the fundamental reason for this is that, with cacao, it has been very difficult to obtain pure lines from which uniform hybrid progeny seedlings could be obtained. Therefore we have had to turn to working with genotypes, which we know to be heterozygous, but which in tests have shown hybrid vigor which is manifested in various forms, including productivity.

Nevertheless, I believe also that one has to keep one thing in mind. Tests have been made in Costa Rica and in other places in which the best clones and the best hybrids were compared and always it has been found that both materials are excellent. With the hybrids, someone is going to say there is a high proportion of plants of low productivity. Certainly. And also there is a high proportion of plants of high productivity, but don't forget that we are working with a population, we have to judge the population by the average for that population, and the average production of the good hybrid population is greater. It is good to have these aspects very clear and well understood and not enter at times into discussions that don't coincide well with present knowledge.

The contribution of Dr. Fulton was to me very interesting. He gave us a series of lines for future research, by researchers including those who are working toward genetic improvement: for example the search for plants that will have a lower growth habit and that have larger fruits which would reduce the total area that has to be covered with protective fungicide and also would reduce the areas of greatest potential infection.

For possibly changing the plants' architecture there are not yet available to us any genotypes with the desired characteristics, but yes, there is a big natural variation in plant height.

As for the size of the fruits, there is much information available on this subject. A considerable number of selections of clones and plant materials which bear large fruits are known. There are several thesis studies made at Turrialba which show that there is a high heritability and transmission of pod size. Dr. Fulton gives us a series of possible research directions which we can follow and try to work toward the desired goal, such as, for example, management of the plantation so trees can be kept low and thus more effectively managed. There are no known genetically controlled characteristics for low plant size, but pruning and other management practices can achieve the same end.

Logically we must experiment, we have to conduct research studies, and these will give us results for the near future.

With this I complete my statement. I open the Forum for questions to and replies from the members of the panel.

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PANEL II

PRODUCTIVITY FACTORS

B. CROPPING SYSTEMS AND CULTIVATION PRACTICES

(Original Document: Spanish)

With your permission I will summarize and make some comments on the papers.

In this section of the panel we have had the opportunity to hear about some experiences, from Costa Rica as well as from places outside the Hemisphere, such as the Philippines and Hawaii. The experience of Costa Rica involves putting into practice the technological package developed by CATIE. Application of these recommendations will give very positive results.

The work presented by André covers part of what had been discussed this morning, with regard to segregation within the hybrid seedling populations. This is something that has been presented in technical papers by several specialists. What I would like to do, perhaps to eliminate any doubt, [illegible] stress that we must not focus our attention on the weaker seedli[illegible] a population, but concentrate instead on average performance wit[illegible] that population. What interests the farmer is production per unit of area.

At CATIE an experiment was done comparing within a hybrid the weakest trees, up to 6 months of age, with the most robust trees, and comparing them as well with an unselected population of the same hybrid. The results showed that selection, done at an early age, can solve the problem of low-producing segregants.

Likewise, Dr. Enríquez explained that in experiments with high density plant populations, elimination of the weak trees also favors the remaining trees in maintaining their productivity.

Use of the best trees among the groups of high producers for vegetative propagation seems to me a good idea, and one that is already being applied.

But the experience of those of us who have worked in improvement and production of clones is that in this case we are dealing with phenotypic expression of the tree. When these mother trees are multiplied vegetatively and placed as clones in experiments to test performance, a great proportion of the trees, which in the field appeared to have high production capacity based on the mother tree performance, don't maintain this characteristic as clones.

This situation will be controlled by the phenotype, but it is necessary to take into account the effects of the environment as well. Therefore this material has to be tested in planned experiments to be able to recommend with certainty that it will be excellent material.

The presentation of Helfenberger on new alternatives for plantation management, a paper complemented by that of Dr. López, is an innovate contribution. As I understand it, these new alternatives will require high technical skills and specialized management. I believe it could be recommended if the farmers are able to use it, but it is necessary to take into account very, very clearly the type of producer, the economic capacity and ecological conditions of the location in order to be able to apply this technology appropriately.

The experiment they are carrying out in Hawaii is very important. It is interesting because here also we are going into an area that ecologically is not among the areas suitable for cocoa. But if it is given technical management, I believe the results are going to be rather interesting. The important issues are those outlined by the author of the paper, specifically that the technical management must be closely related to 1) selection of the plantation sites; 2) the varieties or cultivars they plan to take to Hawaii; 3) their adaptability there, and 4) the types of farmers who will be managing the plantings.

It will be interesting, in a few years, to know the results from these two innovative proposals. We will need to have data covering a period of time, since we must remember that cocoa, as a perennial crop, can't be judged on the basis of one or two years of results. Data covering a series of years are required.

In conclusion, I believe it is a very interesting situation and we will have to be very alert to see whether the results can be applied here in tropical America.

With this I close my review and open the Forum for questions.

Jorge Soria,
Rapporteur

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PANEL II

PRODUCTIVITY FACTORS

B. CROPPING SYSTEMS AND CULTIVATION PRACTICES

AGRONOMIC PRACTICES FOR COCOA CULTIVATION IN COSTA RICA
(Original Document: Spanish)

Oscar E. Brenes Gámez

For many years cocoa cultivation was carried out by traditional producers who, in spite of having, within Costa Rica, one of the best technologies developed by IICA and now CATIE, were not interested in using that technology. They continued to be simple cocoa "harvesters".

However, at the end of the seventies and during the eighties, the expansion of cultivation into other zones of the country, strengthening technical assistance and management services, increase in profitability, and the appearance of Moniliasis combined to stimulate use of improved technologies for cocoa cultivation.

The main components of this technology are the use of genetically improved planting material, proper utilization of shade, increase in tree density, application of fertilizers and control of weeds, diseases and plagues of cocoa.

In the following, I will present some of the outstanding aspects of our recommendations for those components, which are being carried out by the farmers and are the result of about forty years of research in our country and much longer in other countries like Trinidad, Ecuador, Colombia, and Brazil. They place major emphasis on cultivation systems and agronomic practices.

Improved Genetic Material

As a result of the research, it is recommended to plant "hybrid" seed from interclonal crosses. These crosses have been selected through the evaluation of 23 experiments in which 238 crosses were tried, taking as a base its precocity, resistance to disease and plagues, and an optimum production of about 1500 kg/ha of dry and fermented cocoa (see Table 1).

Table 1: Cocoa hybrids utilized in the production of hybrid seeds, CATIE, 1986

Father / Mother	1 UF-29	2 UF-613	3 UF-654	4 UF-667	5 UF-668	6 Pound-7	7 Pound-12	8 SCA-12	9 IMC-67	10 Catongo	11 SPA-9	12 CC-18	No. of hybrids in which it acts as mother
1. UF-12						■			■				2
2. UF-29		■		■	■	■		■	■	■			7
3. UF-296												■	1
4. UF-613						■	■		■		■		4
5. UF-654						■							1
6. UF-667								■	■				2
7. UF-668						■	■		■				3
8. UF-676									■				1
9. UF-677						■	■		■				3
10. EET-48								■					1
11 EET-62													
12. EET-95													
13 EET-96								■					1
14. EET-162								■					1
15. EET-400								■					1
16. Pound-7		■		■	■								3
17. Pound-12	■			■	■								3
18. ICS-6								■					1
19. IMC-67		■	■					■					3
20. SPA-9		■											1
21. Catongo						■	■						2
No. of hybrids in which it acts as father	1	4	1	3	3	7	4	8	7	1	1	1	44

■ Make the hybrid

□ Does not make the hybrid

Prepared by:

W. Phillips

Presently, there is in Costa Rica a Certification Program for Cocoa Seeds, supervised by the National Office of Seeds, which has permitted the production of those crosses in other farms besides CATIE, through artificial pollination. To avoid problems of autoincompatibility, a great number of crosses are produced with a wide range of parents. It is furthermore recommended to plant mixtures of at least five crosses. This immediately prevents problems of genetic homogeneity which occurs when vegetative propagation is utilized.

Proper Use of Shade

In Costa Rica cocoa is usually planted using seeds. The seedling develops a vertical main stem. After about 10 to 16 months of growth this vertical stem develops a group of 4 to 6 principal lateral branches (the jorquette) from a whorl of axillary buds. Further vertical growth may be continued through production of chupons or suckers but it is recommended these be eliminated in order to leave the tree with only one main branching level or story at approximately a one meter height from the ground.

This type of growth of the cocoa plant, and the general recommendation to have the trees at 3 x 3 meters, allows interplanting with other crops of rapid growth, which are cultivated during the first and second year of the cocoa plantation. This system has the advantage of producing additional and quicker income than from the cocoa plantation alone, is useful against weeds, taking advantage of the free space between one plant and another, and reduces erosion.

The crop most often interplanted with cocoa is corn (Zea mays), which is established before the cocoa is planted and is harvested after 120 days. Utilizing corn, yields up to 1000 kg/ha are obtained.

Other plants which are interplanted with cocoa are Ipecac root, beans, ginger, and "tiquisque" (edible root crop).

On the other hand, there are species which do a double function; besides using the free growing space, they also serve as temporary shade for cocoa (such as banana, papaya, manioc, pigeon pea, castor bean, Tephrosia, and Crotalaria). The last two, though not producing income, are nitrogen-fixing legume species beneficial to the soil.

Banana is the most recommended temporary shade but the high incidence of Black Sigatoka disease, caused by Mycosphaerella fijiensis var. diformis, in some areas of the country has diminished use of banana because of the costs of fighting this disease. However, it has been pointed out that with good management the plants may give good yields during two or three production years which coincide with the period the banana plants will be needed for temporary cocoa shade. This good management includes weed control, fertilization, pruning of shoots, fortnightly leaf removal, application of insecticides and nematicide and, if necessary, chemical spraying against Black Sigatoka. Banana shade trees must be removed during the third year of life of the plantation to avoid competition with cocoa. The expected yield from bananas associated with cocoa could be 700 bunches per hectare in the second year and 1400 in the third year. However, an experiment at Turrialba obtained the equivalent of 1364 bunches (34.1 Metric Tons) the second year, 1924 bunches (48.1 M.T.) in the third year, and 672 bunches (16.8 M.T.) per hectare in the fourth year per hectare planted to cocoa with temporary shade of the pelipita variety of banana and permanent shade of laurel (cordia alliodora).

Another plant which could be used as temporary shade is pigeon pea (Cajanus indicus) which could be planted at a distance of 0.75 - 1.00m from the cocoa plant, employing 3 to 4 pigeon pea plants for each cocoa plant. Pigeon pea in the South Zone has produced up to 40 quintales, about 1840 kilos, of green pods per hectare.

At the moment of initiating cocoa planting, we must consider the planting of permanent shade. This is one of the most important factors, as it gives protection to cocoa plants from direct and full solar radiation, and from strong winds. It also inhibits development of weeds, incorporates organic material, avoids sudden changes in temperature, and helps to maintain uniform humidity in the air. By the time temporary shade is eliminated, permanent shade must be well developed and uniformly distributed.

In the last few years in Costa Rica, new cocoa plantations, located in areas where shade was not provided, have higher damage due to the complex Monaloniun-Anthracnose which is in part the cause of dieback. This has damaged the cocoa plant development, slowed growth, caused death of many plants, and prevented the maintenance of sufficient foliage for good production.

One of the best species utilized as permanent shade is the giant poró (Erythrina poeppigiana) which is planted at 9 x 9 meters, using seedling plants or stakes. Starting in the second year, yearly pruning of permanent shade should be carried out to avoid an excess of shade, by eliminating lateral branches up to the third fork and between 30 and 40% of the foliage per year.

Guaba (Inga sp.) is another tree which could be used as permanent shade and which has the advantage of being an excellent source for firewood. It is propagated by a rapidly growing seed and its leaves fall down during the whole year, providing great quantities of nutrients to the soil.

In a study carried out in the Brunca Region of Costa Rica, it was established that many farms have cocoa associated with fruit trees, especially avocado (Persea americana), orange (Citrus sinensis), Mango (Mangifera indica) and rambutan (Nephelium lappaceum).

In the zone of Upala besides poró and guaba, other trees have been utilized as permanent shade, such as the Madero negro (Gliricidia sepium), Cedro (Cedrella sp.) and Laurel (Cordia alliodora).

One of the associations which is increasing especially in the Atlantic Zone is cocoa-coconut, thanks to the experience in other countries and the availability of hybrid coconut seeds of greater precocity and higher production than the common cultivar. With this system yields of up to 23,800 nuts per hectare may be expected, starting with the 8th year of planting the coconuts.

Planting Density

Traditional cocoa plantations in Costa Rica were established with spacing of 5 x 5 and 4 x 4 meters. In spite of efforts over the last few years to increase density, it is estimated that about 60% of plantations still have a low number of trees per hectare (500 plants/hectare) which is made worse by failure to have done proper replanting.

Today the most common recommendation is that the distance be 3 x 3 meters or 9 m^2/plant, to obtain a density of 1,111 plants/hectare. However, CATIE has carried out research with densities of 1667 and 2500 plants/hectare, obtaining good results during the first few years of the planting, but after about of 8-9 years a great quantity of trees must be eliminated, to avoid a reduction in yield due to competition. It is difficult for the farmers to accept this practice, especially for small farmers (less than 50 hectares), who represent 49.1% of the total number of cocoa producers; that is why the recommendation to plant at 9 m^2/plant is maintained within the Promotion Program. This recommendation is also carried out in Brazil and Colombia, where small farmers predominate.

Application of Fertilizers

The use of high planting densities in intensive production systems of cocoa mixed with other species requires applications of fertilizers to provide the nutrient needs of the plants. The recommendation as to quantity to be applied must be based on chemical soil analysis. Through an interpretation guide prepared by CATIE, the level of soil fertility is established as low, medium, or high for the main elements. Based on this interpretation the amount of fertilizer to be applied in kilos per hectare per year is stated. Thus, for a soil which is low in phosphorus, potassium, and sulfur, medium in nitrogen and high in calcium and magnesium, a plantation under production is advised to apply 80kg of nitrogen, 60kg of phosphorus, 150kg of potassium and 150kg of sulfur per hectare per year. It is necessary to make 3 or 4 applications per year, taking into account the rainfall pattern and the growth state of the cocoa plants.

Fighting Diseases and Plagues

The presence in Costa Rica of fungus diseases like Moniliasis (*Moniliophtora roreri*), Black Pod (*Phytophthora* sp.) and "Mal de Machete" (*Ceratocystis fimbriata*) requires that the farm have a weekly program to fight and eliminate diseased fruits, in the case of the first two diseases, and to avoid and protect cuts or wounds when pruning or budding in the case of *Ceratocystis*, which could cause death of the plants.

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Of the three diseases, Moniliasis is the one which has caused most losses during the last few years, due to its high incidence and easy propagation and spread. At this time research carried out,and the experience in countries like Ecuador and Colombia, allow us to live with this disease and to obtain a proper profit, so as to continue promoting cocoa activity. We should point out that in 1978-79 production was 955/MT/ha by weight, in 1982-83 production went down to 2,317, however, in 1985-86 it reached 4,051 MT.

In our country, damage caused by insects is less severe than damage from diseases and only occasionally do insects produce relevant losses, when there is some ecological imbalance. Damage by Monalonium, mentioned before, may be corrected by using proper shade, but if it is not possible to adjust shade immediately, then application of insecticides like Thiodan (Endosulfan) is required. This makes management of the plantation more expensive.

Another one of the serious plagues, in some areas of the country, is the existance of "taltuzas" (Orthogeomys cherrieri), which could damage up to 60% of the plants. Use of traps has been the most efficient method to control them in small areas or after chemical attack in larger areas.

Weed Control

Control of weeds and grasses has to be carried out mainly during the first three years when shade coverage of the soil surface seldom is heavy enough to prevent growth of undesirable weeds. It is recommended that weeds be controlled by hand methods or through use of herbicides applied at low volume and with screens to prevent damage to tender cocoa plant tissues. The mixture of Paraquat with Diuron or Glyphosphate has given good results.

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PANEL II

PRODUCTIVITY FACTORS

B. CROPPING SYSTEMS AND CULTIVATION PRACTICES

COCOA PRODUCTION IN COSTA RICA, ITS LIMITATIONS AND POSSIBILITIES OF EXPANSION

(Original Document: Spanish)

Andre Helfenberger

Summary

Cocoa means for Costa Rica an excellent alternative to generate employment and hard currency, two key elements for national development strategy.

Prospects for the future of the cocoa market on the world scale are promising.

Until now research efforts toward the generation of a cocoa technology have been oriented around social-economic and environmental conditions of the small farmer, when actually a high technology should be developed to reduce the opportunity cost to a minimum, and to transfer this technology to all producers.

Presently, mixes of 44 hybrids approved by the National Office of Seeds are being distributed.

These hybrids are an important improvement over the materials now used, and it can be expected that on an average they would produce three times more than the traditional seeds. Also, it is hoped that because of the great genetic variability a possible decimation caused by some diseases will be prevented, therefore guaranteeing a good yield to the farmer.

Basically, the hybrids currently being sold are combinations of foreign types from High Amazonia with clones of the United Fruit Company, which in turn are hybrids with Criollos. The descendants of those crosses are in every respect quite heterogeneous in all ways. As to productivity, as a general rule 30% of the trees in those populations produce 50 to 60% of the harvest, indicating a severe under-utilization of the productive potential.

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The great variability of the phenotypical expression of the trees makes efficient use of a plantation difficult.

It has been verified that the hybrid plantations, in spite of the great genetic heterogeneity, are affected by the principle cocoa diseases.

Each cocoa type has its own fermentation capacity and develops an intrinsic quality accordingly. The variability present in the hybrids makes it difficult to obtain an optimum and uniform cocoa quality.

For these reasons, alternatives are suggested to increase productivity, reducing the under-utilization through budding of the inferior materials with buds from known cultivars or from new desirable, elite plants selected from the hybrids using novel budding practices.

It is also proposed to utilize the new cocoa technology developed in the plantations of Biao and Kumasi, Philippines made available to "Agro-Asesores San Roque S.A.", by courtesy of Philippine Cocoa Estate Corporation. This technology, for the first time in the history of cocoa cultivation, allows the formation of "pseudo-jorquettes" at a specified height giving great uniformity to the trees. At the same time, the planting system facilitates access to and movement within the plantation, thereby increasing the number of trees per hectare, reducing to a minimum the cost and allowing a degree of mechanization, which before was unknown in the cocoa plantation.

Cocoa Production in Costa Rica
Its Limitations and Possibilities for Expansion

1. Introduction

For Costa Rica, cocoa offers strong potential for development. There is a significant deficit of this raw material in the internal market, and the possibilities for export, both of the bean and elaborated products, are excellent as well. The increase in domestic production and resulting increase in cocoa export could contribute to the economic development of the country, through the generation of employment and hard currency, two of the key elements in the national development strategy.

The world cocoa market, according to World Bank projections is clearly in a period of increase, since each day there is greater demand as well as greater cocoa production at the world level. The main cocoa importers are the United States and the European Economic Community, which together use 65% of the world cocoa produced. It is expected that these markets will grow at a rate of 1.3% per year during the next decade, with a reduction then to 60% of world consumption. Other countries, like Japan (5.1% per year) and centralized economies of Eastern Europe (2.8% per year) will increase in a greater degree their consumption and hence their imports.

2. Present Situation of Cocoa Technology Utilized in Costa Rica

The economic feasibility of any agricultural exploitation is based on two natural resources, solar energy (hence climate) and soil, and also on a technological "package" composed of the genetic plant materials utilized, rational management of water and soil fertility, agricultural and horticultural practices, harvest and post-harvest operations, all applied in the best and most timely manner. If any one of these factors is deficient, the results will suffer, regardless of how efficiently the other factors are applied.

From the agro-ecological standpoint it could be stated that in Costa Rica there are no limitations to the expansion of this cultivation. According to a study by SEPSA, soon to be finished, there are almost 240,000 ha in the lowlands of the country, with or without moderate limitations regarding temperature, rainfall and rainfall distribution, not to mention another 160,000 ha which have limitations, although always moderate, in topography and soil.

In the areas suited for cocoa, which are also the banana zones, they presently produce rice, corn and beans, or they are dedicated to cattle raising. All these activities are strongly subsidized and of limited profitability. Cocoa represents in the long term an excellent alternative.

There is a rather suitable technological package for establishment and management of cocoa plantations developed by CATIE in Turrialba, and the shortcomings encountered in its application can be easily corrected. Also, it is sufficiently flexible so that new technologies may be incorporated, if they are considered to be advantageous.

Until today, institutions responsible for research and extension of cocoa technology in Costa Rica have oriented their work to the generation of a technology to socio-economic and environmental conditions of the small producer. This policy shows a laudable humanistic consideration, but it clearly contradicts the above-mentioned definition, which states that success in agricultural production is based on the efficiency with which the highly sophisticated technological package is applied. If this premise is correct, adapting a technology to prevalent conditions in a less favorable sector implicitly lowers the technological level and, as a result, the natural resources and the high technology available are underutilized, harming the supposed beneficiary of the assistance, increasing what in economics is called opportunity cost. Thus, the efforts of scientific institutions may aggravate the well-known problems associated with State paternalism. On the contrary, these institutions should look for highly developed technologies and make them available to all sectors interested in an efficient and economically viable agricultural production.

In the country, research has been carried out and genotypes have been found resistant to the three diseases of major economic importance in Costa Rica, such as *Ceratosystis fimbriata*, the disease complex caused by the genus *Phytophthora* and *Moniliasis*. The present technology is based

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GRAPH 1

Pod production per 5 trees

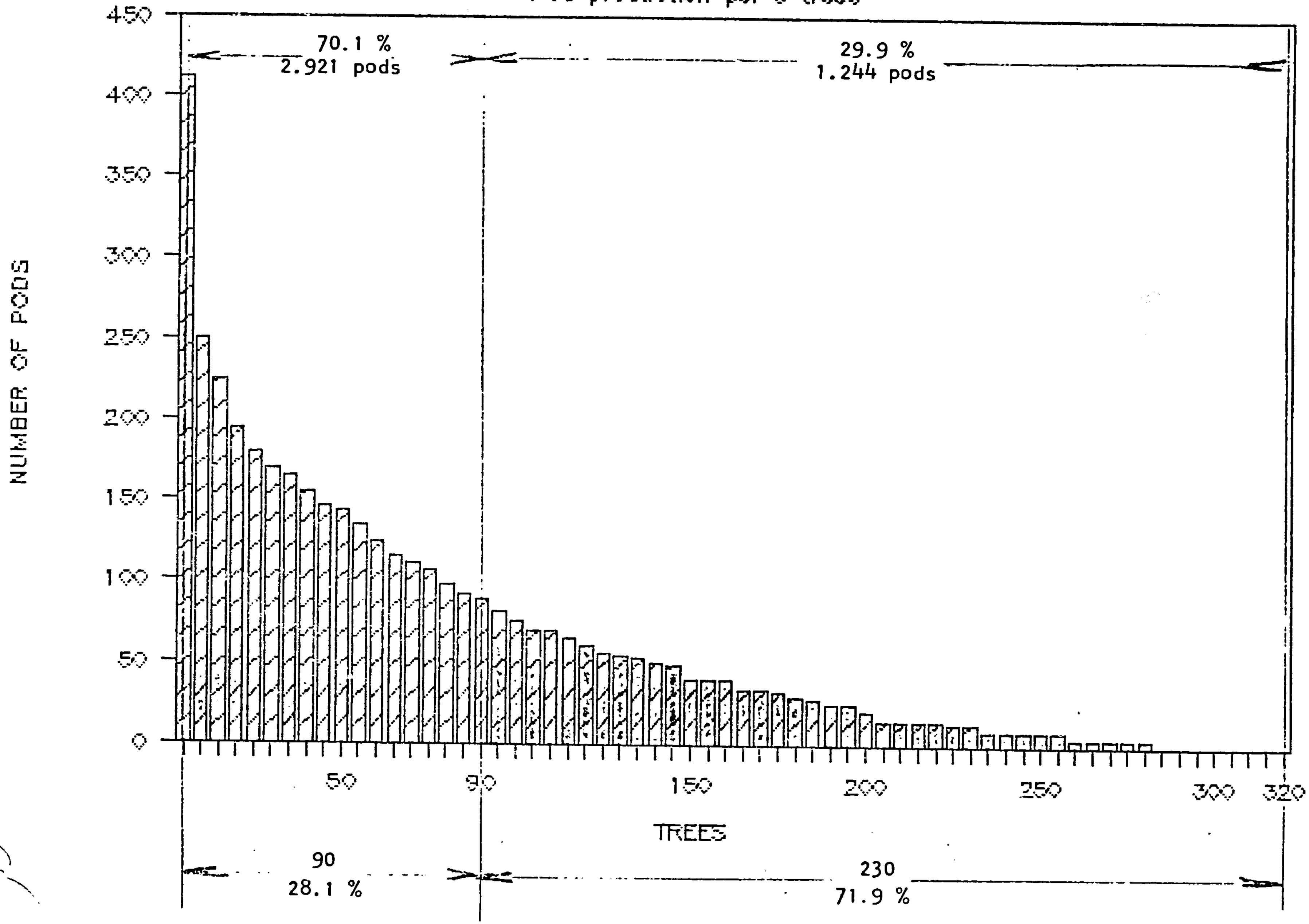


TABLE I

LOCATION OF TREES AND RESPECTIVE NUMBER OF PODS

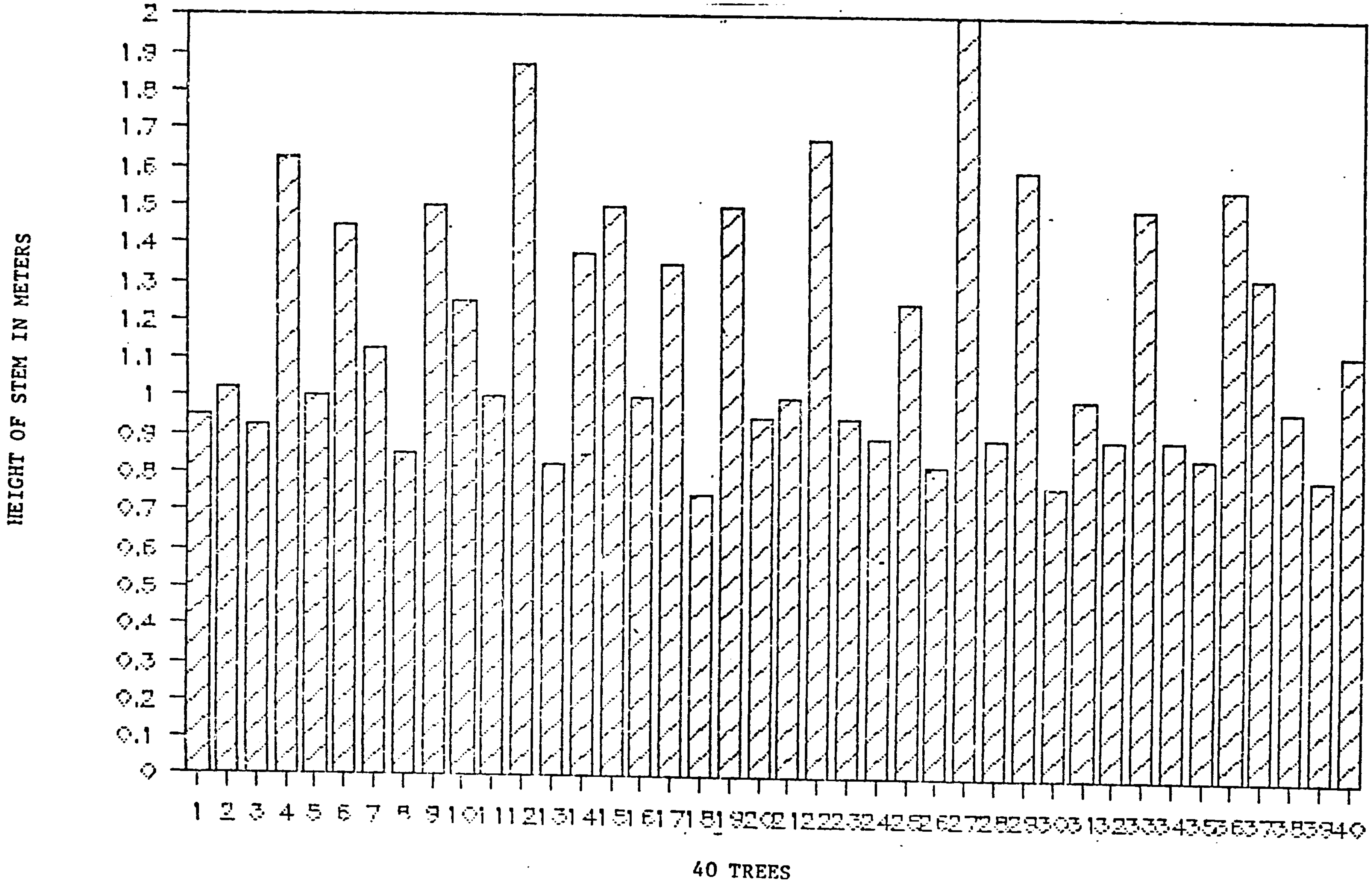
Line \ Tree	1	2	3	4	5	6	7	8	9	10
1	1	3	7	8	5	9	0	0	6	0
2	2	5	11	14	5	6	4	0	10	0
3	3	5	33	30	33	4	2	1	4	11
4	15	8	13	0	5	4	1	0	18	1
5	2	12	11	15	5	0	2	4	20	3
6	39	0	7	21	5	7	5	11	2	4
7	13	16	6	12	8	13	23	2	14	0
8	14	4	29	3	2	0	4	0	8	4
9	5	6	14	0	12	18	15	1	11	45
10	3	3	1	0	0	1	14	15	11	0
11	0	4	10	1	0	0	1	25	0	11
12	9	13	10	11	5	4	12	19	2	10
13	7	1	36	30	8	8	22	29	1	1
14	36	19	22	120	24	6	4	0	26	33
15	18	6	44	19	4	45	3	31	14	29
16	7	21	52	2	0	28	36	28	14	3
17	84	30	33	51	14	0	35	9	7	10
18	43	49	27	7	33	29	9	4	23	22
19	6	16	48	10	23	8	2	10	12	16
20	2	51	93	38	3	33	3	4	8	3
21	7	20	22	14	17	31	14	26	18	21
22	29	17	6	11	25	19	1	4	24	8
23	32	10	23	1	0	0	17	2	3	3
24	15	19	8	20	16	28	5	60	6	7
25	40	4	10	1	23	3	9	48	34	3
26	36	16	1	4	1	2	5	1	3	1
27	0	0	9	2	1	18	34	0	13	5
28	24	12	41	0	26	8	13	0	4	3
29	56	34	15	7	4	6	18	6	27	17
30	1	3	0	1	4	0	4	0	37	36
31	0	0	0	0	14	4	10	4	21	11
32	10	0	0	0	11	28	3	18	22	31

No. of pods per tree	No. of trees	Total No. of pods	Average	Kilos dry trees	at 90 cents per tree	Percentage of the population
50 ->100	8	567	70.87	2.83	254.70	2.5
30 - 49	34	1.199	35.26	1.41	126.90	10.6
15 - 29	67	1.096	16.39	0.65	58.50	20.9
1 - 14	171	1.303	7.62	0.30	27.00	53.4
0	40	000	0.00	0.00	00.00	12.5
Total	320	4.165				

Pods index estimated at 25/kg of dry cocoa
Results

GRAPH 2

PROFILE OF 1 LINE OF TREES



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on the planting of a wide mix of hybrids, with the purpose of preventing the decimation of the cocoa plantation due to some disease, and to guarantee good production for the farmer.

Traditionally, cocoa has been planted with non-selected genetic material, which produces after 5 or 6 years. On the contrary, certain hybrids are very precocious, starting production after 2 or 3 years. Besides, its populations are characterized by having a certain number of trees superior to either one of the parents, as to productive potential.

Basically, the hybrids which are now being sold are hybrid combinations of forastero types from the upper Amazon and clones of the United Fruit Company, which in turn are hybrids with criollos. The descendants of these crosses are very heterogeneous, often with serious problems of incompatibility. In addition, this heterogeneity may signify a great variability in productivity and is shown with an example of a population of 60/40 in a farm in the Huetar Atlantic Zone, where 30% of the trees produced 70% of the harvested pods (Graph 1).

Table 1 shows the trees and its respective pod numbers, and also the average production of 5 categories of productivity with their average of produced pods, kilos of dry cocoa per tree and the percentage each category contributed to the yield.

Aside from this segregation in productivity, there is significant heterogeneity in the phenotype expression of the trees. Graph 2 shows the profile of a line of 40 trees from a mixture of recent hybrids which shows a great variability in the height at which the jorquettes appear. This profile is based on random measurements of 10% of the trees one year old in one hectare, with a very uniform shade of castor bean. If we consider also that each type of tree (and there are about five different ones) produces horizontal branches of different length and at different angles with the trunk, it is clear that it will be difficult to make a suitable pruning for each one of them, giving it the necessary foliage area for maximum production. This great variability in tree configuration makes supervision and application of the required technology very difficult.

As for resistance or susceptibility to diseases and insects, it can't be denied that a genetically heterogeneous mixture has less risk of being decimated by one of them. However, we have not found any plantation where this problem would not be a concern. In all the zones of the country there are plantations afflicted in a general way with dieback when shade is not adequate. In a plantation in the south of the country, 40% of the trees died because of "Mal de Machete" and another plantation is infected 100% with gall diseases. In addition, the two main diseases, Moniliasis and the complex caused by the genus Phytophthora, continue to ravage the plantings. Therefore, in spite of planting hybrid material, we would still have the need, at any given time, for chemical control for one or more of the diseases and plagues affecting this crop.

There is no data about the different requirements of climate and soil for different mixes.

As to quality, the problem is equally serious, or worse. The fermentation capacity, that is to say the potential to reach a certain percentage of well fermented beans in a lot of cocoa, is an intrinsic quality of each cultivar. This means that with a mixture of hybrids it is very difficult to obtain optimum fermentation, since there are small beans, large ones and all the sizes in between, as well as beans with or without a high content of anthocyanins, and the complete spectrum between the two extremes.

In general, large beans and white or pale ones are of better quality than small and dark beans, and the first group ferments more rapidly than the second. Depending upon the proportion of these different bean types, in each one of the mixtures the fermentation time should be increased or reduced to obtain an acceptable average quality. When the fermentation period is extended, however, the fine aromas are lost in the good quality bean, because of over-fermentation, giving to the whole an inferior quality as compared to the one which could be obtained if the mixture were not so heterogeneous.

Another big disadvantage present in cocoa with different bean sizes that cannot be properly roasted, is that the manufacturers of chocolate will have to separate them by size before processing. The cost, naturally, will be charged to the producer. To obtain an acceptable quality of cocoa within what is possible, each region, and at times even at the farm level, will have to carry out fermentation experiments to be able to offer a product acceptable to the chocolate producers, both within the country and in foreign markets.

Unfortunately, there are no data regarding the segregation of the various hybrids regarding productivity, phenotypes, resistance or susceptibility to the various diseases and plagues, requirements of climate and soil and fermentation capacity and quality. The data would have been useful when recommending mixtures of hybrids for different conditions. There are not even regional tests with the mixture of hybrids that are today recommended. Unfortunately, in UNESUR's 1985-86 planting over 1500 ha in the Brunca Zone, a good opportunity was lost for doing this. In one of the cooperatives of this group a study was made based on the certificates of seed issued by the National Office of Seeds, which shows that about 30% of the hybrids planted on their farms with a total of 672 ha do not have any base of experimental data in Costa Rica. For some of them, which may be very good, the recommendation to include them in the mixture is based on experiments in Ecuador and Colombia. In addition, it was found that 2.8% of the hybrids are not approved by the National Office of Seeds.

In the circles responsible for the production and marketing of hybrid seeds there is a conviction that any seed mixture containing a minimum of 5 crosses of the recommended 44 will produce satisfactory results in any zone of the country and under any condition of climate and soil suitable for cocoa cultivation. This means that the criteria for selling the seeds is reduced to what is available at the momment in the clonal garden. It is true that globally it is possible to obtain an average yield

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of 1000 kg of dry cocoa per hectare, which is equal to three times the present average in the country, and which already represents a big improvement as compared to traditional practices.

However, it is still true that the great variability of the hybrids and hence the productivity potential is under-utilized. Accepting this fact, they recommend a doubling of the density of the planting at the beginning, so that the farmer may make a selection of the best trees, and after 4 or 5 years eliminate between 40% and 50% of the trees, the inferior ones of course.

Based on the above-mentioned information, a mathematical model was made of the probability of obtaining 1,000 kg of dry cocoa per hectare in small plots. Out of four farmer plots of one hectare each, which were planted with mixed hybrid seeds, chance favored one of them, which obtained a mixture with a potential of 1271 kg per hectare, whereas another farmer obtained a mixture with a potential of only 762 kg per hectare. Two of the small farmers obtained 927 and 1040 kg respectively, which gives an average of 1000 kg per hectare. The difference between the best and the worst production was then 51%. If this seed were sold to only one farmer with 4 ha of land for cultivation of cocoa, he would obtain a production of 1000 kg per hectare.

Ironically, this means that the small farmer who should be the most favored by the country's policy, could very well be hurt by this policy.

Because of the above-mentioned problems, we are in complete disagreement with the statements by the responsible institutions that those who recommend the establishment of commercial plantings based on clonal materials are 25 years behind the time. On the contrary, we firmly believe that the solution to the problem of low cocoa productivity is in the planting of clonal material, which better utilizes the yield potential, making it possible that each production unit (the tree), which within a plantation will have a space of about 9 m^2, for a period of 30 to 50 years, will be converted into a profit center.

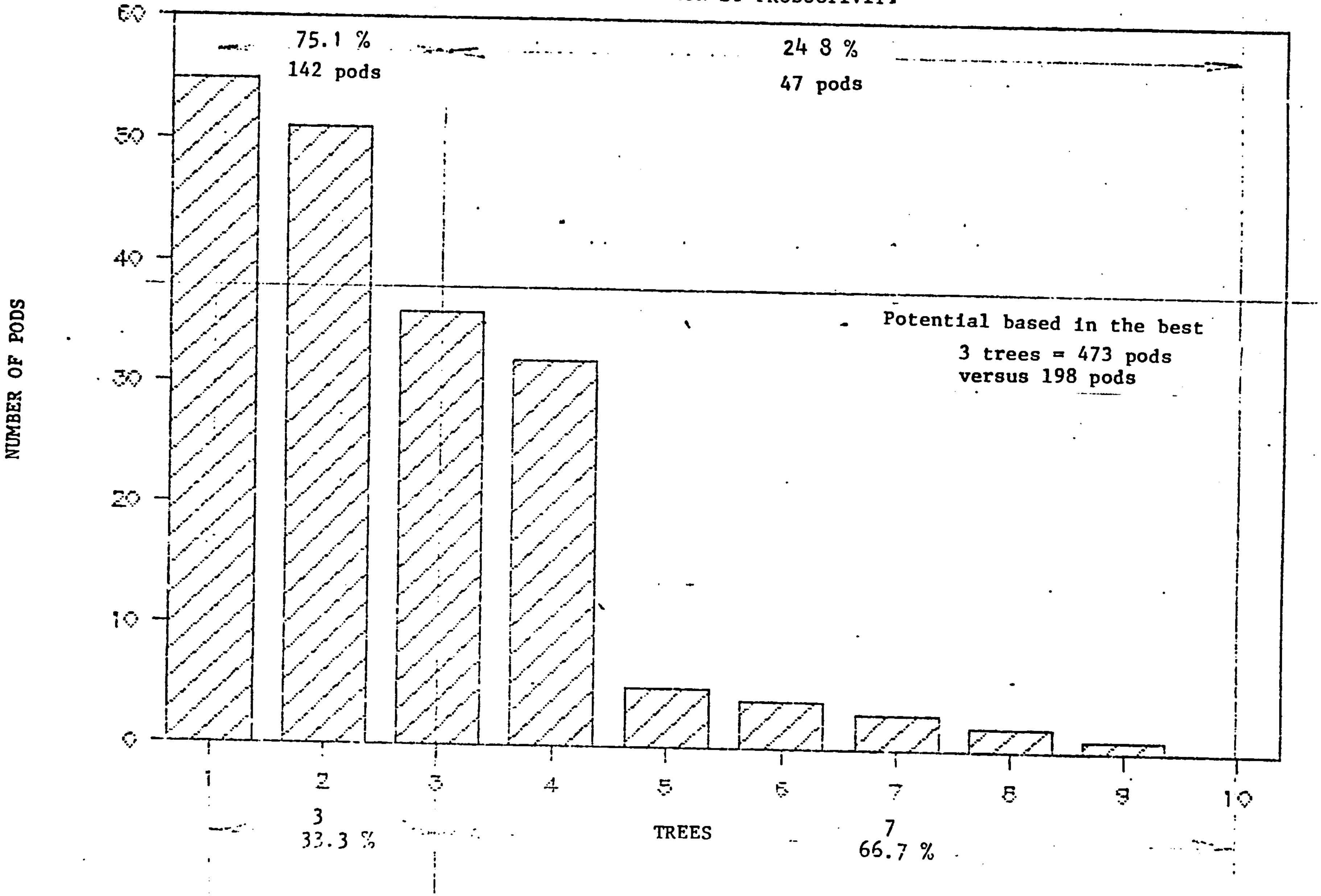
3. Alternatives for Increasing Cocoa Productivity

The great variability of genetic material, both between and within the combinations now distributed, requires a revision of the distribution policy for the material. The proper policy for selection and vegetative propagation to substitute inferior trees is the only and most adequate immediate solution to this problem. Graph 3 shows in a very simple manner the base for this approach. If the average of the 3 best trees from a group of 10 produces 47 pods, and the remaining 7 trees produces only 7 each, we could raise the average total by a factor of 2.5 by budding the 7 lowest production trees with buds from the trees having greater production.

For plantations based on mixtures of existing hybrids which do not reach the desired cocoa yield, or for those where it is desired to reach an even higher production, there are interesting alternatives for reducing the potential under-utilization to a minimum.

GRAPH 3

EXAMPLE OF SEGREGATION BY PRODUCTIVITY



Initially, a thorough study of the plantation in all its aspects will be required, to later classify the trees according to their productivity potential, dividing them into three categories:

Category I : trees with more than 70 pods per year
Category II : trees with 30 to 70 pods per year
Category III : trees with less than 30 pods per year

After dividing the trees into categories, trees in the first category must be located which satisfy the following basic points, with the purpose of utilizing them as budding material in the later development of the plantation:

- The trees must not be located in a priviledged position in the plot, but in average conditions within the plot.
- Compute the number of pods per tree per year.
- Verify the auto-compatibility of the tree.
- Evaluate its resistance to diseases and pests.
- Verify its index of pods (it must be less than to 15 pods per kilo).
- Establish size and color of the seeds (no less than 1.2 grams and of light color).
- Look for trees with an adequate phenotype (preferably low stature).

The stabilization of the plantation at a higher level of production will be made through budding of the trees of the third category, with a mixture of known cultivars, or with a mixture of buds from the best trees of category one, following the methods extensively utilized in Malaysia and also used on some farms here in Costa Rica.

For new cocoa plantations it is suggested that a new system is used, which so far has no name, and about which there is no official publication. Tentatively, we will call it "Biao/Kumasi", for the plantations in Davao, Mindanao, Philippines, where this system has been put into practice on a large scale. The complete technology has been made available to "Agro-Asesores San Roque, S.A." by courtesy of the Philippine Cocoa Estate Corporation.

The distribution of plants in the cocoa plantations is quite different from the traditional methods. A double line of 2 x 2 meters or 2 x 1.5 meters is made, followed by a distance of 3 to 6 meters left between one pair of double lines and the next pair.

The plant management is also a novelty. The new trees are taken to the field at 2 1/2 or 3 months old and budded in the field with plagiotropic buds of known genetic materials. After the budding has taken, plants are formed so that they will grow vertically and will form a "pseudo-jorquette" at the desired height. For the Costa Rican conditions it is necessary to use plants with resistance to C. fimbriata, obtained using the following cultivars in a crossing:

- IMC 67	- EET 399	- EET 400
- SPA 9	- UF 613	- UF 296

As it is known, the first cocoa clones were reproduced through rooted cuttings, an expensive procedure which has the disavantage of producing trees with an often weak root system. Since the rooted cuttings came from lateral branches (plagiotropic), the tree would follow a tendency to grow horizontally. Vegetative propagation through budding, even if it offered a normal root system, still has the problem of the horizontal growth from the plagiotropic buds. Using orthotropic buds, vertical growth was obtained with formation of a jorquette, as in a tree from seeds. However the orthotropic buds are much more scarce and the trees resulting from this type of budding still have the problem of high variability in the height of the jorquette and formation of lateral branches.

In the "Biao/Kumasi" system, seedling rootstocks are used, having a normal root system, and are budded with the desired plagiotropic buds, which are relatively abundant. These buds are then induced by horticultural methods to grow vertically to form a "pseudo-jorquette" at desired and uniform height. This favors formation pruning of the tree to obtain the optimum foliage area for each cultivar, which further increases yield potential.

Both the planting system and the tree formation allow easy access to the plantation and, at the same time, the movement within the plantation. For the first time in the history of cocoa cultivation it could be considered practical to mechanize some of the operations which are carried out. Supervision and rapid detection of possible problems are perfect. If necessary, it is feasible to apply fungicides with a small tractor, and pod collection could be made with a tractor-drawn trailer. Also, mechanical application of fertilizer can be considered. Making the rows and wide alleyways in the direction of predominant winds will favor air movement among the trees and improve the microclimate within the plantation.

When applying this new technology in a proper way, yields of 2000 to 3000 kg of dry cocoa per hectare have been obtained, beginning in the third year, provided the genetic material employed has been of high production potential.

Since the visit was made to the Philippine Cocoa Estate Corporation in October 1985, certain details of the system and in the tree formation were improved.

One of the fundamental differences is in the operation of pruning the stem. Shoots are no longer removed up to a height of 90 cm., but are allowed to grow, and are then removed at one month intervals. This practice favors thicker and stronger stem growth.

Since it is anticipated that there will be great demand for buds of improved material, from known cultivars or new cultivars coming from the hybrid plantations, it is necessary to consider the establishment of clonal budwood gardens.

To accelerate the process for obtaining buds, the method of chip-budding of Malaysia is suggested. This kind of budding is carried out on little rootstock plants that are only 2 to 3 weeks old, producing a tree of good size at the end of 2 years.

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PANEL II

PRODUCTIVITY FACTORS

B. CROPPING SYSTEMS AND CULTIVATION PRACTICES: INTENSIVE CULTIVATION OF COCOA

Arthur L. López

Introduction

The Philippine Republic is a minor producer of cocoa. There are no more than 10,000 hectares of commercial plantings to date. We are also a late entrant into the industry. Commercial plantings started in 1978.

Estate plantings deteriorated in the 1960s because of the pod borer problem and what everybody then called "dieback".

In the late 1970s and early 1980s, we had to rely on the Malaysians for our technology, planting materials and estate practices. The technologies introduced were the under-plantings in the coconut estates and the monoculture systems.

Davao has had a lot of experience in terms of tropical fruit production and progressive plantation management. As we became more familiar with cocoa as a plantation crop, we started applying the lessons we learned from bananas, citrus and other tropical fruit crops.

Slowly we evolved into a system of intensive practices typical of the tropical fruit orchards and farther away from the large scale extensive plantation systems of the Malaysians.

While the conceptualization and design of the system resulted from collaboration of several people, credit must be given to Larry Suarez (then Operations Manager of Philippines Cocoa Estates) for pioneering in the field and developing the technical and operational details. ICEC at that time was a joint venture between Hershey Foods Corporation and some Filipino enterprises.

At the very root of this evolution was an analytical framework we called the yield equation model for cocoa.

Cocoa Yields: A Yield Equation Model

The yields of cocoa farms vary from a low of 100 kilos per hectare in the smallholder farms of West Africa to a high yield of 3,500 kilos per hectare in the more productive estates of Wester, Sabah, Malaysia.

The analysis of the productivity and yields of cocoa farms can be structured with the use of the yield equation. Briefly, cocoa yield can be broken down into the following components:

1. population density per unit area
2. pod bearing capacity of the tree
3. pod and bean characteristics
4. pest and disease damage

The yield equation for cocoa, therefore, can be expressed as follows:

Kilos Dry Beans/Hectare = Number of Trees/Hectare
x Number of Pods Harvested/Tree
x Number of Beans/Pod
x Bean Weight

The yield components can also be aggregated in terms of the pod productivity of any unit area and the corresponding pod value.

Pods Production/Hectare = Number of Trees/Hectare
x Number of Pods per Tree

and

Pod Index = 1/
(Number of Beans/Pod
x Bean Weight)

Damage from pests and diseases is implicit in the measurement of each yield component. It can also be explicitly specified in the model by taking gross measurements and specifying "% Losses due to Pest and Diseases" as a yield component.

By utilizing a yield equation model, production problems on existing farms can be analyzed systematically. More importantly, the yield model can be used in designing optimized farm production systems.

The optimization of the yield equation model is the basic underlying concept of the Intensive Production System (IPS) for cocoa.

Determinants of Yield

The optimization of yields is constrained by environmental and genetic-physiological factors.

The optimum environment for the cultivation of cocoa can be specified in terms of climatic factors and soil properties. The important climatic factors are temperature, rainfall, wind and sunlight. Soil properties have to be specified in terms of physical and chemical attributes. The values for these factors have been determined by the agronomists and plant physiologists.

The genetic potential of the plant is the cumulative result of the process of selection in plant breeding. This potential is expressed as desirable plant characteristics in terms of plant physical structure, photosynthetic production, fruit bearing capacity, and resistance to pest and disease problems.

Yields can also be affected by the interaction between these sets of factors. Thus, plant physiology will be affected by environmental constraints. Conversely, a population of plants will affect the microenvironment of the plant.

Commercial yields are also affected by variability in actual individual plant performance inherent in a given population. In an open-pollinated, self-incompatible plant like cocoa, variability in characteristics and performance in the field is a limitation on a simple yield model. From our observation, only 25% of the F1 trees accounted for 70% of the production.

<u>Production Strategy of the Intensive Production System (IPS)</u>

The process of constrained optimization starts off with defining a feasible solution set and then manipulating the variables towards an optimal solution.

The analogy can be extended into the production strategy of the Intensive Production System. Concretely, feasibility of the production system is defined through:

1. Selection of project site,
2. Selection and propagation of planting materials,
3. Physical planning and farm lay-out design,
4. Production system design.

The details of these activities are discussed in the implementation program. Optimization in the system is specified in the field and plant maintenance programs specified in the implementation program.

It is important to note that the Intensive Production System is not introducing any radically new technique or technology. What it offers is an analytical framework with which proven technology and management practices from other sub-tropical and tropical orchard fruits have been systematically applied to the cultivation of cocoa. Similar approaches have had considerable success with bananas, coconuts, rice and citrus.

The objective of the system is early and sustainable high yields for cocoa.

Projected Yields from the Intensive Production System

The projected yield from the Intensive Production System is the cumulative effect on the crop of several technology components and their systematic application. In terms of the yield equation and yield components, the following are the projected optimal values:

1. Number of trees per hectare. The planting design is based on a high-density double hedgerow pattern. This translates to an average stand of 3,320 trees per hectare. This stand is three times the conventional standard of 1,100 trees per hectare. Critical to the achievement of this standard are the germination rates achieved at planting out the percentage successful takes after 3 rounds of budding.

2. Number of pods per tree. The assumed number of pods per tree at maturity is 40 pods at 5 years after budding. Pod bearing capacity is a criterion for the selection of the clones to be propagated. Clone selection uses a standard of 100-120 pods as a choice criteria. However, for our yield estimates, this pod--bearing capacity has to be adjusted for the smaller tree size desired by the system. Experience in the Philippines has demonstrated pod-bearing capability of 20 pod per tree at three years budding.

3. Pod Index. The yield projection assumes a pod index at a high of 45 in the early years and a value of 30 at maturity. This figure is conservative in comparison to the standard of 27 by plant breeders, a value of 33 from the Hershey farm in Belize, and a value of 29 from the experiments in the Philippines.

The use of mean values in this analysis is also based on the assumption that asexual propagation (budding) will reduce field variability through cloning. As a matter of fact, the whole field and plant maintenance program is geared towards reducing variability in field performance.

The precocity of the crop can be expressed in terms of a yield curve. This can be expressed in terms of the rate of increase of the yield and the age at which the crop reaches its maturity yield. The yield curves used in our projections are based on the early results of the experiments in the Philippines.

The yield curves are shown in Exhibit 1.

The Implementation of the Intensive Production System (IPS)

The implementation of the Intensive Production System follows the logic of the optimization process. Feasibility is established at critical decision points during the project planning stage. Optimization and sustainability is achieved with the implementation of the system.

Critical Project Planning Decisions

Most of the yield determinants cannot be controlled by management. Even the degree to which these constraints can be influenced and manipulated is very limited. It is prudent then to define these constraints such that optimum conditions for the plant can be created within its range.

EXHIBIT 3: Yield Curve for Intensive Planting System

Age (Months from budding)	Yield (Tons per hectare dry beans)
18-24	600
25-36	2500
37-48	3500
49-60	4500 (projected)

1. Rigid site selection criteria. The selection of the project site has to take into consideration the range of the maximum and the minimum values of the environmental factors enumerated above. The prevalence of pest and disease problems in the area also has to be taken into consideration. Climatic pattern and preliminary land capability surveys will be undertaken. The cost of ameliorating constraining factors will also have to be considered in the consolidated evaluation.

2. Selection and propagation of superior planting materials. Rootstock and budwood material is selected on the basis of precocity of bearing, high yields, general plant vigor and resistance to plant pests and diseases. Planting materials should initially be arranged for with reputable sources. A clonal budwood garden has to be established to ensure availability of hishest quality plants. Stringent measures for pest and disease control must be employed in the nursery and budwood garden to ensure highest quality planting materials. The clonal budwood garden should be established as soon as negotiations for the land are completed.

3. Physical planning and farm design. As a pre-requisite to physical planning and farm design, the following detailed surveys will have to be undertaken: detailed land capability survey to assess the physical characteristics and drainage conditions of the land on a 50m. x 50m. grid, detailed topographic surveys at one meter intervals and perimeter surveys, detailed soil fertility surveys. These surveys will be the basis for the selection of areas to be planted and the design of the road network and the drainage system. The topographic map will also serve as the bssis for the drip irrigation system design.

Technology Components of the Intensive Production System

The main agronomic features of this cultivation system are proven practices adapted from other orchard crops.

1. High density plantings. The trees are planted in a double hedgerow pattern at a spacing of 4m. x 2m. x 1m. resulting in a stand of 3,320 trees per hectare.

2. Asexual propagation of selected clones. Selected trees of proven superior performance are cloned by budding them to disease-resistant rootstock. This gives the system a genetic advantage over plantings using open or close-pollinated F1 seeds. By using fan branch bud-eyes, a smaller tree structure can also be achieved. Our selected clones are upper Amazon crosses and Amelonado crosses.

3. Pruning and Tree Shaping. Trees are shaped and trained for optimum utilization of sunlight and space. This is achieved through frequent light pruning to avoid setting back the growth of the plant.

4. Drip Irrigation. The main advantage of drip irrigation is its capability to deliver a uniform, adequate quantity of water at a frequency required by the plant. The drip irrigation system facilitates the efficient delivery of high rates of fertilizers required by the plant.

Other farm practices for field and plant maintenance follow the standard practices for cocoa plantations as adapted to the peculiarity of the system.

Management Requirements of the Intensive Production System

The intensive use of technology, natural resources, labor and material inputs requires intensity and sophistication in farm management. The desired level of management capability can be compared to the more sophisticated banana plantation and other tropical fruits orchards.

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Consequently, the standards of managerial performance and the administrative procedures will follow standard estate practices. However, there are certain aspects of plantation management that will be more critical within the Intensive Production System.

1. Planning and Control System. The yield equation model is the backbone of the management information system. The yield components are closely monitored and all activities and production results are ultimately correlated to the yield paramenters and evaluated on the basis of their contribution to yield increase. Standards have been set for the different stages of growth of the plant and the variations in the parameter values. Consequently, plant growth and yield are closely monitored. It is easier to focus on problem areas before a flare up or to focus on specific areas when something goes wrong.

2. Manpower Training and Development. The system is labor intensive and requires proficient performance in certain critical activities. Training programs in budding and pruning will be very critical in the early stages of the project. The training program for budding will have to start as early as the establishment of the clonal garden. The project management will also have to implement rigid selection process in labor recruitment.

3. Project Scheduling. The first two years of the project will be a critical time period as the project management team will be trying to create a cohesive work team while dealing with the scheduling and cost pressures of land development and planting operations with all the unforseen events attendant on opening up a new farm. It is critical at this stage that the evaluation of the project be done frequently, that the technical support to project management be maximized, and that the detailed project schedule should be updated regularly.

Where do we go from here?

Many details and improvements in the system have to be worked out. The Malaysians have joined in this effort by initiating their trial plantings. BAL Estates and Sr. Darby initiated trial plantings. Hummingbird-Hershey in Belize and Hawaii are also in the initial stages.

The critical areas that researchers and operations people are trying to define are:

1. Clone selection. Initial work on the system was done on a very narrow genetic base (15 clones). We have relied on the breeding work done by the Malaysians and on what they were willing to release to us. With the current experience, we feel that the selection criteria for the clones is clearer and might be contrary to our original criteria of vigour and pod production.

2. Plant Nutrition. The drip irrigation system is an excellent fertilizer delivery system. Some fertilizer calibration experiments have been going on for 3 years now in Southern Philippines. We are very surprised at the preliminary results we are getting in plant responses. We hope to tie up these results with a network of leaf sampling and tissue analyses.

3. Plant Growth Regulations. Interest in plant growth regulators has been triggered by our concerns with the labor intensity of pruning. Some work has been going on in the field for the last three years but the results have been erratic.

4. Crop Manipulation. Preliminary work is being done in Sabah on crop manipulation. The objective is for the pods on the tree to be at the same stage of development. This scenario will have distinct advantages in terms of pest and disease control programs and mechanization of harvesting operations. The researchers are also hoping that they can increase the turnover of the cropping season of trees.

5. Mechanization and Increasing Labor Efficiency. A lot of work needs to be done. By changing our perspective and looking at cocoa as an "orchard" crop, we open an area to explore and ideas to test.

   On a recent trip to Sabah, we had a chance to meet with some of the researchers. The thinking is that we have set our production targets too low. They feel that with their genetics they can achieve 6 to 8 tons per hectare.

   We hope that this has given you some food for thought.

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PANEL II

PRODUCTIVITY FACTORS

B. CROPPING SYSTEMS AND CULTIVATION PRACTICES:

SELECTION AND USE OF BOTH TRADITIONAL AND INTENSIVE PLANTING SYSTEM IN THE DEVELOPMENT OF A NEW COCOA INDUSTRY IN HAWAII

(Original document: English)

Jim Walsh

Summary

Comparatively high labor costs and taxes, limited land availability, agricultural uncertainties, and other problems are given as reasons not to develop a cocoa industry in Hawaii.

Several unexpected successes in cropping systems and farmer programs combined with a changing society have created a window of opportunity. By viewing the industry from demand terms, Hawaii Cocoa was formed to grow cocoa as a means of providing a source of supply for its ultimate product - chocolate products. Various cropping systems are being tested on a large scale basis with an eye toward providing a dependable source of independent supply.

The choice of Hawaii asa new site for cocoa growing appears initially to be misguided. In addition to the questions whether the crop can grow in Hawaii's climate, soil, and wind conditions, there is the overriding question of how it can be economical with such high labor rates. Hawaii thrives as part and parcel of the U.S. service economy. It has high labor rates, substantial worker's benefits, and adversarial labor unions. It also has predatory workman's compensation and unemployment taxes as well as discouraging taxes on profits. Eighty percent of usable land is controlled by five major sugar growers --all with real estate development ambitions. Due to these conditions and a small population base, there exists little or no domestic capital for agriculture expansion.

Innovation does not have to be technological but it does not need to change the yield of resources and it should be defined in demand terms rather than in supply terms. The marriage of Hawaii and cocoa illustrates the value of such innovation. We have searched for changes and determined what opportunities these changes provided for social and economic innovation.

Hawaii has available to support its agriculture a good infrastructure of roads and distribution facilities. It has a strong land grant college providing extension services to farmers and institutionalized research and development. It has a culture of entrepreneur farmers who can react to market opportunities. Hawaii has one undeniable asset --its image of paradise to six million tourists a year. With this as a back drop we started to notice key changes that made cocoa in Hawaii look possible: 1) The unexpected successes in intensive planting systems and a transferable prototype. 2) The successes in Hawaii of independent papaya and guava growers' programs. 3) Management directives by sugar companies to reduce drastically the acres in sugar. 4) The strengthening of the domestic tourist market for Hawaiian grown products. 5) A change of local government.

Since our focus in the project is demand-oriented we saw a window of opportunity to develop Hawaiian chocolate. To do this we have to develop our source of supply --therefore we are now concentrating on the growing aspect of cocoa. It is a crop that can be grown on a large and/or small scale by corporate or independent farmers. To overcome labor costs we are encouraging cocoa growers to plant and harvest under our scheme independently by providing an economic floor for the crop. We are also encouraging plantation-style intensive cropping where the farm will be designed with harvesting in mind.

Based on this plan, we are presently planting out acreage to determine which of Hawaii's microclimates and which cocoa varieties will fit into our two growing systems. We are presently planting out a largescale commercial area with a budded tree population of 3,750 per hectare. We are using five selected varieties that are all self-compatible, quick-fruiting and with a dwarfing tendency. We are planting them in an area of high sunlight and twenty five inches of rain per year. Temporary shade will be removed completely at the end of the first year and all trees will be under drip irrigation. Due to high labor costs for harvesting, these trees will be growth-regulated for uniform pod ripening as pioneered in Malaysia. The field has been designed to facilitate several prototype machine-aided harvesting methods.

Our small scale farm method is to plant a stand of 6,250 seedlings per hectare in a well drained high rainfall area. Trees will be culled, within two years, to a final population of 2,000 per hectare. Extending this out, when perfected, we will provide to willing farmers land, cropping systems, and seeds for the cultivation of cocoa. We will provide a local market by buying pods at a percentage of world cocoa price. Fees for land, seed, and inputs will be taken for marketing revenues. Under both of these systems it will be critical to their success to have chosen the appropriate cocoa varieties.

Our new state government is working on tax relief for agribusinesses and land is rapidly becoming available due to the demise of sugar.

Successful innovation is not only having the perspective to see and create windows of opportunities but having a strong enough motivation to overcome initial set backs. In the case of Hawaii Cocoa the incentive is the vision and gain from a finished product. Growing becomes necessary to assure supply.

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PANEL III

EXTENSION SYSTEMS ALTERNATIVES
(Original document: English)

Jennifer Andall, Cocoa Officer, Grenada, described the purpose of extension as assisting the rural population to increase profitable production and improve its standard of living and general welfare through training. However, the scope of training must be broader than mere production technology: it must include steps to combine and utilize locally adapted and proven agro-climatic technical packages with available resources of land, labor, management, and financial conditions, and to reflect socio-economic circumstances to increase production and incomes.

The presentations supported the view that the extent and rate of acceptance and implementation of new technology is greatly influenced by, and generally dependent on, the availability of such non-educational activities as credit, production inputs, markets and marketing systems, roads, transportation and supportive policies. Government intervention is required for many of these activities.

Ms. Andall and Dr. Frederico Afonso, CEPLAC, stated that hands-on demonstrations of practical production and management methods are excellent extension training tools. A new program in Grenada identifies cocoa farmers and their farms, and establishes demonstration plots that are managed by farmers, and supervised by extensionists, where improved technology is implemented. Records are maintained to show that the technology applied on the plots is cost effective. At CEPLAC farmer leaders are trained at demonstration farms, where short, specific-topic programs are offered, and extensionists are trained at middle schools. This has given new impetus to extension programs since farmers listen to each other.

The CEPLAC program is old enough to measure results, which have been significant. Since the mid-1960s, Brazil has increased its national average annual production from 280 to 750 kg/ha, its total national production from 138,000 to 380,000 tons, and its revenues from $60 million to $650 million. This program also benefited from government intervention, which opened roads, established schools and electricity, supported cooperatives and provided credit and extension radio programs and publications.

José Martínez, Dominican Republic, asserted that for extension to be effective, it must be coordinated and integrated with all aspects of the cocoa industry (from planting to marketing) and with natural, social, economic, and family factors. Cocoa producers must have easy access to the means of production and economic incentives, which would allow cocoa to successfully compete with other commodities on the market.

All panel members seemed to agree on the common problems in extension. Group farmer training programs are necessary and effective where the extension staff is spread thin. Extensionists should be relieved of non-educational activities, such as delivering inputs, supervising credit and transporting produce. Well trained general extension staffs are preferable to single commodity extension staffs so as to reduce duplication of effort and farmer contact, minimize farmer confusion due to frequently conflicting advice, and make more efficient use of manpower resources and supporting facilities and budgets.

Oleen Hess,
Rapporteur

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PANEL III

EXTENSION SYSTEMS ALTERNATIVES

PERSPECTIVE FROM GRENADA

(Original Document: English)

Jennifer Andall

The purpose of agricultural extension is basically to assist the rural populations in improving their standard of living by means of increasing production and productivity on their farms. Improving one's standard of living in the majority of cases involves the conversion of farm produce into cash, which would then be utilized to obtain needed items of food, clothing and shelter.

The job of an extension agent is essentially that of educating or teaching the farmer how to best use available resources, i.e. land, labor, capital and machinery to bring about this increase in production and productivity which he desires to generate increased farm income. The role of extension is to assist in identifying production problems or constraints faced by the farmers, and to communicate these problems to the research department so that strategies or solutions can be developed to help overcome these constraints to increased production.

After strategies have been developed and tested and proven to be technically sound and economically feasible, the extension officer then has the responsibility of transfering that technology to the farming community in order to bring about desirable change.

The process of technology transfer and adoption of improved practices does not take place overnight. It involves a change of attitudes, beliefs and values held by farmers, some of which are based upon many years of experience the farmer himself has had. Adoption often involves major decisions such as changing from an existing variety to improved higher yielding material by replanting fields. In any given farming community, the percentage of innovators and early adopters is small compared to late adopters. The technique or strategy used by the extension service in attempting to bring about the needed change is therefore of utmost importance.

The success of any extension effort depends largely on the extent to which the farmers' non-educational needs are met. If these are not addressed simultaneously with the educational needs, the farmer's ability to adopt improved practices will be greatly reduced in spite of his willingness to do so. I refer in particular to the need for increased availability of inputs, finance, improvement of roads, transport facilities, etc.

If, for instance, the extension department is trying to promote increased fertilizer application from twice to four times per year in order to increase production (based upon scientific facts), the farmer must at the same time, be ensured the supply of adequate quantities of that input at the right time and in the right place. Likewise, if the replanting of old and non-productive trees is being encouraged by the extension department in order to increase yields, the farmer must be ensured some form of financial backup or support simultaneously to enable him to carry out this practice. Without the necessary backup or support services being addressed hand in hand, the rate of adoption of technology by farmers will necessarily be slow and rightly so. The importance of these factors is often overlooked and sometimes grossly underestimated. The lack of success of the Cocoa Rehabilitation Project effort in Grenada between 1982-1986 was largely due to this problem. The success of the USAID contract demonstration program now being operated in Grenada (measured in terms of the adoption/application of the production package on other farmers' holdings also in need of rehabilitation) will also depend upon the extent to which those non-educational constraints are addressed.

The success of extension efforts also depends to a large extent on the level of coordination between the extension services of various commodity organizations. For instance, in many countries, a separate extension service exists for every major crop -- one for cocoa, another for bananas, etc. Whereas this may perhaps be more desirable in a monocropping system on the other hand, such a system may be detrimental where crops are grown side-by-side on small farm units. If extension officers of the various organizations do not transmit the same message to the farmer, confusion arises. The concept of a UNIFIED EXTENSION SERVICE in these situations needs to be carefully examined and if possible implemented. If not, roles and responsibilities of officers attached to different organizations must be carefully defined and demarcated.

The question of conflict of interest between commodity organizations also arises. For example, the Banana Association may be promoting pure stand cultivations of the crop, whereas the Cocoa Association may at the same time be promoting interplanting of bananas as temporary shade for cocoa. Clear policies need to be set, followed and respected by all.

Finally, the need for extension services to concentrate their efforts on purely educational activities rather than those of a non-educational nature, such as the operation of subsidy schemes, transport of inputs to the farmer, etc., should be recognized and addressed. This would allow the officer more time to effectively perform his role as an extensionist.

In conclusion, to bring about the much needed increase in production which we would like to see in Grenada (as well as many other countries), the first priority is that of addressing the non-educational constraints faced by the farmer and if this is done we can experience an almost immediate increase in the production of cocoa.

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PANEL III

EXTENSION SYSTEMS ALTERNATIVES

EXTENSION SYSTEM IN THE DOMINICAN REPUBLIC
(Original Document: Spanish)

José Antonio Martínez R.

Introduction

Improvement and modernization of cocoa cultivation depends on the development of new technology and the proper transference and adoption.

To develop new technologies, a research strategy must be capable of: 1) interpreting the characteristics, needs and constraints facing cocoa production, and 2) scientific creativity to discover existing potentials and use them to develop feasible production alternatives.

For new technologies to be adopted, it is not enough that they be suited to agroecological and producer conditions. Also necessary are complementary types of actions in areas such as credit, prices, marketing, input supplies, facilities for post-harvest management, roads (very important), fair and equitable taxes.

2. Cocoa production in the Dominican Republic

2.1 Origin and cultivated area

Cocoa was introduced into the country at the end of the XVI century, but most of the cocoa plantations were established between 1885 and 1910.

According to the State Secretary for Agriculture (SEA), the country has an area of about 117,375 hectares devoted to cocoa cultivation.

2.2 Structure of land ownership

Eighty-four percent of the farms have no more than 5 ha. They represent 35% of the total exploited areas, where as the remainder 16% of farms covers 65% of the planted area. In the country there are approximately 38,000 cocoa producing units.

2.3 Production and productivity

Over the last four years production was near 40,000 MT. Productivity is about 346 kg/ha. Low yields are caused by different factors, among them the old age of plantations, little agricultural care, the varieties planted, and low density of cocoa trees per unit area.

2.4 Technical level of production

It is estimated that between 65 and 70% of the plantations are 45 years old or more. Between 18 and 20% of the cocoa area is planted with hybrids.

According to a 1973 study of the Secretary of State for Agriculture called "Cocoa Special Study", barely 2% of the sown cocoa area received fertilizers. A 1981 study of production costs, carried out by the Division of Marketing of the Cocoa Department of the SEA, showed that the situation had changed very little. Of the total expenses of the producers, barely 11.93% was employed in inputs, whereas the remaining 88.07% was spent on labor and other expenses, showing a very low level of applied technology.

The Dominican Republic is free of the worst diseases which decimate cocoa production in other countries. There are, however, a number of pests and diseases less damaging, reducing production levels sometimes by more than 20%. Presence and incidence of those pests and diseases which we could call minor, are only the result of inadequate handling of the plantation and/or lack of minimum agricultural practices which ought to be carried out in the plantation. That is the case for the high incidence of Trips (selenothrips rubrocintus), which on occasion affects a plantation and is due to deficient pruning and inadequate labor. The high incidence of black pod, caused by phytosphthora, which often affects plantations, is due to the high shade density in most of our cocoa plantations and deficient drainage. The high density of shade trees, on the other hand, seriously limits production increases, as in some zones of the country where plantations have as many as 50 shade trees per ha, competing for space, nutrients, light, etc. with cocoa plants.

2.5 Post harvest handling

The quality of our cocoa is inferior to almost all other types of cocoa from the rest of the producing countries. Its international commercial name is "Sánchez". Its principal characteristic is insufficient post-harvest treatment caused by lack of fermentation and inadequate and/or insufficient drying.

Starting in 1979 a fermentation program was initiated from which came the "Hispaniola" cocoa. This type of cocoa was accepted by the New York Coffee, Cocoa and Sugar Exchange as falling within the "B" group of cocoas with a bonus of $80 per ton, starting in May 1986. Although in the beginning the volume of Hispaniola cocoa grew constantly until it reached 5% of total bean exportation, during the last 4 years, as a result of a wrong fiscal government policy, the volume of this cocoa has been reduced, reaching today 2.5% of total exports.

2.6 Marketing within the Country

Operations for buying and selling cocoa within the country are carried without any kind of market regulation or norm, with the exception of export requirements (quality standards).

The commercial structure is formed by the operations of intermediaries, from the lowest level to the highest. There is funding for marketing, which is carried out informally at the different levels of intermediaries. This makes the process more costly, compromises the producer's crops, and hence limits his negociating position.

The commercial structure is oligopolistic: four exporting companies control 90% of the cocoa exports, and they have a network of brokers and intermediaries who assure supply through buying anticipated production.

Consumption of cocoa within the country is very low, barely reaching 2000 TM per year.

2.7 International marketing

One hundred percent of our exports go to the U.S.A. Of this total export volume, only 6% is processed cocoa, in spite of the existence of installed industrial capacity that could handle nearly 40% of total production.

3. Programs for development of cocoa cultivation in the Dominican Republic

Steps to integrate our agricultural technician into activities of cocoa production and specifically to the requirement of technological cultivation innovations (already known and adopted in other producing countries) started in 1962, 25 years ago. That year the first hybrid seeds and improved vegetative materials were introduced into the country.

In 1966, a FASE-1 program was initiated, which did not include specific areas for improvement. This program was based rather on the selection of some farms for improved work through various methods to compare results and to support extension to introduce and expand hybrids. That program sent a first group of Dominican extension technicians to foreign countries to receive training on cocoa cultivation. Under this program, the first fields for production of hybrid seeds were established.

In 1968, FASE-2 was initiated, with the objective of financing activities in cocoa cultivation specifically renovation and rehabilitation of plantations. Due to the lack of allocation of economic resources, this program was maintained within a phase of operational activities and standards, and did not enter into credit or into field or extension work.

Even so, this program attracted the interest of the Agency for International Development (AID), which had already supplied in 1966 resources to carry out the FASE-1 Program, thus starting a five-year funding program for cocoa cultivation.

This program was well conceived and included actions for authorization and training of the technicians which were to carry it out, both from the State Secretary for Agriculture and from the Agricultural Bank, the entity in charge of financing. This program included also training activities and other extension methods for producers participating in the program. Unfortunately, due to many problems like the lack of hybrid seeds, allocation of local counterparts and dismembering of the executing technical structure, the program did not produced the hoped-for results. It is convenient to point out that the last straw adversely affecting this program was produced by the implementation of a new agricultural extension policy. This SEA policy established a program of geographic dispersal of extension technicians to assist producers of different products (rice, corn, banana, etc.) that would be within their area. This new policy made the extension service more efficient in general terms, but was detrimental for cocoa producers and cocoa cultivation, as the plantings of short cycle crops require more continuous attention. The re- gionalization of the extensionists to specific areas left out of the cocoa producing zone are those extension agents who had the best knowledge about this crop.

Finally, the introduction of a lot of hybrid seeds from Trinidad infected with Witches Broom (crinipellis perniciosus), lead to the elimination through burning of all little cocoa plants in existence (about 1 million), which completely paralyzed the program.

In 1975 a Cocoa Commission was created as an agency in charge of developing a cocoa policy for the country. The Cocoa Commission is comprised of representatives of the producing sector, industrial-exporting sector, and the government. The Commission's funds, produced by a tax on exports are used in financing research activities, extension, training, production of improved hybrid seeds, improvement of quality, and construction of roads to serve the cocoa producing areas.

Starting in 1978, the Departments of Coffee and Cocoa were separated, having previously operated within the same structure. The Cocoa Department, starting in 1978 initiated a number of programs emphasizing traning and extension, and also considered the actions to be taken in the areas of renovation and rehabilitation. A group of other programs was initiated, among which were financing for structures for drying and fermenting, control of rats and wood peckers, and a fermentation program which gave origin to the Hispaniola cocoa. A program funded rehabilitation and renewal of cocoa plantations, but was stopped because the resources had to be allocated to the recuperation of cocoa plantation damaged by hurricanes David and Federico of August 1979.

It can be stated that during 1978-82 the cocoa sector benefited from positive and successful work, leading to significant increases in production starting in 1982. Thereafter, our production has been about 40,000 TM per year.

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Starting in 1983, the World Bank financed a project for rehabilitation and renovation of plantations and for construction of drying and fermenting structures. Execution was slower than programmed, due to: a) slow recruitment of extensionists into the program; b) limitations in transport; c) SEA's extension policy to pressure the program to provide service to other cultivars; d) problems in the credit policy of the financing institution (Agricultural Bank), which resulted in exclusion of many cocoa producers, who could not receive credit; and e) problems in handling of hybrid and improved seeds.

This credit program is still going on, but because of limits on the size of planting a grower must have 6 ha; it has been only about 25% implemented. Fortunately, starting in January 1987 it will be extended to benefit larger plantations.

4. Research activities

In 1972, SEA bought an experimental farm, "Mata Larga", with an area of 75.5 ha. When the Cocoa Department was created in 1978, the farm became the subdirectorate for research, thus giving greater importance to research activities. At present, this research entity has a staff of 11 technicians who, in spite of having research functions, devote substantial effort to the production of hybrid seeds and improved material.

Within the Experimental Farm, a training center is operated where, during the whole year, courses are given for technicians and producers on intensive cocoa cultivation. Besides, there is a laboratory for studies of quality improvement. This laboratory, together with two foreign technicians, is financed by the government of West Germany.

5. Extension and training activities

Extension activities for cocoa cultivation have been limited by lack of understanding by the policy makers of agricultural extension. To carry out his duties, an extensionist must work under difficult conditions, including low salary, inadequate transportation for follow-up work, and lack of job stability, and a lack of incentives.

Training has been principally oriented towards cocoa producers. It is carried out through field days, classes, etc. Between 1979-82, 120 annual activities of this kind benefited about 6000 producers each year.

The training program has led to great acceptance of and greater demand for improved planting material (hybrid seeds). In spite of the fact that the Cocoa Department multiplied by 10 the production of those seeds in the period of 1978-82, this was insufficient to meet demand. At the same time, we should point out that many small producers resist the introduction of hybrids into their plots, as they do not want to be in debt and do not believe that that type of cocoa is better than the native one they know. Furthermore, the farmer does not easily accept reduction in number of shade trees in order to allow for planting of more cocoa plants, because he believes it will be very difficult to control weeds under reduced shade conditions and fears the hybrid plants may not develop in a way to permit easy harvest.

6. The traditional concept of technology transfer in cocoa cultivation

In the beginning, agricultural extension programs in most of our countries were based on the idea of promoting innovations. The assumption was that the extensionist or progressive farmers could easily disseminate the innovations to all places and regions within our countries. Programs did not take into account the problems and specific needs of small and large farmers.

While it is obvious that the final purpose of technological innovation is incorporation of new technology into the productive process, the important role of the producer has to be considered since he is the one who generates development.

7. Determining factors in the implementation of an efficient extension service for cocoa cultivation

To be effective, extension work must be closely linked to coherent actions by a series of institutions which have as their task the organization, handling and administration of the factors and/or services which generate agricultural production.

If extension services are not adequately integrated, duplication will continue to waste resources, energy and time. This also will lead to development of a negative attitude on the part of the producers as they face the disorienting image of the State services and of the technicians involved in those services.

Assuming an ideal conception of agricultural extension inter-related with a series of public and private actions that will achieve the common objectives of agricultural development and social promotion of the rural family. The extension service is closely linked to the whole and to the several internal and external factors affecting its structure.

7.1 External factors

7.1.1 Natural resources

Among the most important resources we could point out are land, water and climate. If the agroclimatic conditions are unfavorable or incompatible with those which gave rise to the generated technology, it will have difficulty being successful.

7.1.2 Rural credit

It is not conceivable from an objective and practical point of view that changes to improve cocoa production systems can be promoted only through demonstrations, without creating suitable conditions, so that the producer can have the elements he requires for production; i.e., economic resources for buying inputs and for payment of labor. More specifically, we refer to agricultural credit without which it is practically impossible to dynamize production.

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7.1.3 Technology in evolution

Cocoa production technology is always evolving and is subject to results of basic and applied research within the conditions of its own environment. This is a very important factor for the success of an extension service which seeks to guarantee the development of the cocoa producer and his family.

7.1.4 Input, equipment and infrastructure

The availability and adequate supplies of inputs for production are an indispensable component in which production is based. Furthermore, proper quantity of equipment and infrastructure that would facilitate movement, transport and safekeeping of inputs and production are important. In this way there will be an adequate movement of them, so the producer can have easy access to inputs and the markets, and the possibility to add value to his production.

7.1.5 Incentives for the producer

The day-to-day risks to which the cocoa growers are exposed during the production process require from the State a certain level of protection and stimulus. This can be translated into adequate and fair tax treatment of the producers to guarantee their competitive position as compared to other sectors of the economy.

We must remember that our rural areas are characterized by the lack of basic health services, education and recreation, and the State must make it possible for an adequate environment to stimulate the rural family toward greater production.

7.2 Internal factors

7.2.1 Institutional frame

The institutional frame in which an extension service should operate for cocoa producers must be well defined and solidly formed. This implies that cocoa extensionists must be sufficient in number and dedicated to the service of the cocoa producers and that they should have enough resources, equipment, work materials, etc. They also must not be without institutional support or clear definition of the objectives of their action policy.

7.2.2 Defined policy

By necessity, extension directed to the cocoa producers must have a well defined action policy, which must be coherent, practical and adequate to the conditions of the sector served, having as its strength the experience and know-how of technicians of the country familiar with the problems of national cocoa growing.

7.2.3 Work plan

In this case I refer to the preparation of a work plan at the field level. This must have well-defined objectives and goals so as to permit its quantitative and qualitative evaluation of the work.

7.2.4 Sufficient and adequate resources

We principally refer to the human resources. It is well known that, due to the characteristics of cocoa cultivation, the technicians assisting the producer must be sufficiently trained and capable, in cultural techniques of the crop and have basic knowledge of the phylosophy of extension and methodology of comunication. On the other hand, mechanisms to stimulate personnel must be considered, specifically for those who live in the field, living a rural way of life without enjoying the urban conditions.

8. Towards a new approach for extension in cocoa growing

Our concept in this presentation has been to present what could be an educational process in which the participation of the cocoa producer may guarantee the introduction of new technologies producing notable increases in productivity and production, promoting also the participation of the producers in definition of development policies and guaranteeing their own well-being and the well-being of the social group.

We believe in agricultural extension and education work that will try to create the possibility for cocoa producers to learn by doing, so that they will be educated, will get the know-how with which to solve problems, and will make progress through their own efforts.

Thank you.

3470c

1st INTER-AMERICAN COCOA FORUM
January 27-30, 1987
San Jose, Costa Rica

PAN AMERICAN DEVELOPMENT
FOUNDATION (PADF), 1889 F St. N.W.
Washington, D.C. 20006, USA

Panel III

EXTENSION SYSTEMS ALTERNATIVES

EXTENSION SYSTEMS IN COLOMBIA AND HONDURAS
(Original document: Spanish)

Jesús A. Sánchez

I wish to refer in this brief statement to the extension system and training which have been used and/or are still used in Colombia and to the structure of the plan that APROCACAHO wants to implement in Honduras.

Speaking of cocoa extension in Colombia, it is necessary to point out two types: one for cocoa growers, and one carried out for those who do not grow cocoa, that is to say, for those who know nothing about its cultivation.

Extension carried out for Colombian cocoa growers has used different methods which I will mention, even if I don't pretend to analyze here their results:

1. The first method I have named "Paternalist" or "Do it all". It was popular during the 1950s and consisted in formation of gangs under a foreman (technician or paratechnician) who came to the farm and did everything without any cost for the user (even the inputs). Thus, paternalism was created. Because this method cost the farmer nothing, when it was finished the farmer had not learned much. Many farms receiving this type of extension subsequentely deteriorated.

2. The second method was the direct view. With this system, there is a more personal communication with the farmer. The extensionist could more closely know the crop limitations and especially the man himself. Its disadvantage is that coverage is reduced. In a country where cocoa growing areas are dispersed, resources become insufficient.

3. Later the method of Basic Courses came into being, which ran for one or two weeks and usually were conducted on the farms and in areas where cocoa culture was concentrated. These courses included theory and practice and were much used by chocolate companies with good results at the beginning. The need to special-

ize the courses soon became apparent in order to direct them more to the needs of each group of farmers. For example, if the problem in a certain area was disease, a short course was set up covering details of the problem and ways to solve it. This helped maintain farmer interest and achieved better attendance.

4. Demonstration farms or plots. This system has been implemented extensively in Colombia, starting in 1980, and has given a new look to the extension service. It also served the technical assistants from the Practical School, where the farmer is converted into a multiplying agent and the principal ally of the extensionist. The farmer is more often convinced by the testimony of another farmer who has the same limitations and problems.

   It is important to point out that even though the ideal is that a farm demonstrates all the aspects related to the "technological package", it may often demonstrate the success of a single given practice. For example, I personally have experience in Colombia with farms which, with the complementary practice of discarding fruits infected by Monilia, have increased yields from 300 to 900 and even 1,200 kg/ha. I say complementary, because the farmer was already carrying out added management work, but was failing to control Monilia.

Except for the method of the "do it all" gang, the other extension methods have continued in use by agencies like the National Federation of Cocoa Growers, which is financed by the producers themselves.

As to the type of extension for those who do not grow cocoa, it seeks to demonstrate that cocoa is as profitable as other crops, like coffee, for example. The important point in this extension method is the growth of cocoa as a business. Extensionists explain, not so much practices or technological components, as profitability concepts, benefit-cost relations, labor utilization, diversification of income, etc. This extension is carried out with and for managers, who instead of technological ideas need economic criteria.

There is no doubt that the best system to promote the cultivation in those areas (coffee areas), is for farmers to visit farms with high technical concepts, above all supported by modern systems for rural administration, where the technical-economical parameters and priorities (profitability analysis, systematization, etc.) are pointed out. To this end, the extensionist is supported by the program of rural administration of the Federation of Coffee Growers, which has specialists in those areas.

The Federation of Coffee Growers at present supports a planting project of 15,000 ha in the lowland coffee zone, as a strategy to re-order coffee production and increase production of other raw materials, to diversify the income of the coffee growers and of the country.

As for Honduras, with few exceptions the producers are merely cocoa "harvesters" and not growers. APROCACAHO (Association of Cocoa Producers of Honduras) is implementing the following extension plan:

First: Integration of institutions which are interested in some way in the crop and in organization of the producers.

Second: Training of its technicians and others who have been assigned by other entities, part time or full time.

Third: Definition of areas and identification of agricultural leaders in each sector where the technician will work.

Fourth: Each technician, within his area of influence will identify, with the help of the leader farmers, five other farmers to collaborate in establishing demonstration farms.

Fifth: Other farmers of each such group will be trained through courses and technical visits to the demonstration farms.

Logically, it is essential to open the "bottlenecks" which are: lack of cocoa credit, lack of improved material for propagation, and solution of the drainage problem. These require government programs because they are so general in the zone and for market consolidation.

If these plans work out, cultivation of cocoa in Honduras will finally be a reality.

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PANEL III

EXTENSION SYSTEMS ALTERNATIVES

THE CEPLAC CASE

(Original document: Spanish)

Frederico Monteiro Alvarez-Afonso

1. Introduction

CEPLAC (Comissao Executiva do Plano de Lavoura Cacaueira) is the Executive Commission of the Cocoa Planting Plan, an office of the Brazilian Government in charge of the cocoa policy. To promote development of cocoa cultivation it has used rural extension as a principal instrument, as well as research and training.

Over 30 years of activity different extension methods have been applied and adapted to the various circumstances which were confronted. In Bahía, Espírito Santo or Amazonia, CEPLAC has applied different methods, varying its methodological emphasis according to environment characteristics, kind of farming, (large, medium or small), and availability of human and financial resources.

2. Characteristics of CEPLAC Assistance to the Cocoa Region of Bahia and Espirito Santo

In 1959-60, CEPLAC started its program of assistance, primarily financial assistance for "operations of debt adjustment" through contracts with the agronomists.

During the period 1960-62, all the services were provided through a single office, the Regional Superintendancy of the Cocoa Planting Plan, and its technical corps, called SETAC--Agricultural Technical Services. The extensionists travelled throughout the cocoa region to evaluate production of the cocoa farms, support the "debt adjustment" plan, and prepare investment plans to improve conditions of both on-farm processing facilities (the "beneficios") and work conditions for the administrators and rural workers. Extensionists sometimes were absent from the stations for as long as 20 to 30 days at a time because of the very bad roads in the cocoa zone in those days. During this early period, field trials popularized and spread new agricultural practices, prior to development of full scientific knowledge of the cocoa region. This was known as the "heroic period" of assistance to cocoa agriculture.

Starting in 1962, a policy of decentralizing the assistance services was started, with the installation of the Regional Superintendancy of Ipiaú, located in the transition zones between the cocoa zone and the cattle raising zone to the west. In 1962, a Regional Superintendancy of Canavieira was also installed, located in the region of the big rivers, Rio Pardo and Jequitinhonha, which dominated one of the oldest cocoa areas in Bahía. In 1964, a Regional Superintendancy of Ubaitaba was established between Itabuna and Ipiaú, in the large cocoa area on the banks of the Rio de Contas.

In 1963 CEPEC, --Center for Cocoa Investigation-- was created to study various technical problems which were damaging cocoa cultivations and to develop technologies to minimize their effects.

CEPLAC in 1964 introduced a major change, in its technical/extension assistance by creating DEPEX, an Extension Department. This new department would establish policies for rural extension and direct and supervise the local offices in the cocoa region.

The local office is the front line of the extension service as it is in constant contact with producers in their economic and social universe. Each local office has its own action plan at the community level for farm and producer. At present, the local offices, coordinated by regional offices, make up CEPLAC's network in the cocoa regions. There are 559 extensionists helping 22,000 farmers in Bahía and Espirito Santo (Annex 1).

Initially, personnel was insufficient. To impact on production as rapidly as possible, priority was placed on helping that 14% of producers who had 33% of the calculated area and accounted for 43% of total production. Next priority was given to the group of large producers who made up 1.4% of all farmers, had 12% of the area, and accounted for 16% of the production.

It was important for CEPLAC, a new organization, to demonstrate that it was capable of reversing the decline in Brazilian cocoa production. The strategy of conducting rural extension work first with the medium and large producers was necessary because these were the growers who had collateral security for, and access to, rural credit.

2.1 Methods Employed in Bahia

At the beginning of CEPLAC's rural extension work in Bahia, when there were no roads and visits to the farms had to be made by mule, individual farm visits were very difficult. Nevertheless, extensionists did visit, and individual meetings of technicians with the farmers at the farm level also were carried out.

Visits to the farms were justified by the farmers' extreme lack of the technological know-how necessary to reverse the very poor social and economic state of the cocoa plantations.

Productivity was very low mainly because of pests and diseases. There was need for a concentrated effort not only to take to the farmers theories about how to control pests and diseases, but, more important, to teach them to carry out those controls.

By working with the extensionists, the growers and laborers learned how to apply pest and disease controls as well as other improved practices.

By working with the extensionists, individual demonstrations for the farmers, their families and employees, followed by repetitive and patient training of workers "in situ" were the most frequently employed methods.

Training gave substantial consideration to proper quantities of material, proper operation of equipment, timely application of control measures, and maintenance of machinery and small repairs. Direct and personal contacts with the farmers were required for training and for subsequent monitoring and guidance.

The same teachings were also given to rural workers, through "mobile courses" carried out with the help of the simplest brochures and other training materials, that the extensionists could use in the field. After a time CEPLAC benefited from the donation of a vehicle, imported from the United States, equipped with audiovisuals more sophisticated than those used in the mobile courses. Rural workers gathered around that vehicle, in places where the vehicle could travel, for the lectures from the extensionists.

Starting in 1965, CEPLAC began formal courses for rural workers, with the support of EMARC, The Cocoa Region Medium School of Agriculture. Starting in 1966, EMARC was the site of an annual "Farmer's Week", a national gathering of farmers with extensionists and researchers of CEPLAC. The week permitted a kind of recycling of knowledge and information about the latest technological discoveries in cocoa and other economically important crops of the region. The Farmer's Week became an annual networking event, among the farmers since 1966.

A close link exists between credit and the recommended technologies. As credit supervision required the presence of the extensionists in the farms, farm visits became burdensome for the financing agencies.

Despite the high cost of the process of visiting the farms, and of the related individual demonstration method, the practice grows at a dizzying pace. Momentum expanded with the encouragement of other technologies, such as fertilization and renovation of plantations, and with expansion into new areas with new technical requirements. Visits to the farms were made for collection of soil samples for analysis in relation to fertilization, and for establishment of work priorities on the farms. For many years, visits to the farms were mandatory to take to the rural man both the credit and technologies he needed for control of diseases and for restoring nutrients to the soil

Physical presence of the extensionist in the cocoa farms was necessary to carry out the work. His clinical eye was essential for proper

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follow-up of the project. During those mandatory visits required by the rural credit organization, the extensionist took to the farmer the new knowledge being generated by agronomic research.

Financing projects were prepared for the funding of these technology transfers. Financial agents sought projects for investments in new cocoa plantations, for renovation and development of entirely new areas, in the same way as they demanded technical projects for construction and expansion or for changes in the farm improvements.

Starting in the year 1967, the big growth described above became possible because new roads were built in the country which permitted efficient use of vehicles. This important working tool of the extensionist was initially a government car. Later, to reduce expenses, CEPLAC changed to financing vehicles of its technicians who received payment for kilometers travelled. Thus, CEPLAC avoided investments in official cars, maintenance, and the contracting of drivers.

The individual methods--effective though costly--were changed into a group methodology, when because of vehicle shortages, the extensionists could no longer carry out periodic individual visits to the farms (Annex 2). This shortage began to be felt in 1981, when a top level government order prohibited CEPLAC from providing the extensionists with financing to buy vehicles, the practice it had followed since 1967.

The group methodologies, which came into common use in 1982, were already being carried out simultaneously with individual methodologies, especially for promotion of cooperativism and rural syndicalism. On those occasions, the purpose was to point out to farmers the importance of group work, through conferences, field trips, group demonstrations of methods, etc. Through those extension methodologies, persons were placed in contact with each other and assisted the habit of group decisions on what to do and how to do it for the common benefit.

Later, methods of mass communication were used with radio as the information vehicle. The program "From Farm to Farm" was broadcast daily, Monday through Sunday, between 4:00 and 7:00 in the morning to towns in the various areas of the cocoa region. Contrary to the other DEPEX methods developed by extensionists, the radio program was carried out by news reporters of DICOM, Communication Division, which got technical information from CEPEC, the Center for Research of Cacao, and DEPEX.

The radio program has an outstanding technical section which transmits information and new technology; a second section which is a news report, providing cocoa prices and weather forecasts; a third, comprising interviews with farmers who report their experiences, successes and difficulties; and finally, a segment of messages for the inhabitants of the farms, sent by relatives and friends who live in the cities or are on travel, plus rural music within the program sections.

Another instrument for reaching individuals and groups in the cocoa region is a newspaper Journal of Cocoa Growers, which has completed 15 years of good services to the rural media. Extension materials are also used by DICOM, which publishes magazines and technical bulletins.

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As part of the incorporation of the small farmers into the regional economic process, the rural extension service introduced use of groups of voluntary workers near their communities as a means of making more effective the actions of the small producers and as a way of obtaining extension services at lower cost.

Not only technical instructions were received by groups of farmers; but all the productive activity began to be carried out in groups. Thus were built the collective flour houses, community tanks for pisciculture, primary schools, etc.

3. CEPLAC Programs in Amazonia

Amazonia was the cradle of cacao, and cacao was its principal export beginning about 1830. Amazonia was characterized from the second half of the 17th century to the middle of the 1960s as a region where cocoa exploitation was carried out essentially as an extractive activity. The County of Cametá, in the Municipio of Pará, which in that decade was the main productive region, reflected the regional extraction method with its plantations on canals reached by Amazonic rivers.

In 1970, CEPLAC created ASTECCA, a program of Technical Assistance to the Growers of Cacao in Cametá, and formalized agreements with ACAR, Association of Credit and Rural Assistance, with the purpose of orienting the farmers of Pará and Amazonas in plantation management to increase local cocoa production.

In 1971, by agreement with INCRA, National Institute of Colonization and Agrarian Reform, CEPLAC was induced to participate in an effort to help settle the agricultural frontier of the then Territory of Rondónia, collaborating in settlement of migrant colonies from the south of the country.

With substantial growth of CEPLAC's Amazonia activity during the 1970's, the need arose for central coordination. In October 1974, PROAM was born, a Special Program for Amazonia, based in Belém, to administer the activities of the organization in the north of the country.

Starting in 1976, with preparation of the Directive for Expansion of the National Cocoa Agriculture, PROCACAO, the embryonic planting program which was timidly started a few years before, grew and became more complicated, and led to DEPEA, a new Special Department for Amazonia. PROCACAO set for Amazonia a goal of 160,000 ha. of new cocoa growers, a challenge to be completed in ten years. The organization thus was faced with the need to create its own structure for rural extension.

CEPLAC then established local rural extension offices which were concentrated in locations in the states of Amazonia with the highest agronomic potential for cocoa. Today, the network of rural extension offices in Amazonia consists of eleven offices in Pará, six in Rodonia, two in Amazonas, two in Mato Grosso, one in Acre, one in Maranhao. Some 111 extensionists provide technical assistance to almost 6,000 farmers. The map in Annex 3 locates the so-called cocoa poles, where there are units of rural extension of CEPLAC in Amazonia.

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3.1 Methods Employed in Amazonia

The kind of farmer established in Amazonia to develop the PROCACAO program was the colonist, a migrant from other regions where cocoa was unknown. Many had not even seen cocoa plants before. There is a marked difference, therefore between "cacaocultura" of Bahía and that of Amazonia.

In the Amazon Municipio of Rondonia, for example, 73% of farmers are small scale (9 to 12 ha. of cocoa) who control 45% of the land under cultivation. The medium sized producer has a cocoa area of 20-25 ha. per farm, representing 20% of farmers and 33% of the cocoa area in Rondonia.

The prohibition of loan financing of vehicles for extensionists by the governmental authorities resulted from a decision of the "Tribunal de Cuentas de la Unión" that it was outside the law. As a result CEPLAC technicians faced great travel problems in working on a Project for Incentive Control of Witches' Broom in Amazonia, carried out simultaneously with CAVAB, Control Campaign of Witches' Broom to block expansion of the disease into Bahía and Espirito Santo which were and still are free of Witches' Broom.

The CAVAB used the Bahía approach in Amazonia, namely mass communication to transmit technical know-how to the farmers. Thousand of folders, bulletins and notices were published and distributed in the most remote corners of Amazonia. In them was always present the message about the importance of vigilance for exclusion and thus the permanent control of Witches' Broom. They included technical information about symptoms and control methods for the diseases.

CAVAB extended its messages also to the urban area to avoid the possibility that persons in transit through Amazonia might carry with them, to other regions of the country, botanical material (plants, fruits, seeds) that contaminated with the pathogen that causes Witches' Broom. Enforcement is mainly at the airports, making it therefore a method of phytosanitary defense. But this is also an extension methodology, as it is extending to the common man scientific knowledge generated in the laboratory and in the experiment stations by the scientists. Audiovisual methods used intensively at airports include films in which different technical aspects of Witches' Broom are shown to alert tourists and others throughout Amazonia about contamination risks to areas which are free of the fungus.

Also in Amazonia, CEPLAC promoted voluntary groups, which in this region have the Indian name of "Ajuri", for carrying out work of community interest in communities where small plots owners are concentrated similar to those in Bahía. In Amazonia, voluntary work in groups is undertaken, when the concentration of farmers permits the use of that method. A recent example is construction of community nurseries of cocoa, in Urupá-Rondonia, where CEPLAC has been carrying out, with financial support of the World Bank, a project for expansion of cocoa production.

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Brief but adequate radio messages are also used in Amazonia, to spread technical information, cocoa market prices and news of interest to cocoa growers. This is supported by Radiobrás, the state enterprise of radio-diffusion of the Ministry of Communications. Daily, Monday through Friday, between 8:00 and 11:30 in the a.m., the National Radio of Amazonia broadcasts the program "Good Morning Amazonia", with messages from CEPLAC. These messages try to answer farmers' questions sent to the stations. (Annex 4 presents the first CEPLAC messages of the program "Good Morning Amazonia".)

4. FORMAL LABOR TRAINING

CEPLAC began in 1965 to carry out formal courses for rural workers, through EMARC, and carried out in Bahía by teachers from DEPED --Department of Education, Coordinating Unit of the EMARCs and in Amazonia, coordinated by TMO, Training of Labor, based in the Extension Services with financial support from SENAR --National Service of Rural Learning, Labor Ministry. As such, within CEPLAC, those courses are not considered to be a proper methodology of extension.

While this training may be considered a separate segment, it is discussed here because of its relevance to the diffusion of technology. In fact, without the TMO, the actions of the cocoa growers would be of little value if their employees were not trained to apply well in the field the techniques generated by the research.

Proper specialization of rural workers is a task not really completed by training at the field level through informal training methods. Examples of such specialized labor are: 1) operators of the cocoa "beneficios" (plants for handling, fermenting, drying, bagging, etc., all post--harvest processing), who are responsible for primary processing at the farm level (Annex 5); 2) the person who trains new growers whose training must cover all steps in cocoa renovation, from nurseries to care of field plants up to harvest age; 3) the man who identifies and who controls pests and diseases using machines and proper amounts of chemicals; and 4) the farm administrator himself who coordinates these actions and all others in the production unit.

The teaching methods of EMARC and the Extensive Service have been effective for specialization training of this type of operator through rural workers groups which for weekly periods are subjected to a teaching and socialization program.

A fundamental segment of the production process, the specialized rural worker, is highly valued by the extensionist, who generally identifies him by name and deals technically with him in the presence or absence of the boss, transmitting to him details of what has to be done to solve the problems in the plantation. In Amazonia, the owner of a Colonization Project plot is at the same time, with his wife and children, a worker and owner.

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5. CONCLUSIONS

The extension system, with support from research and the complementation of teaching, has been responsible for the success of CEPLAC efforts through the years. This success is reflected in reversal of the decline of the Brazilian cocoa producers, who at the time of CEPLAC's creation in 1960-65 produced 123,000 tons and 380,000 tons during the five-year period 1980-85, (Annex 6) and in the year 1985, a record 457,000 tons.

Since CEPLAC's administrative and fiscal autonomy were reduced, CEPLAC has faced both as an organization as a whole and in its extension efforts in particular. The number of farm visits has had to be reduced, and training of labor was not continued at the same intensity. Thus, if in much of the verbal presentation of this "paper" we use the past tense, it is because we are aware that the present conditions are different from those of the past and from what is desirable.

The present system of extension of CEPLAC requires urgent rethinking and immediate revitalization. It is mandatory that CEPLAC recuperate its autonomy and that it again receive the total resources that the Brazilian cocoa grower contributes, so that its system of extension can regain its past efficiency.

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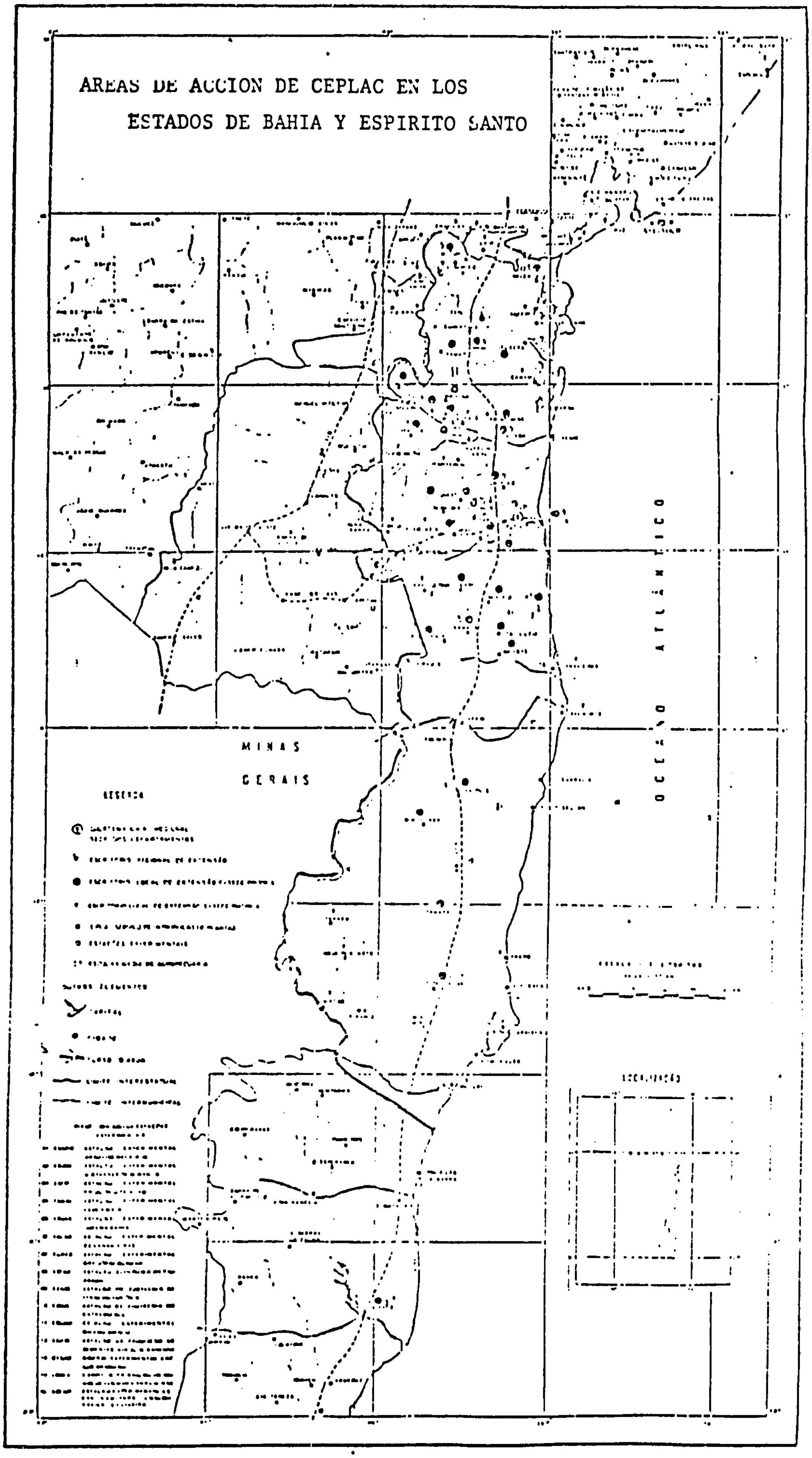
CEPLAC

ANEXO 1



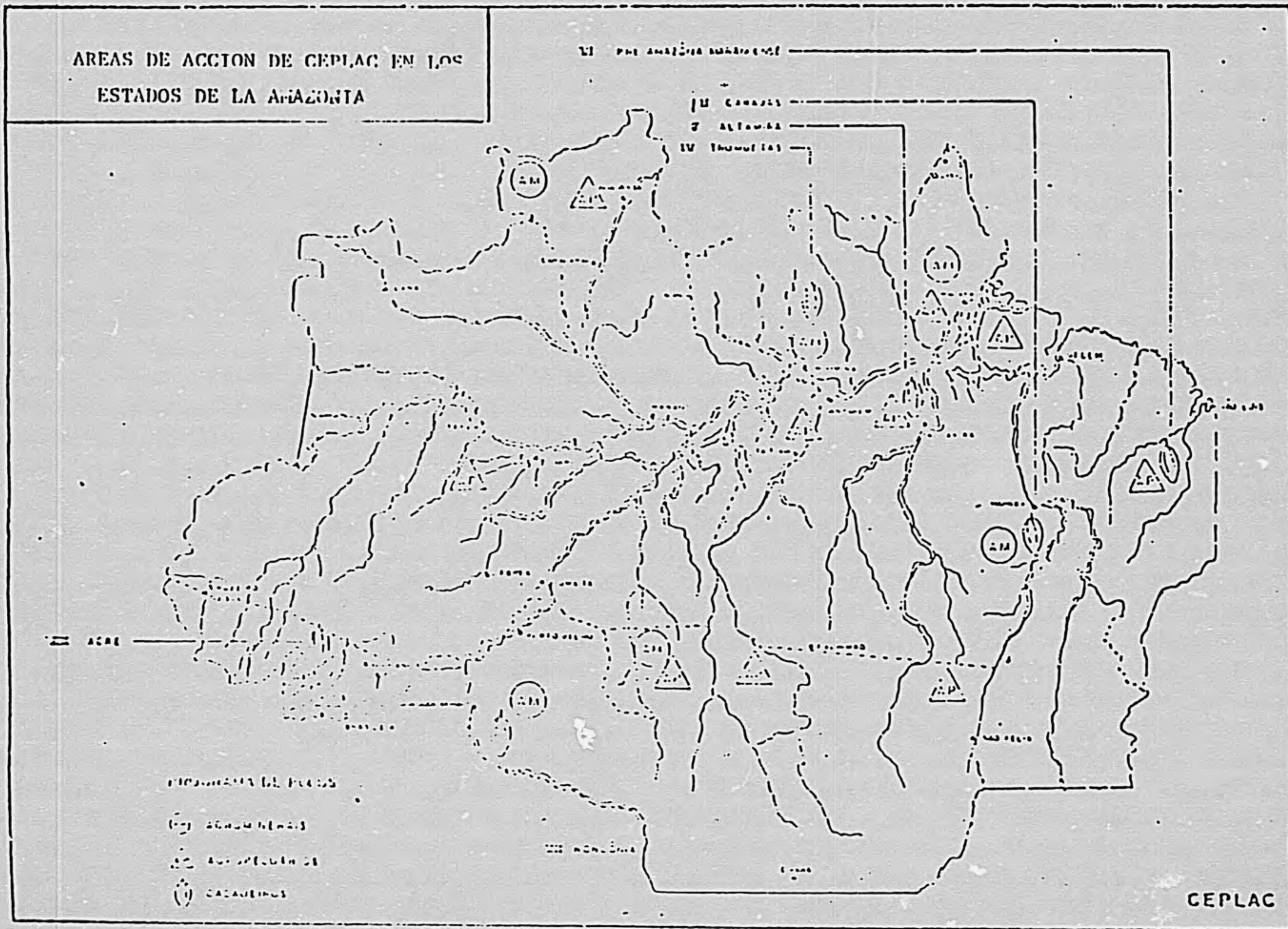
Anexo 2 - Evolución de las visitas a las haciendas - 1976-86

AÑO	UNIDAD DE MEDIDA	VISITAS A LAS HACIENDAS	
		BA/ES	AMAZÔNIA
1986	Nº	22/255 (1)	13/482
1985	Nº	50/671	10/806
1984	Nº	65/887	9/402
1983	Nº	71/730	8/961
1982	Nº	72/080	21/347
1981	Nº	81/607	14,808
1980	Nº	60/985	8,078
1979	Nº	48/942	(2)
1978	Nº	36/838	(2)
1977	Nº	29/715	(2)
1976	Nº	30/373	(2)
TOTAL	Nº	571;083	86,884

(1) Hasta septiembre 1986

(2) Sin información

ANEXO 3



AREAS DE ACCION DE CEPLAC EN LOS ESTADOS DE LA AMAZONIA

ANEXO 4

RÁDIO NACIONAL DA AMAZÔNIA

Lauda nº 01 — Programa "BOM DIA AMAZÔNIA"

-----ATENÇÃO, PRODUTOR DE CACAU DA AMAZÔNIA: A PARTIR DE HOJE A CEPLAC, ASSOCIADA À RÁDIO NACIONAL DA AMAZÔNIA, ESTÁ COM VOCÊ NESTE HORÁRIO PARA FALAR DE TUDO SOBRE A CACAUICULTURA, UMA DAS MAIORES RIQUEZAS DO BRASIL. DE SEGUNDA A SEXTA, DOIS MINUTOS POR DIA, O PRODUTOR DE CACAU FICARÁ SABENDO DAS RECOMENDAÇÕES TÉCNICAS, DOS RECADOS DA EXTENSÃO RURAL, DAS ÚLTIMAS DESCOBERTAS DA PESQUISA E DE OUTROS ASSUNTOS MUITO IMPORTANTES PARA O BOM DESENVOLVIMENTO DA LAVOURA.

ATENÇÃO, CACAUICULTOR DO PARÁ, DE RONDÔNIA, DO AMAZONAS, DO ACRE, DE MATO GROSSO E DO MARANHÃO: A CEPLAC TEM SEMPRE UM ESCRITÓRIO DE EXTENSÃO PERTO DE VOCÊ. LÁ ESTÃO OS AGRÔNOMOS E OS TÉCNICOS AGRÍCOLAS DO CACAU PRONTOS PARA ESCLARECER QUALQUER DÚVIDA SOBRE AS PRAGAS E DOENÇAS DA LAVOURA, O PLANTIO, A ADUBAÇÃO, OS CUIDADOS COM A ROÇA, A COLHEITA E O BENEFICIAMENTO DAS AMÊNDOAS. ENFIM, TUDO O QUE VOCÊ PRECISA SABER PARA PROGREDIR O SEU LOTE, A SUA FAZENDA, VOCÊ QUE PENSA NO SEU FUTURO E NO FUTURO DE SUA FAMÍLIA.

AMIGO AGRICULTOR, VAMOS COMEÇAR FALANDO DE UM PROBLEMA QUE VOCÊ CONHECE MUITO BEM: A VASSOURA-DE-BRUXA.

A VASSOURA-DE-BRUXA É A MAIS SÉRIA DOENÇA DO CACAUEIRO. ELA ATACA OS GALHOS NOVOS, AS ALMOFADAS DE FLORES E OS FRUTOS DO CACAU. É UMA DOENÇA PERIGOSA: SE O CACAUICULTOR NÃO TOMA LOGO UMA PROVIDÊNCIA, A VASSOURA-DE-BRUXA TOMA CONTA DA LAVOURA E O PREJUÍZO PODE SER GRANDE. A PRODUÇÃO DIMINUI, E O DESÂNIMO DO AGRICULTOR AUMENTA.

MAS A VASSOURA-DE-BRUXA TEM SOLUÇÃO. PARA ISSO, É PRECISO

RÁDIO NACIONAL DA AMAZÔNIA

Lauda nº 02 — Programa "BOM DIA AMAZÔNIA"

QUE TODOS, AGRICULTORES E EXTENSIONISTAS DA CEPLAC, TRABALHEM JUNTOS NO CONTROLE DA DOENÇA NOS CACAUEIROS. POR ISSO, AGRICULTOR PRESTE ATENÇÃO: PROCURE O ESCRITÓRIO LOCAL DA CEPLAC MAIS PERTO DE SUA FAZENDA. CONTE COM A AJUDA DO EXTENSIONISTA. A UNIÃO DE TODOS VENCERÁ A VASSOURA-DE-BRUXA.

AMIGO CACAUICULTOR DA AMAZÔNIA: AMANHÃ, VOLTAREMOS A FALAR SOBRE CACAU. ATÉ LÁ.

Anexo 5 - EVOLUCION DEL ENTRENAMIENTO DE MANO DE OBRA - 1976-86

AÑO	UNIDAD DE MEDIDA	EMO		
		FORMAL		INFORMAL
		BA/ES	AMAZÔNIA	BA/ES
1986	Particip.	3,363(3)	215	12,946(1)
1985	Particip.	3,691	1,352	22,975
1984	Particip.	3.908	2.536	30.873
1983	Particip.	1.480	3.737	34.003
1982	Particip.	3.196	2.498	45.777
1981	Particip.	8.667	3.115	55.479
1980	Particip.	8.812	126(2)	45.878
1979	Particip.	12.950	4.077	38.995
1978	Particip.	11.112	(3)	24.551
1977	Particip.	8.015	(3)	21.233
1976	Particip.	5.294	(3)	15.787
TOTAL	Particip.	70,488	17,656	348,497

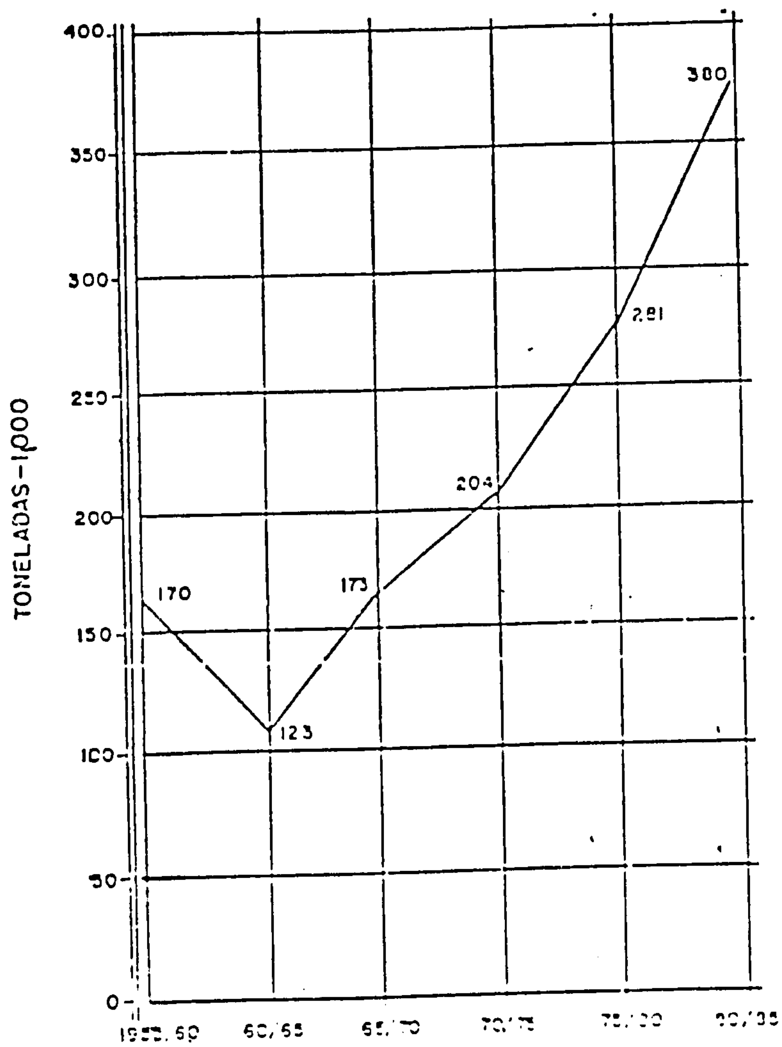
(1) Hasta septiembre 1986

(2) Recién en diciembre 1980

(3) Sin información

ANEXO 6

PRODUCCION BRASILEÑA DE CACAO
(Médio por Quinquenio)



Brasilia, Diciembre 1986

1st INTER-AMERICAN COCOA FORUM
January 27-30, 1987
San Jose, Costa Rica

PAN AMERICAN DEVELOPMENT
FOUNDATION (PADF), 1889 F St NW
Washington, D.C. 20006, U.S.A.

PANEL IV

ECONOMICS OF COCOA PRODUCTION AND MARKETING

Ron Bixler of M and M Mars supported discussions regarding the agronomic objectives of research, but encouraged a stronger emphasis on flavor, since only cocoa without flavor defects (moldy or burnt rubber characteristics) has an assured market to benefit the producer. Flavor quality is the key to consumer confidence and increased consumption.

Dr. L. Purdy, speaking for Russell Jensen, reviewed the perceived and real risks of Witches' Broom disease on farms in Tomé-Acu, Brazil. Results of studies on preventive practices indicate economic justifications for regular pruning and plant care.

Michael Evnin, entrepreneur, described in outline what his company defines as a "Complete Cocoa Investment". The four necessary components are a processing factory, a nucleus cocoa estate farm, independent cocoa producers, and an estate-owned extension service. The estate must be a minimum economic unit and use the intensive system. Independent farmers should be minority owners of the factory, and would use traditional production strategies. Financial costs and returns were elaborated.

José Martínez, Dominican Republic, reviewed the economic and labor conditions of cocoa production in the Dominican Republic. Recommendations to increase profits included improved plastic export bags, simplified export procedures, greater transportation efficiency, and better premiums for quality.

In response to questions, the panelists made the following statements:

- There is no operating example of a "complete" cocoa system;

- Many cooperative efforts between cocoa producers and consumers exist, such as the U.K. in Africa, ACRI in the Americas, and others;

- Rather than planning to develop chocolate production in developing countries, most processors prefer to control quality by buying beans. Development can therefore be carried out through joint ventures.

- The minimum economic unit for an estate farm in the "complete" cocoa project is considered to be 8 million pounds/year. A "small" investment for a complete cocoa project was defined as about $5 million/year.

- Standard yields of cocoa should be what is normally produced from stands of 1,000 trees/hectare, with farmers receiving a fair price, plus dividends from their ownership in the factory.

James Corven
Rapporteur

1029c

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PANEL IV

ECONOMICS OF COCOA PRODUCTION AND MARKETING

THE ECONOMIC IMPACT OF COCOA FLAVOR
(Original Document: English)

Ronald G. Bixler

Before I proceed, let me clarify one point concerning the title of this presentation. I am not an economist nor am I directly involved with the pure economics of cocoa. My experience is in the processing of cocoa beans and the development of chocolates and chocolate-related products. So, rather than presenting volumes of economic data, let me present a processor's viewpoint on a cocoa attribute which, in my opinion, can be missed when planning cocoa producing projects. It is an attribute which can impact significantly on the ultimate economic return obtained by the producer.

Most plant breeders and cocoa growers consider various characteristics when developing hybrids or selecting stock for planting. Some of these characteristics could be:

1. Increased yields.

2. Disease resistance.

3. Increased environmental stress tolerance.

One must agree that the above are of prime importance when attempting to increase the economic returns realized by the producer.

Another very important are in the production of quality cocoa is post-harvest treatment. We would include such factors as:

1. Pod quality.

2. Fermentation regimes.

3. Drying techniques.

Again, one cannot argue with the importance of the above with the objective being a maximum return for the resources committed. In fact, the literature cites many examples relating the post harvest treatment to the production of quality cocoa. This is especially true with cocoa flavor. For example, it is stated that flavor precursors produce the chocolate flavor after roasting the cocoa beans. These flavor precursors are created through the use of proper fermentation and drying regimes. It is this attribute -- flavor -- which I would like to discuss further.

Flavor is a very subjective attribute and leads to many debates. We can debate the relative importance of tree type versus post-harvest treatment and their impact on chocolate flavor. We can and frequently do debate "What constitutes good flavored cocoa?" Actually, these debates belong in another forum and will not be pursued today. Rather, we ask you to consider the final flavor of the cocoa produced as an equal partner with the previously mentioned factors in the planning of future cocoa projects. We are not necessarily discussing the low volume flavor cocoas of the past, but bulk cocoas in significant volumes.

As one reviews present cocoa supplies, it cannot be denied that cocoa with varying levels of flavor defects is being sold and used by processors. In fact, all of the cocoa being produced is being used somewhere. By setting low use rates in blends, by product selectivity, and by adding processing steps, the manufacturer does use the cocoa. At times, given a choice, a processor would not use this cocoa, even at low levels. This leads to a question: What will happen to cocoa with flavor defects; should a surplus in supply develop and the processor has a choice? My argument is that only cocoa free of flavor defects has the potential of providing the maximum economic benefits to the producer.

Examples of varying economic returns exist on the cocoa exchange today. There are bulk cocoas which sell at a discount to the board and there are bulk cocoas which sell at significant premiums. Yield can be a factor in this situation, but the major portion of the price difference is in the flavor values of the cocoas.

There are two factors mentioned briefly which can be key to a cocoa's economic return. When a cocoa is available on a consistent basis and at consistently high quality levels, a processor will develop a high degree of confidence in this material. This can result in higher use rates in blends and the use in all products requiring cocoa-related new materials. Another possible advantage to be derived from this increased confidence level is the elimination of additional processing steps required to improve flavor. This can reduce the asset base of a manufacturing facility and thus increase the desirability of the cocoa. Potentially, these factors can improve the economic return of the cocoa.

To give you one other opinion on the trend of cocoa flavor, let me read a paragraph from "Chocolate Production and Use," by L. Russell Cook, recently revised by Dr. E. H. Meursing:

> No better way could be used to individualize the cocoa of any given producing country, and lift its price above the more common cocoas which, though good, are distinguished only by their freedom from flavor defects. Too much "sameness" of flavor character has developed in the bulk cocoas of the world during

the past few decades, as attention to individual flavor has suffered in the admittedly necessary battle to develop high yielding and disease resistant varieties. It could well be that a greater variety of good chocolate flavors could serve in at least a modest way as "breakwaters" against volatile price fluctuations, and at the same time help lift per capita consumption by breaking the "flavor monotony" with which too many chocolate products are now afflicted.

With the interest in cocoa development being noted here in the Americas, I would hope that efforts will include an attempt to reverse the trend discussed above by incorporating a concern for flavor in the planning process. An increase in per capita consumption of chocolate products, as mentioned above, is desired by all. Key to this consumption increase is providing flavor systems that satisfy our consumers. Many things can be done to products in an attempt to increase consumption but, when all is said and done: "We Sell Flavor."

What I have said during this presentation could really be stated in one sentence: To obtain the maximum economic benefits from producing cocoa, it must be available in significant quantities and free of flavor defects to allow a processor to use it at high percentages in an unrestricted manner.

In closing, let me state a possible objective for this group. Cocoa, we are told, started in the Americas. This part of the world, at one time, had the reputation of producing consistent and significant quantities of the world's finest cocoa. I would hope that the efforts put forth by this group will again make the above a true statement.

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PANEL IV

ECONOMICS OF COCOA PRODUCTION AND MARKETING

WITCHES' BROOM AND COCOA IN THE AMAZON: MANAGEMENT BY JAPANESE-BRAZILIAN FARMERS

(Original Document: Spanish)

Russell C. Jensen *

Introduction

Perception and management of risk by small farmers have been addressed by many, including Wharton who argued that risk aversion is a major concern of small farmers. Rejection of new technology by small farmers is often because of their attempts to avoid risks. However, empirical data that fully substantiate this point are still needed (11).

Ortiz studied risk management of Colombian small holders by viewing risk as an opportunity cost included in decisions on time and labor allocation. She found that small, more traditional farmers are no more risk averse than their "modern" counterparts (32).

Brush identified three types of strategies that Andean farmers utilize to reduce risk. (A) Production strategies that include cash crops and a variety of subsistence crops, and the use of proven cropping practices such as small, scattered fields, long fallows and traditional crop varieties. (B) Exchange strategies such as labor exchange and sharecropping lessen risk, although risk is not always reduced but may be spread or shared among farmers. (C) Sociocultural strategies like the kinship system and the patron-client relationship often allow the farmers to gain access to needed scarce resources, i.e. land and credit (13).

Management strategies (Table 1) may be preemptive or reactive (32). Production strategies such as diversification and scattered fields, attempt to preempt or reduce risk before it arises. Reactive measures, that might include replanting or borrowing, occur after a loss or damage.

Factors that affect the use or non-use of a risk reducing strategy may be one of several socioeconomic variables. Chibnik related farmer

* Delivered by Laurence H. Purdy.

status and residence to a labor allocation decision in Belize (26). Resource access and allocation influence decision making and may be linked back to Brush's sociocultural strategies which seek to relax or decrease the constraints of small farmers (10).

Climate, diseases, pests and product prices are major sources of risk for certain small farmers (12). The relationship of 21 different risk management responses and seven socioeconomic variables was examined using a logit regression model. Leverage ratios (debt to assets), farm size and farmer experience were the most important variables explaining the use or non-use of a management strategy (12).

While this study (12) does provide important insights into farmers' perception and responses to risks, it fails to analyze certain important aspects of the problem. For example, whether or not the strategy was successful in reducing risk was not examined. Whether or not a particular practice was utilized by a farmer is not sufficient, the factors that explain success or failure must be evaluated. Successful strategies then can be improved and those that cause failure can be corrected.

This study will provide a more complete analysis of the relationship between risk management strategies and a farmer's resource base, using Boggess' study as a basis (12). It is hypothesized that restricted access to resources is a major limiting factor that affects the success of a risk-reduction strategy. Control of the witches' broom disease (Crinipellis perniciosa (Stahel) Singer) by cocoa growers in Tome Acu, Brazil will be utilized to test the hypotheses.

Cocoa in the Amazon

Since the colonial period in the 16th and 17th centuries, cocoa has been harvested from wild stands of Theobroma cacao, L. located along the river banks in Amazonia. Cultivation of hybrid cocoa began in the early 1970's. The "Initial Program for the Cocoa Project" was undertaken in 1971 by CEPLAC (Commissao Executiva do Plano da Lavoura Cacaueira) in conjunction with the IPEAN and Para Secretary of Agriculture and resulted in the planting of 1800 hectares throughout the state of Para (17). With the opening of highways throughout the Amazon region, soil surveys identified 8 to 10 million hectares of excellent soils for cocoa. The major areas for potential expansion were found in the states of Para, Rondonia and Mato Grosso (5).

In 1975, CEPLAC responded to these optimistic surveys by creating the Special Program for the Amazon, which was transformed a year later to the Special Department of the Amazon (DEPEA) under PROCACAU. PROCACAU, a national program to promote the expansion of cocoa in Brazil, set a goal of 160,000 hectares of new cocoa in the Amazon over 10 years. Amazonian cocoa production rose from about 2000 tons in 1972, to over 8000 tons in 1981 and estimates for the following years are significantly higher (fig. 1) (24). The region's share in national cocoa production rose from less than 1% in the mid-1970's to 2.5% in 1981.

While the growth of cocoa in the Amazon is indeed impressive, the ultimate success of the program depends on the successful control of the witches' broom disease (4). The threat posed by the disease cannot be overstated: it was responsible for a significant reduction of the cocoa economy in Ecuador, one of the leading world producers at the turn of the century. The cocoa industries of Suriname, Guyana, and later, Trinidad, were also severely affected by the disease in the early 1900's. This fungal disease is spread by airborne spores that infect the young growing vegetative tissues, flower cushions and pods. Brooms that develop die after four to six weeks, and either fall to the ground or remain on the tree until removal. Basidiocarps develop on diseased plant parts soon after the advent of rainy weather. The basidiospores that are produced are dispersed by air movement and in turn infect newly developed, unhardened host tissues (9, 37, 38, 39).

The possibility that the disease might reach the older established cacao plantings in Bahia, as well as destroy the new Amazonian plantings, has caused CEPLAC to step up its quarantine and research efforts. Establishment of quarantine posts to intercept all plant material leaving the Amazon region, intensified research on disease resistant hybrids, epidemiology studies, expeditions to seek and collect resistant wild plants, and fungicide trials on experiment stations, all are directed at witches' broom in the Amazon region of Brazil (22).

CEPLAC technicians found that the cocoa farmers in the Tome Acu area of the state of Para were controlling witches' broom disease successfully. Although the control methods (the management strategy) used in Tome Acu are known, a description of these strategies and an evaluation of their effectiveness with respect to resource input has not been done.

Evaluation of management strategies versus risk will complement previous studies by providing insights into the reasons why a particular strategy is utilized in response to a perceived risk of the witches' broom disease. The hypothesis that farmers with access to resources, such as credit and extension, are more likely to have low levels of witches' broom in smaller areas of their plantings will be tested by relating disease levels to 17 variables that are grouped into five categories. The categories are: General Farmer Characteristics, Land Resources, Labor Resources, Capital Resources and other. The specific variables and the expected relationship to disease level are shown in Table 2.

The Study Area

The study was initiated in July, 1984 and completed in late October, 1984 in and near the municipality of Tome Acu, Para State, Brazil. Known as the black pepper capital of Brazil, Tome-Acu is located at 2 41' South latitude and 48 16 West longitude, approximately 200 km south of Belem (Fig. 2).

The climate of the Tome Acu region has been classified as Ami, under the Hoppen system of classification (47). Rainfall is heaviest between January and April (Fig. 2). The average annual temperature is 27.9 C, with minimum temperature of 27.6 C and a maximum of 28.4 C. A soil survey in the region, published in 1969, placed yellow latisols (Oxisols) of medium and heavy textures as the predominate type, making the soils marginally fertile (38). Topography of most farms is flat, although some are located in hilly areas.

Methodology

Fieldwork consisted of three stages:

I. Familiarization during July with the study area in the company of local CEPLAC extension agents on their visits to farms, and observing and conversing informally with farmers. Also CEPLAC's files on individual farmers were examined and reports on past production were evaluated.

II. The second stage involved formal inteviews with cocoa growers. A random sample was drawn consisting of 68 cocoa growers listed in CEPLAC's local files. This amounted to approximately 15% of the total number of growers who are assisted by CEPLAC. Eight farmers were eliminated from the study, because of language problems and/or they did not wish to cooperate. As a result, inteviews with 60 individual farmers were included in the study.

III. A questionnaire was developed and tested with several farmers, then modified to include four sections: (a) general farmer and production information; (b) risk and witches' broom perceptions; (c) management of witches' broom and (d) detailed crop enterprise budgets. The last section was modified to cover only one crop on each farm, instead of all crops grown. Although daily records for witches' broom control on the sample farms were not part of the study, three farmers agreed to record their activities daily.

Interviews were difficult because of language differences that were compounded since Japanese farmers did not speak Portuguese. Frequently, family members were recruited to serve as interpretors. In general however, I feel that the overall quality of responses was very good. The final stage of the study during October, 1984 consisted of the review of questionnaires, and where necessary, followup interviews with farmers.

Results

Of the 60 farmers interviewed, 37 were of Japanese origin, the remainder of interviewees were Brazilian from various regions of the country. The average age of 44.5 years applied to both ethnic groups.

The educational level differed according to ethnic group, 71% of the Japanese farmers had a high school education or better, compared with 5% of the Brazilian farmers. Almost 70% of Brazilians had some primary education, whereas all Japanese had completed grade school. Most farmers had worked the majority of their lives in agriculture, with an average of 29 years.

Japanese farms tended to be slightly larger than Brazilian owned farms, with 149.2 hectares and 128.7 hectares, respectively, and a vast majority of interviewees had legal title to their land.

Land use varied considerably, according to ethnic background. Japanese farmers devoted a much greater portion of their crop area to cash crops (black pepper, cocoa) with little area planted to food crops. Brazilian farmers placed greater emphasis on the basic food crops of rice, beans and cassava. The average land area devoted to forest, pasture, capoeira (secondary growth) and crops show the relatively small areas in pasture; a sharp contrast with current trends in Amazonian agriculture (Fig. 3).

Farmer Perception of Witches' Broom Disease Risk

What is the importance of the risk of the witches' broom disease compared to the other risks faced by farmers? Interviewees ranked 10 major risks on a scale of 1 (not a serious problem) to 5 (a serious problem). Disease problems were ranked well behind high input prices (61% giving rank of 5), high interest rates (50%) and low product prices (36.6). Only 35% of the farmers perceived disease as a major risk or problem. The risk of crop disease was perceived to be more important than the risk of unfavorable weather, excessive insects, bad health, and robbery of harvested products (Fig. 4).

Preoccupation with high input prices and interest rates resulted from the poor economic climate throughout Brazil. In 1984, the inflation rate (200%) caused difficulty for many independent farmers to purchase fertilizers. Because the soils in Tome Acu are relatively low in nutrients, farmers, especially the Japanese, have applied high rates of fertilizer to attain satisfactory yields of black pepper, cacao, etc. Fertilizer use had been subsidized by the government, but the recent economic crisis has eliminated these subsidies, thus shifting the cost to farmers. Agricultural loan rates have soared from 35% to over 70% in the last year, and many farmers find it impossible to pay back the bank and stay in business. Fire has been a major cause of loss for many farmers, usually due to a carelessness of a neighbor, or failure to control a planned burn.

Witches' Broom vs. Other Diseases

Farmers were asked to name the most serious crop disease/pest on their farm. Ten different diseases/pests were cited, including Fusarium, witches' broom, black pad rot, ants, thrips and others. Thirty percent of farmers selected Fusarium wilt of black pepper as the number one disease/pest. This disease reached epidemic proportion in the 1970's, and was a major cause of crop diversification. No cost effective control measures for Fusarium wilt have been developed, and farmers plan on a 5-7 year maximal life for a pepper plantation. Witches' broom of cacao was the second most important disease on the farm.

Witches' Broom vs. Other Cocoa Disease/Pests

Cocoa farmers in the Amazon region must combat several important pests that affect yields. "Vassoura" (witches' broom) was ranked as the major cocoa disease problem by 47% of the farmers. Japanese farmers were overwhelming in this view, whereas the responses of Brazilian farmers were evenly divided among witches' broom and black pod as the number one disease/pest problem.

Black pod rot was selected by 20% of the growers as the most important cocoa disease. Losses due to this disease were high in 1984, because of excessive rainfall. Presently, black pod is combatted by spraying a 4% cupric hydroxide solution during the early months of the rainy season.

Thrips cause a change in the color of immature cocoa fruit, and growers might harvest damaged fruit that may be mistaken for mature fruits. Fermentation of the immature cocoa beans lowers the overall quality of the dried cocoa beans. Thrips and almost all other insects can be controlled with insecticides.

The Management of Witches' Broom Disease Research and Official Recommendations

Witches' broom disease and its control have been studied intensively since the early 1900's. Although intensive effort has been devoted to produce resistant hybrids, no truly acceptable selections have been developed. Research on phytosanitary control methods has not developed techniques superior to those first proposed by Stahel in 1919, "...the careful removal, every 3 to 4 weeks of witch brooms, indurated pods and diseased cushions which should be buried, burned or taken away from the field." (46) Others have argued that annual or semi-annual prunings of diseased parts is sufficient and will reduce control costs (21). Chemical controls have received attention. Evaluation of 58 chemical formulations in the field and greenhouses of Belem, Brazil failed to detect any of sufficient effectiveness. In Colombia, a mixture of Plantvax and spray oil reduced basidiocarp formation and sporulation (21). Major constraints to the use of chemicals are their high costs and the need to purchase spray equipment.

For the Brazilian Amazon region, CEPLAC's previous official recommendation for witches' broom was an annual pruning of infected fruits, cushions and branches during the dry season. Branches were to be cut 10-15 centimeters below the point of infection. All diseased plant parts were to be removed from the plantation and burned. Use of fungicides was recommended to protect young fruits on higher yielding farms. Recent epidemiological research provided the basis for a change in the official recommendation to two annual prunings, during the months of August/-September and November/December (the beginning and end of the dry season, respectively) (6).

Management and Levels in Tome Acu

To determine the exact magnitude of the witches' broom problem in Amazonia, CEPLAC researchers developed a simple classification system with four levels of disease:

Level 0 - No incidence
Level 1 - Low incidence, less than 25% of trees affected
Level 2 - Medium incidence, 25-50% of trees affected
Level 3 - High incidence, more than 50% of trees affected

CEPLAC technicians evaluated witches' broom on farms for which they were responsible. The following results were obtained from sample of farms.

Level 0 - 30% of farms
Level 1 - 38.3%
Level 2 - 28.3%
Level 3 - 3.3%

These results differ from a previous study which found only 20% of farms rated a level 2 or 3 and 80% were ranked 0 and 1. Differences may be attributed to different survey dates, sample size and method of assessment. Regardless of these factors, it is apparent that on the majority of the cocoa farms in Tome Acu, control of witches' broom is satisfactory at present, even though considerable deviation from CEPLAC's official control recommendations was observed (15). For example, 30% of the farmers stated that they pruned for witches' broom three times or more during the year, whereas 22% followed the CEPLAC recommendation of two prunings per year. The remaining farmers (38%) performed only one major prune annually. As many as 60% of the farmers flatly rejected the recommendation to remove the diseased plant parts from the area, citing the excessive costs of gathering, transporting and burning the material. Instead, they elected to leave this material, as well as healthy branches removed to improve tree architecture, on the ground.

Analysis of factors which might account for differences between controlled (levels 0 and 1) and uncontrolled farms (levels 2 and 3) is presented, using the results of cross tabulations. Percentage distributions for each variable, by uncontrolled and controlled levels are presented in Table 5.

Influence of Resource Factors

(1) Ethnicity. A larger proportion of Japanese farmers had unsatisfactory levels of disease control than did Brazilian growers: 80% of the farmers with unacceptable levels were Japanese. There might be several reasons for this situation. For example, Japanese farmers might have larger areas of cocoa to maintain, thus it may be more difficult to control witches' broom over large areas. It appears that Japanese farmers are also more diversified, forcing farmers to spread resources and managerial skills over several different enterprises.

(2) Experience. There appears to be no clear relationship between a farmer's experience and his success in witches' broom control. Approximately 40% of the interviewees had less than 20 years experience in farming.

(3) Education. Farmers with a higher educational level were more likely to have poorer disease control; that is opposed to preconceived expectations.

(4) Crop Preference. 58% of the farmers stated that they preferred cocoa over black pepper and other crops. Findings were almost identical when grouped into controlled and uncontrolled categories.

Labor Resources

(1) Family Labor. The size of the family labor force appears to be related to the quality of control, in that 30% of farmers with good control had a force of four or more persons, whereas only 15% of those with poor control had a large workforce. The vast majority of farms operate with a relatively small family labor force of less than four persons.

(2) Permanent Labor Force. Notable differences in the use of permanent labor were also observed. Only 5% of farmers with poor levels of control had four or more permanent workers, whereas over 25% of farmers with effective control had the same number of workers.

(3) Family as % of Total Labor Force. There was no clear relationship between this ratio and the level of control. Of the total sample, 35% of the farms operated with family labor comprising 75% or more of the total labor force. Less than 20% operated with a low level of family labor force. Taken together, these three variables indicate that a large labor force, whether paid or unpaid, is a key factor in achieving good control.

Land Resources

(1) Farm Size. Approximately half of the farms with high levels of witches' broom were less than 50 hectares, compared to 40% of farms with a low incidence of the disease. It is unclear whether or not there is a significant relationship between farm size and control level.

(2) Cash Crop Area as % of Total Crop Area. Farmers with poor levels of witches' broom control appear to be more dedicated to cash crops. Over 80% had cash crops on at least half of the crop area, compared to only 56% of those farmers with good control of witches' broom. This would appear to be inconsistent with the hypotheses that farmers with greater resources would have better disease control. However, it is possible that cash crop growers are short of money to finance the proper maintenance of cacao. Instead they might spend a larger proportion of their resources on fertilizers, other inputs for cacao, or for the production of other crops.

(3) Food Crop Area as % of Total Crop Area. Over 80% of the farmers stated that food crops accounted for less than 25% of the total crop area. Again, the survey indicates that farms with high levels of witches' broom were primarily devoted to cash crops.

(4) Cocoa Area as % of Cash Crop Area. No clear difference was observed between controlled (those farms with low disease levels) and uncontrolled farms.

Capital Resources

(1) Use of Credit. Over 60% of the farmers stated that they used credit on their farm operations. However, a sizeable difference was noted between farms with good witches' broom control and those farms with poor control. Over 75% of the farmers with good control used credit, while only 47% of poorly controlled farms utilized credit. Perhaps CEPLAC technicians made more visits to those farms using credit.

(2) Off Farm Employment. A slightly larger proportion of farmers with good witches' broom control work off the farm. This relation is not strong however.

(3) Number of Prunings. Over 40% of the farmers with poor control of witches' broom disease performed three or more prunings annually, compared to only 24% of those with good control. While this contradicts the hypotheses, it does make sense in that farms with good control are less likely to require continual intensive pruning.

It is difficult to quantify the exact economic gain achieved solely from pruning for witches' broom disease, as many other production variables influence each farmer's yield. However, farmers with acceptable levels of witches' broom estimated that the pruning operation, done properly, required between 6 and 8 man days per hectare, while farmers with greater disease problems, required approximately 16 man days. Some farmers noted that after several years of careful pruning, the disease incidence reached acceptable levels which could be maintained with one or two annual prunings. Yield figures for farms with good levels of control were approximately 1 kg/tree, while farms with poor levels averaged just over 1/2 kg/tree.

(4) Pruning Price Per Plant. A higher proportion of farmers with poor control paid minimum wage for the pruning job. Farmers with good control were also more likely to pay a higher piecework wage than those with poor control.

Other

(1) Disposal Method. Almost 80% of farmers with poor control opted to leave the pruned, diseased plant parts on the ground, rather than remove them as recommended by CEPLAC. Only 50% of those with good control left the cuttings within the grove.

(2) Distance From CEPLAC Office. A very strong relationship between level of control and distance from CEPLAC's office was noted. Over 60% of farms with poor control levels were located in areas distant from the office, whereas 34% of farms with good control were located in these areas. A possible explanation might be that extension technicians are less likely to visit the distant farms because of scarce resources for fuel and expenses.

Conclusions

The following variables appear to be related to satisfactory control of witches' broom; family and permanent labor forces, use of credit, off farm employment, costs of control, disposal method, and distance from CEPLAC. Data did not support relationships between disease control and education, experience, crop preference, cash crop emphasis and high pruning frequency.

These results can provide the basis for several recommendations concerning future efforts to control witches' broom in the Tome Acu area and in Amazonia as a whole:

First, CEPLAC should attempt to place more emphasis on farmers in outlying districts. Scarce resources should be utilized primarily for visits to these areas or for media campaigns via radio. Farmers in nearby areas should not be ignored, but the majority of training and visits should be directed at farmers in outlying areas.

Technicians should continue to emphasize the need to remove the diseased prunings from the grove, despite farmer perception of the high costs involved. Until further research determines the exact effects of leaving the cuttings within the grove, present evidence suggests that higher disease levels result when pruned, diseased plant parts are left in the field.

CEPLAC extension efforts should continue to emphasize proper training of cocoa growers and farm labor, with respect to pruning and other management practices. The human element is very important in the control of witches' broom, and disease levels are likely to be reduced when members of labor forces are trained. Technicians should also convince growers of the need to obtain quality pruning, even if this requires offering slightly higher than normal wages.

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TABLE 1

TYPES AND EXAMPLES OF MANAGEMENT STRATEGIES

PREEMPTIVE	REACTIVE
Diversification	Replant
Mixed Cropping/Polycultures	Reduce hired labor, inputs
Staggered Planting	Develop new practices
Insurance Crops	Increase hired labor, inputs
Low useage of purchased inputs	Utilize by-products
Social Cooperation	Borrow
On farm Storage	Sell land, equipment
Produce subsistence crops	Work off-farm
Soil and site selection	Substitute foods
Construct drainage system	

Source: 32, pp. 8,9

TABLE 2

SUMMARY OF VARIABLES RELATED TO DISEASE CONTROL LEVELS

VARIABLE	EXPECTED RELATIONSHIP	DATA SUPPORTS?
1) Ethnicity	Japanese farmers, more established have better control	NO
2) Education	More education, better control	NO
3) Experience	More experience, better control	NO
4) Crop Preference	Farmers who like cocoa will have better control	NO
5) Family Labor	Larger force, better control	YES
6) Permanent Labor	Larger force, better control	YES
7) Family/Total labor	More family, better control due to motivation and incentive	NO
8) Farm Size	Larger farm, better control	POSSIBLY
9) Cash Crops/Total Crops	More cash crops, better control	NO
10) Food crops/Total Crops	More food, less control	NO
11) Cocoa/Cash Crop Area	More cocoa, better control	NO
12) Use of Credit	Have credit, better control	YES
13) Off farm work	Work offfarm, better control	YES
14) Pruning Frequency	More prunes, better control	NO
15) Pruning Price/plan.	Higher price, better control Pay minimum wage, less control	YES YES
16) Disposal Method	Pay to remove, better control	YES
17) Distance from CEPLAC	Close to office, better control	YES

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TABLE 3

PERCENT DISTRIBUTIONS OF SAMPLE, CONTROLLED AND UNCONTROLLED LEVELS

VARIABLE	% CONTROLLED (LEVEL 0 or 1) N=41	% UNCONTROLLED (LEVEL 2 or 3) N=19	TOTAL (ALL LEVELS) N=60
1) Ethnicity			
Japanese	51	84	62
Brazilian	49 (100)	16 (100)	38 (100)
2) Experience			
0-20	39	42	40
21-40	32	26	30
40+	24	32	30
3) Education			
None	10	0	6
Primary	49	32	43
Secondary	34	47	38
Technical/Univ.	5	21	10
4) Crop Preference			
Cocoa	59	58	58
Black Pepper	29	32	30
5) Family Labor Force			
0-2 persons	29	26	28
2-4	39	58	45
4+	31	16	27
6) Permanent Labor Force			
0-4	73	89	78
4+	27	5	22
7) Family/Total force			
< 50%	46	42	45
> 50%	54	58	55
8) Farm Size			
0-50	41	52	43
50-100	27	16	23
100+	32	37	33
9) Cash Crop/Total Crops			
< 50%	44	16	35
> 50%	56	84	65
10) Food crops/Total Crops			
< 25%	78	95	83
25-50 %	20	5	15
11) Cocoa/Cash Crop Area			
< 50%	37	42	38
> 50%	61	58	62
12) Use Credit			
Yes	76	47	67
No	24	47	32
13) Work Off-farm			
Yes	37	26	33
No	59	63	60
14) Pruning Frequency			
0 and one annually	42	37	38
2 annually	22	21	22
3 or more annually	24	42	30

15) Prune Price/plant			
0-50 cruzeiros	45	46	27
50-100	18	8	8
100-300	14	8	7
Min. Wage	23	38	17
16) Distance from CEPLAC			
Close	29	16	25
Near	37	21	32
Far	34	63	43
17) Disposal Method			
Left on ground	51	78	60
Removed from grove	39	21	33

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FIGURE 1

AMAZON COCOA PRODUCTION, BY STATE (TONS)

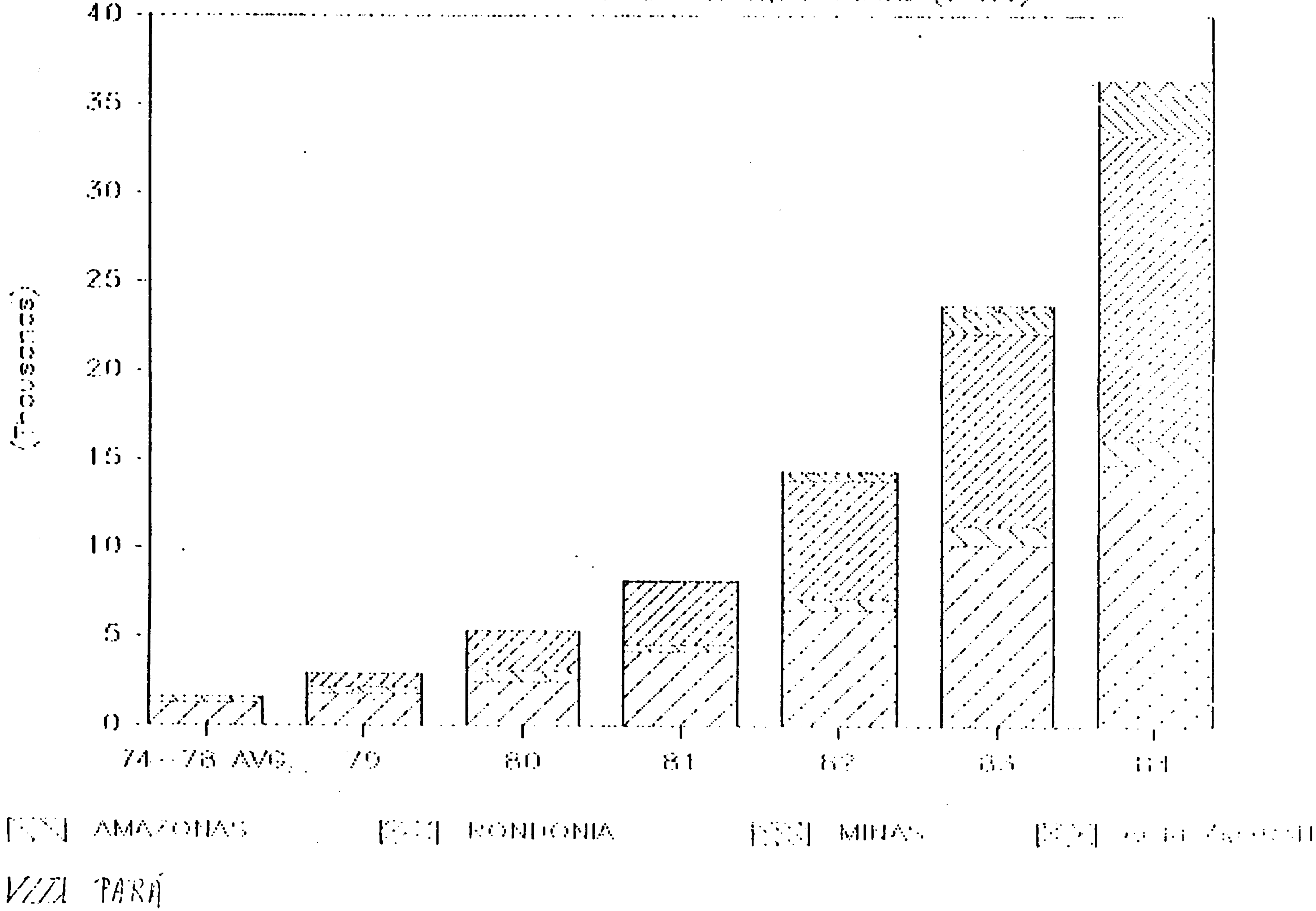

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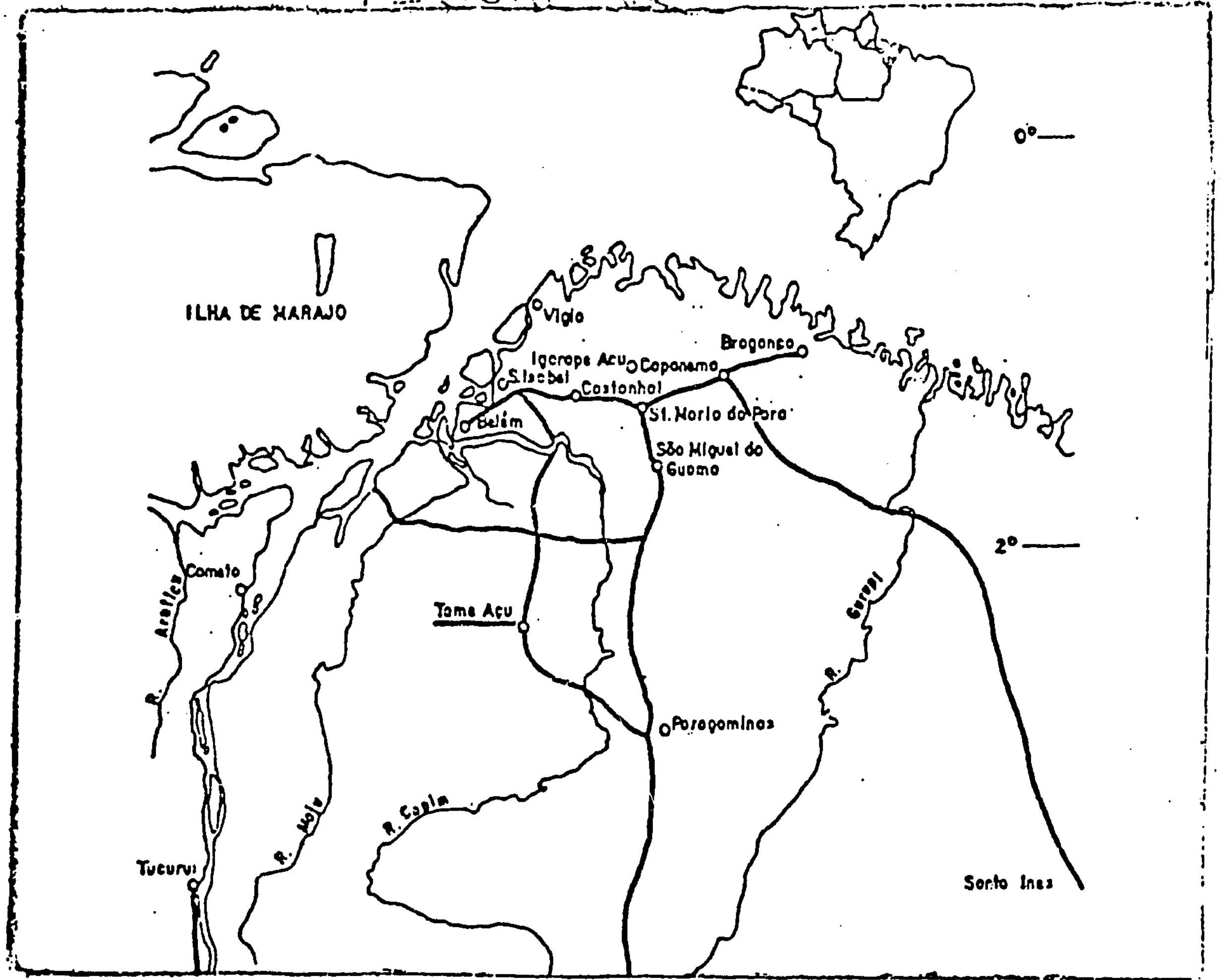
FIGURE 2



Location of Tome Acu, Pará, Brazil

RAINFALL REGIME, TOME ACU

MONTHLY AVERAGE, 1951–83

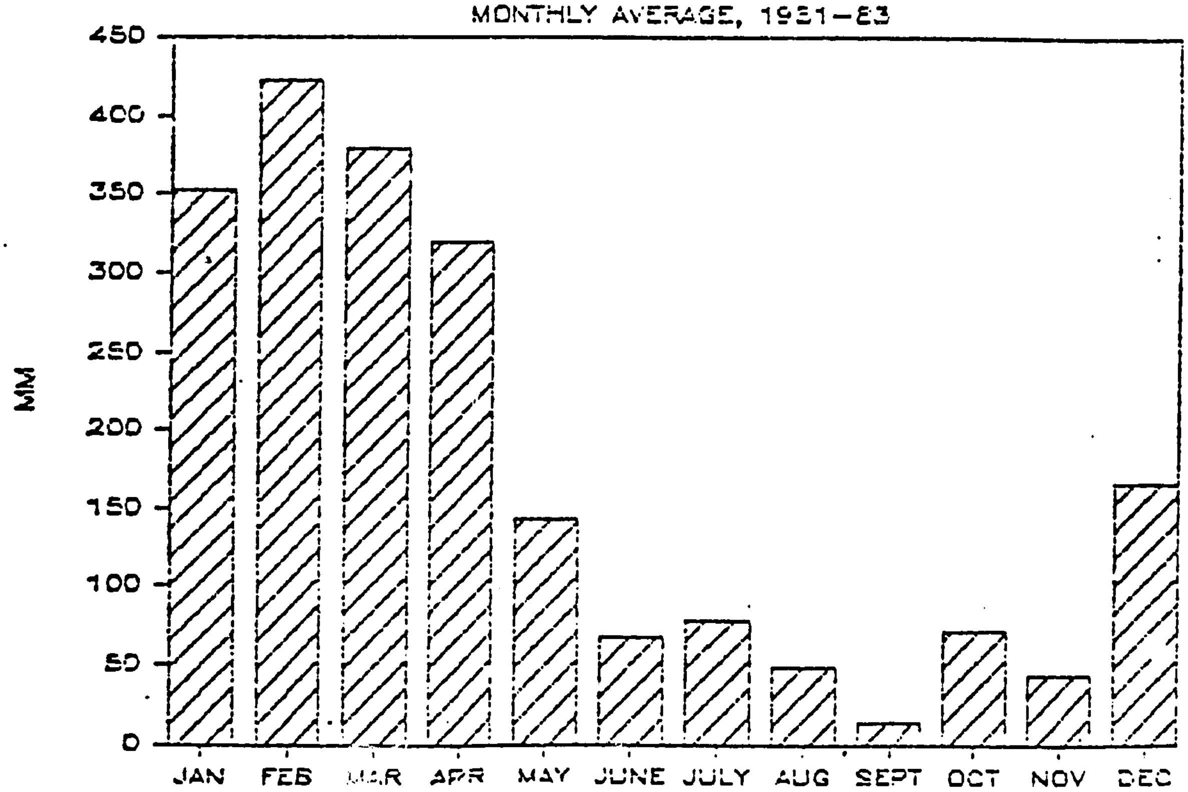
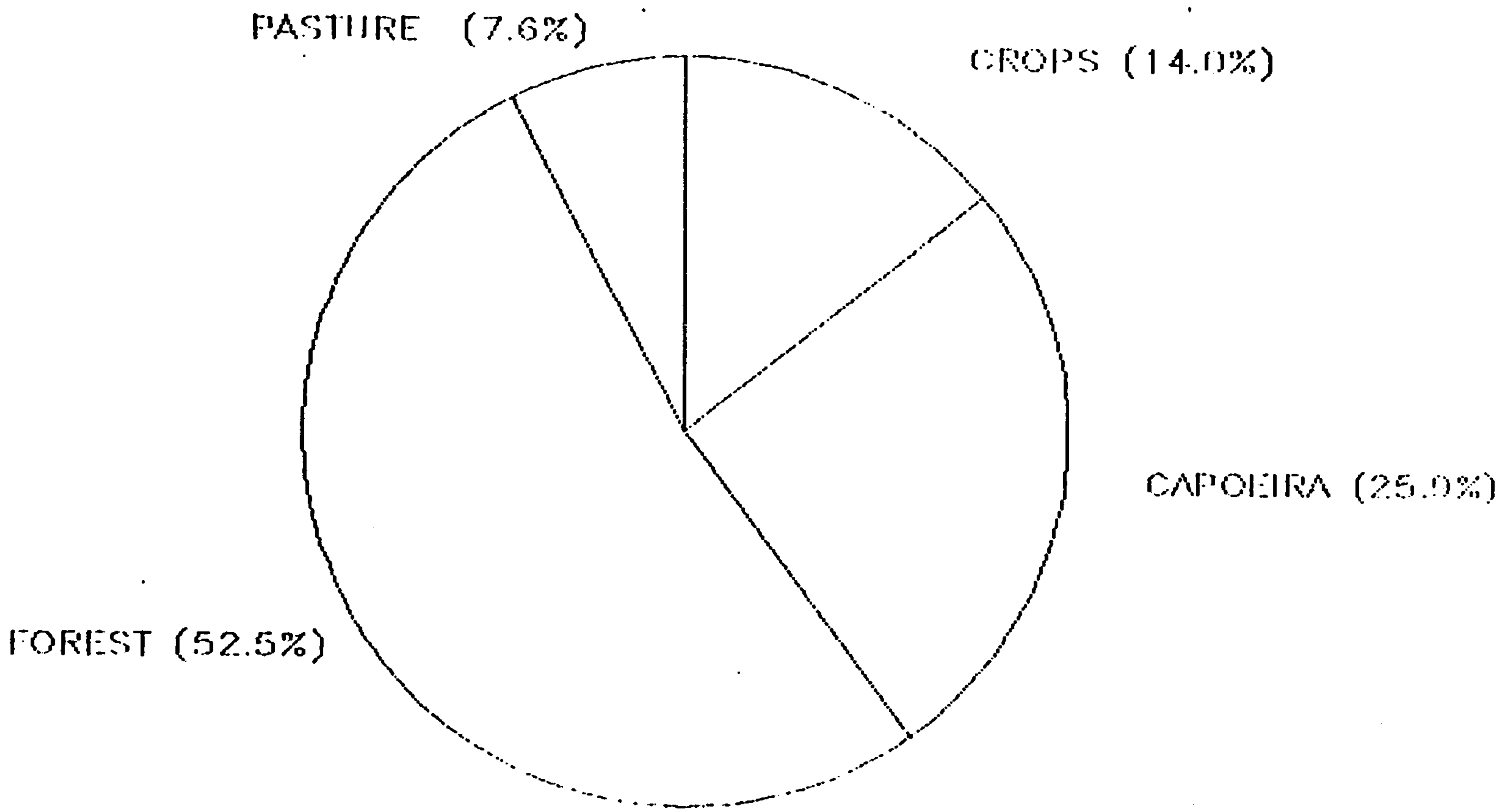


FIGURE 3
LAND USE ON SAMPLE FARMS



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PANEL IV

ECONOMICS OF COCOA PRODUCTION AND MARKETING

THE COMPONENTS OF A COMPLETE COCOA INVESTMENT

(Original Document: English)

Michael E. Evnin

There are certain aspects of a cocoa project which, if all are present, make a complete project. In my presentation today, I will refer to these as the components of a cocoa investment. Therefore, before proceeding, I wish to define what I see as these components. In an ideal situation, we should have, within close proximity to each other, the following four components:

1. A cocoa processing facility whose raw material is cocoa beans and whose finished products are cocoa butter/cake or liquor (depending on the prevailing market ratios). The factory should certainly have a press and thereby the option to stop at liquor or proceed.

2. A "nuclear estate" owned by the processing facility, which can provide a minimum of 40% of the raw material requirements of the factory.

3. Many independent small cocoa farmers (probably 3 - 20 hectares each) which could provide at least 80% of the raw material requirements of the factory.

4. An extension service provided by the owners of the factory and estate.

The four components just listed make for a complete investment as each benefits by the success of the others. This is definitely a case where the whole is greater than the sum of the parts. The audience here is sophisticated and can immediately understand this concept and can visualize the productive inter-relationships. As my time is limited to only a few minutes, I will move on but would certainly enjoy exploring these many inter-relationships with you individually during these days.

Unfortunately, we rarely have an ideal situation and inevitably one or more of the components is missing. We have all seen this. There are areas in this region with a surplus of processing machinery - some of it idle. Other areas have many independent farmers and no processing facility to create value added (in the most ideal situation, the factory would be at least partially owned by the farmers' cooperative). Energetic, realistic extension services, with a commercial reason for existence, are the rarest of all.

The great pity of a missing component is that, if it were present, all the other components would become more valuable. With proper management and a spirit of cooperation, all will benefit. This is one of the goals of my organization, Cocoa Development S.A. We seek ouc a situation where there is a missing part and correct it by creating, as a commercial venture, the missing ingredient. We are a profit-making organization. What I am saying makes business sense. In many cases, most of the work has already been done. This especially applies to all those regions where the trees are already in the ground. All that is necessary is the ability to see the larger picture and be creative. An investment in one component can create, almost automatically, returns from the existing components.

Again, the components are:

1. The processing facility (the factory).
2. The nuclear estate.
3. Independent farmers.
4. An extension service.

Due to limited time, I can only go into financial detail on one of the components. The emphasis of this forum is agriculture. I will, therefore, select the nuclear estate and review with you some specific numbers. The following data reflects the opinion of Cocoa Development S.A. based upon our feasibility studies prepared specifically for this region of the world.

-- Minimum economic size, gross: 400 hectares (approx. 1000 acres)
-- Minimum economic size, net: 300 hectares (approx. 750 acres)

The difference between net and gross is the roadways, building, unusable areas within the site, etc.

-- The system utilized would be the Intensive Planting System already discussed. This is the system used today in the Philippines and Malaysia: 3300 trees/hectare, and each tree budded with branch wood from a high yielding parent.

-- Such a facility will require an equity investment of between US$1.6 - 1.8 million. This equity figure is based upon

-a debt/equity relationship maintained at 60/40;
-a loan interest rate of 10%;
-a four year phase-in of equity and debt;
-a grace period of four years on principal, principal to be repaid during the following six years;

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-the payment of $500,000 over 5 years to purchase technology (including specialists);
-a labor rate of $7/day inclusive of all benefits, reserves, and allowances;
-drip irrigation is not used;
-relatively inexpensive land (i.e. $150/hectare, fully titled);
-a reasonable contingency factor built into the cash flow.

If the beans are sold for US $1.00/lb FOB, then the equity investment of approximately US$1.7 million will earn a return on investment of approximately 28% over a period of ten years.

The nuclear estate, with a return on investment of 28% is certainly a good investment by itself. However, one must also take into account the benefits it will add to the other components of a complete cocoa investment. Allow me to quickly run through one series of causes and effects.

1. The nuclear estate provides employment.
2. The employees are drawn from the families of the neighboring independent cocoa farmers.
3. The independent cocoa farmers learn good agricultural management from the managers of the nuclear estate. They learn by doing and seeing.
4. An extension service has automatically started. The estate is also the base for formal education.
5. Yields obtained by the independent farmers are improved.
6. The factory receives more raw material and can go from, say, 2 shifts to 3 shifts.
7. The owners of the factory benefit by the additional volume. Hopefully, one of the owners will be the farmers themselves through their cooperative.

The other three components of the complete cocoa investment benefit just by virtue of the existence of the nuclear estate.

It is hoped that the owners of the factory and the estate are the same. One reason is that the early positive cash flow from the factory could go into financing the early growing years of the estate. Just in passing, I wish to mention that particular attention must be paid to the project completion and cost overrun clauses of the loan contract. This we should also discuss individually.

Cocoa Development S.A. has noted the inefficiencies and short falls created by missing components and feels that excellent investment opportunities exist by either:

(a) moving an existing component (i.e. the factory) from one location to another where it will be fully utilized.
(b) creating the missing components.

During the days ahead I would welcome discussions with you regarding specific situations you have noted regarding opportunities created by missing components.

Cocoa Development S.A. can provide:

--Feasibility studies and consulting
--Management and training
--Machinery and equipment
--Arrangement of bank financing
--Marketing, etc.

We are project developers and implementors. We can provide a complete turn-key project or any part thereof.

When we like a project, feel comfortable with the local partners, and can participate in the management, we may join in providing equity.

Thank you for your time and attention.

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PANEL IV

ECONOMICS OF COCOA PRODUCTION AND MARKETING

LOCAL PRODUCTION COSTS AND IMPORTED LABOR IN THE DOMINICAN REPUBLIC

(Original Document: Spanish)

José Antonio Martínez

Introduction

Production costs and contracting of foreign labor have been going through an adjustment period, as a result of establishment on January 23, 1985, of a unitarian rate of exchange by the Monetary Board of the Central Bank in the Dominican Republic. Before that day, the harvester of traditional export products (coffee, cocoa, sugar, and tobacco) received for each exported dollar RD$1.48, whereas the official rate of exchange varied in between RD$3.00 and RD$3.40 per dollar. Obviously, this distortion was ruining the agricultural producer, who also had suffered until 1984 from an unfair rate of US$1.00 for RD$1.00 to sustain the no less distorted economic policy of export substitution.

Dominicans have not as yet become accustomed to the inflationary hemorrhage that this action produced and whose climax was the Government's establishment for traditional exports of an Exchange Surcharge of 36%, obviously passed on integrally by the exporter, together with other taxes, to the primary producers. These had to support that heavy burden, as they could not transfer it to anyone else.

This illegal and unfair surcharge was the detonator producing migration from country to city, and the force which impelled many cocoa plantation owners to sell and to place their money in safer places within the financial system, both formal and informal.

A. Imported Labor

Until the fall of the Duvalier government in neighboring Haiti, the Dominican Republic imported, through a contract very similar to slavery, about 19,000 day laborers annually to cut sugar cane. For this, the Haitian Government charged the Dominican Republic US$300 per person. At the beginning, these day laborers were to live on the premises of the sugar mill to which they were assigned, and were supposed to return to their country of origin once the sugar cutting was finished. Of course, they could not work in any activity unrelated to the sugar mills.

However, it did not work out that way in practice. Those workers, attracted by higher salaries and especially by less tiresome work, escaped from central sugar mill barracks and went to participate on coffee and cocoa plantations, removing grass and weeds, phytosanitary control, application of herbicides and elimination of rats, and also shade regulation, under the direction of the agronomist or owner.

Because of lack of experience with cocoa in their country of origin, they were not employed in cutting cocoa pods, pruning and twig removal. They were used, however, in the fermentation process, sun drying, cleaning and storage. Today, about 450,000 Haitians live illegally in my country - a factor which could produce serious social problems in the rather near future.

The minimum salary for agricultural workers in the Dominican Republic is RD$175.00. The Haitians carry out specific labor, generally contracted by mutual agreement. If a Haitian becomes a permanent worker, he receives the same salary as a native.

B. Production Costs

Production costs attached at Annexes A, B, C, and D omit several elements, which if included, would cause cocoa cultivation to be definitely abandoned in our country. We refer to land cost, bank interest for land acquisition and, most importantly, the unlimited and low-paid time of the owner.

As you may note, our costs are a little higher than those of the countries of the area-- way out of range for the production of 1 quintal of cocoa (Annex D), as February 1985 costs reached almost 48% of the price paid in the local market, and the producer must absorb the marketing cost which, due to the price control system, is very expensive.

If we add to this the progressive tax of Law No. 199, which burdens coffee and cocoa within the first brackets, and the "voluntary" contribution to the Cocoa Commission, then we see really that the producer receives only 11% and must carry all the risks, such as: sudden fall in prices, drought, floods, tornados, plagues, diseases, etc.

C. Actions that Producers Could Take to Increase Profits

1. The exportation bag

The bag used to export cocoa beans is a gift that the producer passes on to the foreign importer, without receiving anything for its quality.

Let us see: It was specifically the Dominican Republic and our agricultural company, MALLANO, which for the first time exported the Hispaniola type cocoa beans (fermented) to the international market (U.S.A.) in polypropylene bags. It was 1978, when the program for

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improving quality, sponsored by the Hershey Foods Corporation, was initiated. (Presently, also Belize and Malaysia export using this kind of bag).

What is the meaning of this? That the Sánchez cocoa type (not fermented) is exported in a sisal bag, with a cost of RD$4.50 for unit, whereas the Hispaniola is sent in polypropylene, with a value of RD$1.60. Here alone the producer makes a saving of RD$2.90.

For countries of the area, there would be an additional saving if instead of exporting 60 net kilos of cocoa per bag, they would send bags with 70 Kilos, as is done in the Dominican Republic. Each lot of 250 bags, which is generally the capacity of the container, would effect an important saving of 42 bags, an additional RD$755.50 or US$251.83 per box-car.

2. Elimination or consolidation of steps

The cost of export procedures apparently paid by exporters are in fact passed on to the producer.

In the Dominican Republic, it was necessary until two years ago to carry out about 38 bureaucratic steps from bag-filling to ship departure. Today, fortunately and thanks to the intervention of the Dominican Center for Promotion of Exports (CEDOPEX), those steps have been limited to 18. This is still a high number, if we consider that we are in the computer era. If an exporter did not have to pay for all these unnecessary steps in the export process, he could increase the price paid to producers for beans by the equivalent of the salaries of superflous employees, costs of paper work, fiscal stamps, and time. The state also would benefit.

That is why producers must try to get their respective governments to reduce steps and should claim from the exporter a rightful share of such savings.

3. Maritime Transport

Without doubt, the privileged situation of the countries of Central America and the Caribbean permit our cocoa to reach the U.S.A., the biggest importer, in only three days. If producers had sufficient knowledge about shipping transport, they could use the advantages that our competitors, the African and Asiatic countries, do not have.

For example, in the Caribbean and Central American area, idle shipping capacity presently exceeds demand by 70%. This means that there is a sharp rivalry among the shipping lines.

Automation and use of containers have provided advances and substantial savings in shipping cost. When loads are placed in ships' storage areas, docking and stowage represent additional costs that somebody must pay. The container makes the shipping cheaper as the product is not moved manually, it offers more safety and makes unloading easier, at the same time that the cost of land transport is reduced.

Yet, it is possible to have further savings if container transport is used, with the innovation of the warehouse-to-warehouse container. We used this system with success in the Hispaniola program. Cargo was sent to Hershey Foods Corporation and M & M Mars. Unfortunately, because those two processing companies had no brokerage departments, it was necessary to discontinue the practice.

The latest efficiency innovation in transport is the system of barges. Instead of a conventional ship, according to its power, a tow-boat moves a number of barges full of containers. Tow-boats generally have a crew of five persons compared to crews of 25 or more on other ships.

For a producer to benefit from any reduction in freight cost, he should make arrangements with the maritime agents and ultimately the buyer.

4. Final Considerations

One of the advantages of this type of international forum is the opportunity for direct discussion of problems affecting parties involved, with the additional convenience that the problems and the solutions are put in writing. Representatives of the cocoa processing industries have made their needs clear: "We want quality, aroma, big beans, and little husk".

There is another side: We want adequate payments for each additional process that we carry out. The big processing firms of the U.S.A. use brokers to buy cocoa from producing countries which generally charge a commission of 2 to 5%. There are two main factors: a monitor connected to the floor of the exchange and a telephone or telex to negotiate the price of the day.

These brokers do not even use the word quality nor the word aroma. For them, all cocoa of similar type, in their logic, must have the same price, disregarding the intensive care that the producer may have given the product. As gamblers, they only think of profits.

In this situation, what incentive has a producer to make efforts to improve his cocoa? The answer is easy. None.

We are of the opinion, and this should not be interpreted as meddling or criticism, that the big U.S.A. processing companies should have complete marketing department, closely linked to the modern laboratories. In this way when a producer offers an amount of cocoa, and information together with the name of the offerer, these be sent to the laboratory, which, assessing organoleptic qualities, will determine what bonus above the average price should be paid.

The chocolate producers would thus find that each cocoa producer would try to send cocoa bean types that would benefit the chocolate industry.

Finally, we wish to congratulate the Government of our brother country, Honduras, for having declared this "the year of exports".

To produce and to export, those are the goals of Latin America necessary to get out of the economic marasmus in which we presently are.

Thank you.

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ANNEX A

RENOVATION COST OF ONE HECTARE OF COCOA

JANUARY 1987

1.	Soil Preparation	RD$ 397.50
2.	Two weed controls	254.40
3.	First shade regulation	143.10
4.	First thinning and field prunning	190.80
5.	Tracing, hole-making and sowing	143.10
6.	Cocoa little plants, 1120 at 0.15 each	168.00
7.	Transport from nursery to farm	44.52
8.	Plant transport within farm	63.60
9.	Fertilizers	185.05
10.	Two applications of fertilizers	127.20
11.	Buying and planting of permanent shade	127.20
12.	Phytosanitary control	97.63
	TOTAL	$1,942.10

Source: APROTEX

NOTE: Rate of exchange US$1.00 = RD$3.00

Cost by hectare - US$647.35

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ANNEX B

AVERAGE COST FOR REHABILITATION OF ONE HECTARE OF COCOA IN RD$/YEAR

I.	LABOR	490.67
	1.1 Weed control	381.60
	1.2 Phytosanitary control (application of pesticides)	15.90
	1.3 Shade regulation	25.44
	1.4 Prunning	42.29
	1.5 Fertilization	25.44
II.	INPUT REQUIREMENTS	420.26
	2.1 Insecticides	51.68
	2.2 Fungicides	3.98
	2.3 Raticides	6.84
	2.4 Arboricide	19.88
	2.5 Fertilizers	178.88
	2.6 Soil insecticides	111.30
	2.7 Little plants of cocoa	47.70
III.	AGRICULTURAL MATERIALS AND EQUIPMENTS	1.75
	3.1 Materials	.79
	3.2 Agricultural equipment	.96
IV.	TRANSPORT EQUIPMENT	26.55
V.	FUEL AND LUBRICANTS	7.47
VI.	GENERAL AND ADMINISTRATION EXPENSES	49.61
VII.	OTHERS	.96
	Sub-Total	997.25
	Incidentals	99.69
	GENERAL TOTAL	RD$1,096.94

SOURCE: SEA/AGRICULTURAL BANK

ANNEX C

MAINTENANCE COST OF ONE HECTARE

First Year

1.	Weed control (2 per year)	RD$111.30
2.	Deep prunning	107.32
3.	Fertilizers	238.50
4.	Application of fertilizers (2 per year)	36.57
5.	Removal of shoots	25.44
6.	Shade control	102.56
7.	Phytosanitary control	13.99
8.	Pesticides	41.66
9.	Harvest management	103.35
10.	Transport	15.90
	SUB-TOTAL	796.59
	INCIDENTALS (10%)	79.66
	TOTAL	876.25

SOURCE: SEA

NOTE: Rate of exchange US$1.00 = RD$3.00

Cost per hectare US$292.08

ANNEX D

PRODUCTION COST OF ONE QUINTAL OF "SANCHEZ" TYPE COCOA
FEBRUARY 1985

1.	Resowing	RD$ 2.15
2.	Shade regulation	7.85
3.	Weed control	22.75
4.	Maintenance pruning	10.50
5.	Removal of shoots	1.70
6.	Phytosanitary products	8.60
7.	Application of phytosanitary products	3.50
8.	Fertilizers (80 pounds/tarea)	29.50
9.	Application of fertilizers	6.50
10.	Harvesting, drying and transport	22.15
11.	Control of rats and woodpeckers	3.50
	SUB-TOTAL	118.70
	Interests on advances (18%)	7.20
	TOTAL	125.20

Source: APROTEX

NOTE: Tarea is a national unit, equivalent to 628.9 m^2; that is to say, 1 hectare equals 15.9 tareas.

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1st INTER-AMERICAN COCOA FORUM
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PAN AMERICAN DEVELOPMENT FOUNDATION (PADF) 1889 F St. NW
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PANEL V

MARKETING
(Original document: English)

John Buckley, Nestle's Vice President for purchasing, presented a bullish point of view on the future world market position for cocoa. He foresees the marketing experts of the chocolate manufacturers pinpointing a potential specialized chocolate market segment, in which the manufacturers will expand sales, thus increasing the demand for cocoa.

The growth areas within the global demand for chocolate products will not come at the cost of traditional taste patterns and products. They will be developed by cultivating a more gourmet or quality market for new specialized products, and through the creation of new chocolate snacks that will compete directly with non-chocolate snacks. Besides developing new products and opening new market sectors, manufacturers will have to be more agressive in their merchandising tactics to counteract many of the "old wives" tales associated with the consumption of chocolate, related to its effects, nutritional value, health precautions, etc.

This expanded effort by the manufacturers will increase demand for quality cocoa. Manufacturers will not only need a quality cocoa product with a variety of flavors, but a consistent source of it.

Producers must therefore be ready to supply the necessary amount of quality cocoa. Mr. Buckley noted that the world market sets the price for cocoa, and that, although there will be short term price fluctuations, in the long term the market should be bullish and hold firm. It is the expertise of the dealers which help stabilize short term fluctuations and match the needs of the manufacturers with those of the producers.

Noel Smith, a cocoa dealer with Drexel, Burnham and Lambert, described the dealer's role within the cocoa industry as acting as principal to the exporters' in a producing nation, while at the same time serving as principal to the final user in a consumer country. He provides a liquidity in the market place, absorbing excesses and later supplying the market when there is demand. Thus the fluctuations of supply and demand are somewhat evened out without greatly inconveniencing producer or consumer. To perform this function the dealer himself must accept a certain degree of risk. The merchant's role in the market place is not only one of service, but also of entrepreneural gambler. In the current economic structure, his risks involve contract performance of both consumer and producer, finance rates, insurance, ocean freight rates, etc. Because he needs assurances that contracts will be met, small scale, new suppliers are considered risky.

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Mr. Smith noted that dealers can buffer themselves against most risks, but in the case of non-fulfillment of contract, it is almost impossible to get full recompense for losses incurred, which would, in any event, affect future trading relationships in a business where working relationships are very important. Even when such situations arise, they can be dealt with if the dealer has sufficient information and time to act, based on his ability to gather information and use it successfully, so as to smooth out the fluctuation within the market. He therefore takes a special interest in his trading associates, and tries to gather as much information as possible about each local area, and to form a global picture.

Larger producers have a long history in cocoa production and are rather sophisticated in growing and marketing cocoa beans and semi-processed products. However, over the past 6 or 7 years many changes within American producing countries have lowered production and caused erratic deliveries. As dealers also represent manufacturers, they must respond to manufacturers who blend beans in their respective recipes, based on certain quantities of beans of various origins to produce the desired flavor. When such supplies can not be depended on, new suppliers will be found.

Mr. Smith's recommendation for small producing countries is to work toward assuring consistent quality and quantity of product, prepare the beans for shipment in accordance with international standards, guarantee safe shipping, and make only forward contracts that can be fulfilled.

As an exporter, Steven Aronson, President of the Granex Team that has been exporting from Costa Rica and Ecuador for the past 10-12 years, stressed the need for improved planning in producing countries. This planning should be based on the realities of the international market for cocoa products and not on illusions that often result in creative but unrealistic subsidized plans that backfire on the country and producer alike. As an example, Mr. Aronson presented the case of Ecuador. The Ecuadorian government attempted to force expansion into other cocoa products by offering subsidies. The program caused losses at the farm level, industrial bankruptcies, governmental loss of hard currencies, and idle assets. Also exporters lost once dependable channels for Ecuadorian beans because supplies could not be assured.

To avoid such suicidal policies, Mr. Aronson recommended that cocoa producing nations realize that they are "price takers", not "price makers". This implies a very simple marketing strategy: try to supply what the market wants when the market wants it. If customers are satisfied, they will buy more. Governments should facilitate the export process so that in times of price booms aggressive tactics can be easily implemented to take advantage of high prices. Subsidies do not work. Governments should focus on techniques for improving production, lowering production costs, and improving the infrastructure for processing the bean and getting it to market. Intermediate industries should be encouraged only after extensive and careful study.

Dr. Alex López, PADF Cocoa Advisor in the Eastern Caribbean, discussed in detail the various aspects that in their totality define "quality" with respect to the cocoa bean. The flavor potential of the cocoa bean is genetically determined, though the degree to which this potential is realized is governed by the curing (fermenting) process: curing time, pod maturity, container used, methods used, climatic, and environmental conditions. After the fermenting process, the beans must be dried either naturally or by some artificial method, also affecting quality, and sometimes producing extraneous odors that affect flavor. In combination, these elements give the cocoa its flavor.

The preparation of the bean for export affects its quality as well. The cocoa would generally be graded at this stage, following one of the international standards, from one of the International Cocoa Standards: Cacao Association of London Standards, the French Association of Cacao Commerce Standard, and Cacao Marketing Association Standards. Storage and shipping practices also affect cocoa bean quality, making the list of variables even longer.

Mr. López concluded that although areas of more scientific concern are those of genetic flavor capabilities and fermentation practices, there exists a need to focus on all post-harvest stages to assure that quality is maintained until the cocoa reaches the end user.

Mr. Fitz Shaw of the Cocoa Industry Board of Jamaica, outlined the history of Jamaican cocoa and the Board's present structure. Cocoa production is marketed by a central board which manages regional fermenting facilities. Farms are individually owned. Farmers depend on the cocoa board for improved seed, improved farming techniques and the entire market process. All cocoa is purchased wet and taken to the fermentaries, where it is fermented, dried, cleaned, bagged, and exported. The Board assures that all Jamaican cocoa is of a standard acceptable in the international markets.

The Haiti situation was presented by Larry Kurtz of MEDA (Mennonite Economic Development Association). Conditions in Haiti are less well organized than in other producing countries of the Americas. MEDA is forming regional cooperative groups to use as delivery systems of technology packages to the farmers and as mechanisms for marketing the production. At present, it exports directly only to Hershey Foods Corp. The focus has been on technology transfer, education and administrative skills. It is hoped that the Haitians will manage the technical assistance and marketing effort on their own in 1989.

A question was asked of Mr. Buckley about using other non-cocoa fats to cut down on the use of cocoa butter in chocolate. He stated that no fat other than cocoa butter is permitted in the U. S. in products labeled "chocolate".

Mr. Shaw was questioned on the weight loss of wet beans due to drying. He answered that each 100 pounds (wet) received by the CIB/J yields approximately 36 pounds dry. The board sets an advance price on wet bean purchases based on the international market, then at year-end pays the farmers a bonus when the books are closed and the actual profits are calculated.

A question on Costa Rican price fixing was asked of Mr. Aronson. No mechanism exists in Costa Rica, all prices being based on the international market. Local industries must assure favorable prices to keep cocoa in the country, because there isn't enough Costa Rican production to fulfill local industrial needs.

A last question was asked about the reason for cocoa problems in Ecuador, to which Mr. Aronson answered "planning". The initial planning on the exact market to be entered and the objectives to be gained was not done extensively enough.

Patrick Inkster
Rapporteur

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PANEL V

MARKETING

THE COCOA MARKET

John Buckley

We still have much to learn, much to study. I have to say that many constructive suggestions were made yesterday and today. I wish to thank the Pan American Development Foundation for its initiative and for having invited me to this Forum.

Some pessimism and some optimism continues this week. I have hoped that, from the point of view of the USA, I am on the side of the optimists. The cocoa problem today is the problem of the past. When production is higher than consumption, industry must go out and create new markets and must expand the use every time there is a rise in the production cycle. With a little time, industry has always solved the problem; and I trust that it will do so again.

We have the ball in our court: what are we going to do with it? We must improve existing products, develop new ones, and be innovative and find new forms to satisfy the consumer's appetite regarding chocolate.

One element of new growth in the USA, which relates to some of the increase in use during the last few years, is the fad of placing emphasis on prime quality in the market sector, and on maintaining the existing base of the market. We can see it in all sectors of the food industry, in the supermarkets and stores which sell specialized products. The chocolate market is part of that tendency. That is one key reason why there is so much development work in the manufacturing industry in the USA. Across our industry, products have been reformulated, and packaging has changed or given new thickness so as to provide the consumer with more variety, better selections, and better product quality.

Parallel to this, another very important tendency in the USA is the increase of sales of expensive products of high quality from countries like Switzerland, West Germany, Belgium, Italy, and the Netherlands.

In other areas, chocolate continues to be the flavor most preferred by itself and as an ingredient in other products. The cookie industry, for example, uses many small pieces of chocolate, a market which has greatly increased during the last few years. There are many industries now producing specialized ice cream types and using chocolate more and more. In the industry of soft drinks, manufacturers of chocolate desire that their names be used in those new products of high quality which use chocolate in making drinks. The sale of chocolate milk during the 1970s suffered due to low quality. Today, inspired by the manufacturers of chocolate, sales have increased.

As we saw yesterday, it is time that we take an offensive position and so we are. The negative perceptions mentioned yesterday -- obesity, that chocolate is a poor food, dental cavities -- all of that is not true. It is a complete food; it is an infinite pleasure; it is a snack and even may be eaten with moderation by those on a diet. New dietetic products, for example, the granola bars which are in vogue, now may be found in the supermarket covered with chocolate. Raisins covered with chocolate are a very popular snack. The entire chocolate industry in the United States is involved in the snack market. We have to compete. We have to be part of this and then we must introduce products which will be a success in that area.

Quality products may be obtained with quality ingredients, and here is where you producers are involved. Tropical America and the Caribbean are in a unique position to provide us with quality cocoa with good aroma. The consuming world needs variety and needs aroma, flavor. All of us in the world of manufacture have our own requirements for mixes, products we wish to be different from those of our competitors. First quality cocoa with good flavor provides us with that element. The quality of our product begins with you, the producers. It begins on the farm with the best genetic materials available, good clones, good harvests, well cultivated, well fermented, well dried, clean, and classified and prepared in adequate form for its exportation.

As I previously stated, regarding the market expansion, the ball is in our court. As to producing the raw material of first quality, then the ball is in the court of the producer. The interchange of information and the discussion in this Forum, I believe, is a vital contribution.

We are essentially one industry, from the farmer to the final consumer. Working together we may reach new heights. We in the manufacturing industry naturally are buying from the world market, in a direct way or through an exchange. The world market establishes the price. It is bigger than all of us; so bean producers and the industry have to learn to manage those tendencies of the prices. Also, price volatility is probably going to continue. New elements like the investment funds which come in and go out of the market have their effects, but, whatever the short term impact, none of those external situations affect the long term tendency and we have to try a long term approach.

I believe that the merchants are the vital voices in the chain, always ready to buy at the origin, to sell to the manufacturer, and to use the futures market to minimize risk. I believe they have experience that is beneficial for the producer and also for the manufacturer. They are part of our industry. They contribute to industry vitality and growth; this morning we listened to two experts on that field who talked in detail about their activities.

We all have a common purpose: a common role to expand and increase the market. The opportunity is there. Together we are going to take advantage of it. We have to.

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PANEL V

MARKETING

ROLE OF PROCESSING IN COCOA
(Original document: English)

Alex López

Industry in general is full of jargon which may sometimes be confusing to the lay person, and this is very much the case with the chocolate industry. The cocoa or cacao bean, the basis of the chocolate industry, is obtained from the plant Theobroma cacao, L. belonging to the Sterculiceae family. It is different from "coca", botanically Erythroxylum coca, the source of cocaine drugs. Both are, however, adapted to the same geographical regions, generally cultivated within the latitudes 20^o north and south of the equator.

Although chocolate and cocoa are known to be high energy food sources, this is not the reason for its great commercial demand and universal popularity. Its appeal lies in the unique and characteristic flavour that is developed by combined processes in curing and manufacture.

The cocoa seeds straight off the tree do not possess any semblance of chocolate flavour and must be submitted to a curing process immediately after harvesting. During this process, complex bio-chemical transformations are provoked, which result in the formation of primary flavour precursors. These precursors later evolve into the compounds responsible for the flavour characteristic of chocolate during subsequent roasting of the beans in chocolate manufacturing.

Since cocoa beans are primarily marketed for this flavour, curing may be considered as the most important step in the preparation of cocoa for the market and chocolate manufacture.

The flavour potential of the cocoa bean is genetically determined, but the degree to which this potential is realized is governed by the quality of the curing process to which it is subjected. However, although it is quite easy to ruin good quality beans by careless processing, it is not possible to produce superior quality beans from genetically inferior ones by superior processing techniques. Other factors such as climatic and environmental conditions also have a significant effect on flavour. In fact, it is believed that these are responsible for the flavour variations which characterize cocoa beans of different geographical origins.

The curing of cocoa involves an on-the-farm fermentation and drying process carried out exclusively in the producing countries. In the processing of cocoa beans for market, seeds from ripe fruits are harvested and placed in wooden boxes in heaps covered with banana leaves to undergo spontaneous fermentation. This is brought about by a succession of wild native microflora which are introduced by contact of the freshly harvested seeds with the air, the worker's hands, and the various implements and vessels used in the harvesting and transport of the seeds. The fermentation is allowed to procede from three to eight days, depending on the variety and physiological state of the cocoa being fermented, and environmental conditions. Following fermentation, beans are dried either naturally in the sun, artificially using hot air driers, or by a combination of both methods. Beans dried to a moisture level of 8% or less are bagged and ready for marketing.

Having undergone such a curing process, the cocoa bean interior is no longer the grey, slaty color characteristic of unchanged cocoa authocyanin pigment of unfermented cocoa, but assumes a rich brown or brown/violet colour. And when roasted it will develop an aroma and colour generally associated with cocoa beans suitable for chocolate manufacture.

The marketing system for processed beans varies in different countries. They may be sold through middle-men or directly to exporting agents. But somewhere along the line, prior to export, they are graded to assess their marketability.

In commercial circles, cocoa quality is judged by what is known as "the cut test". In this test, beans from a random sample of a lot for export are cut horizontally to expose the largest surface. Beans are visually assessed for the quality of fermentation by the colour of the cut surface and defects such as mold, insect infestation, germinated and flat beans and the presence of extraneous odours such as smoke. Lots are then sorted into several grades reflecting the percentage of defective beans.

According to the Model Ordinance of the Code of Practice of the International Cocoa Standards three grades are recognized based on the count of defective beans in the cut-test. In grade I beans, the defects shall not exceed the following limits:

a. 3% mouldy beans
b. 3% slaty beans
c. 3% total maximum count of insect damaged, germinated or flat beans.

For Grade II the maximum tolerated defects by bean count are:

a. 4% mouldy beans
b. 8% slaty beans
c. 6% of a total of insect damaged, germinated or flat beans.
A maximum of total of 18% defective beans.

All other cocoa that fails to reach Grade II standard is regarded as substandard and marketable only under special contract.

Other standards under which cocoa is marketed are those of the Cacao Association of London (CAL), the French Association of Cacao Commerce (AFCC), and the Cacao Marketing Association (AMA), which are less rigorous with slightly higher tolerance.

Other quality requirements such as uniformity, bean size and nib to shell ratio are genetically and physiologically determined and not governed by processing.

At its best the cut-test is subjective and gives only a vague indication of the quality of processing. From evaluation of the defects related to bean colour, the presence of mould, insect damaged and germinated beans, some idea may be obtained of the quality of the processing.

It, however, does not provide any measure of chocolate flavour. Cocoa of excellent quality as judged by the cut-test may be defective or lacking in chocolate flavour.

The assumption in applying the cut-test is that cocoa that has been well fermented and is within the accepted limits of tolerances for defects, will be suitable for chocolate manufacture and possess the flavour and quality typically associated with cocoa from that particular geographical location.

The chocolate manufacturer's desire is for cocoa beans that are uniformly well fermented, possessing strongest possible chocolate flavour and the ancillary flavours characteristic of cocoa from the particular region, yet free from off flavour and extraneous material.

This, however, is a tall order, because the farmer can control only to a minimum extent the fermentation process by determining fermentation time and frequency of turning. All other factors involved in flavour precursor development such as micro-biological and physico-chemical processes occurring during curing, are spontaneous, inter-related and beyond his control.

Unlike many well-known fermented foods and beverages which rely on specific selected micro-organisms for the process, cocoa fermentation involves a sequence of spontaneous fermentations by unselected micro-organisms whose activities are governed solely by the physico-chemical conditions of their environment.

From the complexity of the fermentation process described, it is evident that the possibility of manipulating the quality of cocoa in a system almost devoid of means of control is virtually nonexistant. However, certain precautions can be taken to minimize variations in this spontaneous process, stabilize it, and increase the chances of obtaining standard market quality products each time.

<u>State of Maturity of the Fruits:</u>

The best fermentations are obtained from ripe fruits. Overripe fruits contain seeds within a dry pulp which tends to ferment too rapidly. Similarly, drought and other factors that provoke loss of pulp humidity, e.g., an unusually long delay between harvesting and pod breaking, will also result in rapid fermentation. Conversely, excessively wet seasons, cold spells and unripe beans will delay the onset and prolong the fermentation time.

However, in normal harvesting the proportion of unripe or overripe and the unintentional inclusion of some partially diseased seeds is generally insufficient to cause problems in fermentation and flavour. The actual limit of undesirable beans that can be tolerated is unknown and will depend not only on the proportion of these beans in the ferment, but also on the degree of the defect. It is best whenever possible to exclude defective beans from fermentation lots if high quality is desired.

Selection of Planting Material:

The selection of planting material influences fermentation time. Thus, criollos are generally fermented for 2-3 days and forasteros 5-8. Hybrids of these two are fermented for the same duration as forasteros.

Fermentation is a batch process. Vessels are designed so as to accept a charge that is appropriate with the production of the property. Quantities in excess of or less than the recommended charge will affect the rate of fermentation. In most cases, it is recommended that harvesting be carried out in such a manner that only material sufficient to completely fill a box be obtained. However, in unusual circumstances this is not possible and departure from the recommended procedure is inevitable. In such cases, fermentation time should be varied accordingly, shortened under circumstances of insufficient cocoa and prolonged when excessive quantities are fermented.

Mixing beans obtained on separate harvesting occasions over a day apart will increase the heterogeneity of fermentation and the number of underor over-fermented seeds. It is preferable to ferment separately lots harvested on different days, making appropriate allowances for the rate of fermentation, than to mix them to obtain a full load.

Fermentation duration and the required turning should be followed rigidly as long as there is no necessity - as determined by quality and quantity of the raw material - for doing otherwise. Both overand under-fermentation methods, duration and turning routines vary the world over. There is at present no single correct method of fermenting cocoa that can be recommended to all producers. Until such time that this has been achieved, any method, no matter how rudimentary or primitive, capable of producing good quality cocoa must be accepted as the best in those circumstances.

The drying process that follows fermentation should not be looked upon as merely removal of water from the cocoa bean. Although this is the overall (main) objective, other important chemical transformations also occur during this process that can profoundly influence flavour. In fact, if drying is carefully conducted, deficiencies in fermentation can sometimes be made up for on the drying floor. Biochemical changes initiated in the seed during fermentation continue during drying, and the rate of water removal and the drying temperature will both have an influence on these. Under-fermentation can be compensated for by a slow drying and conversely, over-fermented beans should be more rapidly dried.

Other precautions in storing and transport of the prepared cocoa under conditions where it will not deteriorate or pick up odors will help preserve the quality of good beans.

Finally, the importance of the genetic component responsible for flavour can not be sufficiently stressed. In the past, the emphasis in plant breeding has been aimed at producing high-yielding and disease-resistant varieties. Little or no attention was paid to the flavour potential of these selections.

This is probably because of the lack of knowledge of the factors that contribute to chocolate flavour and the lack of analytical means of measuring it objectively. Furthermore, there were constraints on growing large acreages and hence insufficient material was available for properly fermenting these new test varieties. This situation has changed and it is now possible to obtain a good indication of flavour of the beans by fermenting small quantities of cocoa and organoleptic evaluation of chocolate produced from these.

Therefore, if chocolate flavour is to be preserved, it is necessary to place more emphasis on its study and the genetic factors that control flavour. Furthermore, monetary incentives should be made available to encourage increased production of flavor varieties once they are identified.

At the same time work must continue, albeit at an accelerated rate, on fermentation methods. The process has remained unchanged for decades due to lack of enough interest in producing countries to devote resources to research projects that will not yield information that can be immediately translated into financial benefits for the farmer. However, this kind of basic information is essential if new methods are to be developed that will benefit the farmer by improving the efficiency of the process.

Research into flavour mechanisms will aid in the elaboration of processes of controlled curing with selected microorganisms and/or curing by chemical means whereby a complete control of the process may be achieved. Until such time we must be content to work with the methods presently used in the manner in which they will produce best results.

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PANEL V

MARKETING

THE ROLE AND PERCEPTIONS OF THE COCOA BUYER
(Original document: English)

Noel Smith

Dealers or merchants are perhaps the second oldest profession there is. The supplying of goods and services for other articles of like value is the cornerstone of the opening up of new horizons and the boundaries of the world.

Merchandising and trade have brought us a large part of our history, and are largely responsible for the exploration of new continents. They have also been the main reason behind many of the international problems the world has seen, and been largely responsible for many wars. Moreover, one can argue that without such trade the world would be a much smaller and less enjoyable place in which to live, and much of the external contact we currently have is directly due to the international trade each country enjoys.

Though the methods of trade have changed dramatically since early seafarers began trading, the basic principle remains largely unchanged: the dealer acts as principal both to the exporter in a producing or selling country and to the final user in the consuming country.

With the advent of modern technology, however, today's problems are much different from those experienced in the past. Then, trade was predominantly by barter. People in producing countries generally had little use for any foreign currency - only gold and other like commodities had value. In today's climate, currencies are readily interchangeable for the most part, and are the fastest growing of the commodities currently traded. Buyers and sellers alike have a wealth of technology at their fingertips: both understand the economics which affect their commodity price flunctuations, and in large part capable of taking the appropriate steps to protect themselves from adversities which may affect their business.

Cocoa, like many other commodities, has its own rather distinct traits. It has its own growing season, and is therefore at times readily available, but at other times, between growing seasons, there may be none. Demand, however, is usually constant. If a certain growth of cocoa is needed in a formula, then the manufacturer needs a source of material available to him at all times, rather than just in times of the year when it is grown in an specific country.

The dealer provides a liquidity in the market place because of the differences in the various growing seasons of cocoa. Often when there is a great availability of cocoas because demand is slow, the merchant will absorb this short term excess production, and feed the cocoa types into the system when demand for them improves or supplies become limited. Thus, swings of supply and demand of the physical supplies are somewhat evened out, reducing inconvenience to grower or user.

To do this, the dealer himself must take risks, some of which can be offset, others only partially so. Therefore the merchant's role in the marketplace is not only a service role, but also entrepreneurial risk-taking. In the current climate, these risks include finance rates, insurance, ocean freight rates, etc.

Cocoa is a commodity which historically is traded for forward delivery, often as many as 18 months in advance. Therefore, when a decision is made to buy or sell for delivery in the future, a dealer has to assess all aspects which will affect his final buying or selling price. With merchants assuming these risks, shipper and manufacturer alike can sleep a little easier at night knowing that once they have made a commitment, any change in costs over which they have no control will not affect their final buying or selling price.

As cocoa is only produced in countries close to the equator, this means at this time that the commodity occurs mainly in developing nations. These nations are somewhat at the mercy of climatic conditions and may be affected by unstable social and political conditions. Because of these circumstances, shipments from a producing country are often subject to delays and occasionally lack of contract fulfillment. Though non-fulfillment of contract does not happen very often, because of the volatility of cocoa it is the single largest and usually the most expensive risk a dealer incurs. We can buffer ourselves against most of the risks, but in the case of non-fulfillment of contract it is almost impossible to get full recompenses for losses incurred.

We therefore take as many steps as we can to ensure that new suppliers have the necessary wherewithall and integrity to honor commitments that they have made. Realizing that in the case of small and new shippers this may be hard to provide, a performance bond can be opened until a working relationship is established.

We also realize that smaller exporters in less developed growing areas of the world are affected by adverse weather conditions, and these conditions could cause problems for them in fulfilling their forward obligations on a timely basis. However, if this information is known beforehand, then we can, in cooperation with the manufacturer, often make adjustments to help overcome some of the difficulties. But it is essential that the facts be known as far in advance as possible so that alternatives (if available) can be worked out to try and relieve some of the problems that late shipments often cause.

As I have said before, it is our function not only to move the goods from the growing countries to the consuming countries, but also to provide an outlet for both buyer and seller alike, as well as to assume the risks involved therein. Without a good knowledge of all aspects of the business entailed in this role, as well as the principal contracting parties involved in the transaction, our life span would be very limited.

In the past 10 years in commodities, we have seen some very large disruptions to our business. Governments have gotten involved in areas which have been extremely sensitive and often the results have left bad feelings on the part of the injured parties. Commodity pacts have collapsed, as in the case of the tin agreement, and innocent parties have had to absorb huge losses, in many cases hundreds and thousands times larger than any profit they could have possibly hoped to have made. Because cocoa in many countries plays a large part in those countries' foreign exchange earnings, it is to be expected that a certain amount of government legislation must be felt. But the main role should be one of support in assisting production and the services needed to ready the goods for export.

It is always somewhat distressing to producing countries that events over which they have no control, and happening many thousands of miles away, can have an impact on commodity prices upon which their own economy is so dependent. A drought in Africa would mean higher cocoa prices not only for Africa but for the rest of the world as well, but excesses in production in Africa will mean lower world prices for all growers also. Commodity pacts or agreements have tried to stabilize prices somewhat by trying to defuse these price swings, but for the majority of agreements the reality is that they haven't been very successful in defusing market swings and in many cases have led to price fluctuations by their own actions. I am not going to comment on such agreements, as there are many valid arguments both for and against them. But the point I want to make here is that there is no substitute for knowing what the world situation is, with the amount of information available and communications as sophisticated as today's. If a grower in South America wants to know what is happening in Asia, this information is available and should be utilized. The dealing community invests a lot of money each year trading with partners in origin and consuming countries. We take special interest in our trading partners and try to gather as much information about each local scene as possible so that a global picture can be formed.

Multinational trading companies are becoming the norm, their resources are larger, and the day of the small domestic trader seems to be diminishing. Because the multinational has offices in many parts of the world, information is more readily available, and the large amounts of money needed to finance these commodities are more readily available.

I want to make some mention more pertinent to Central and South America in regard to the problems that we sometimes meet. The large producers (Brazil, Ecuador, Mexico and Colombia) all have a long history in cocoa and as such are sophisticated in their growing and marketing of

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cocoa beans and products. Though they are still subject to internal problems, they are sufficiently knowledgeable in the ways of the market and of cocoa in particular to withstand any changes in internal policies without adversely upsetting their marketing policies and disrupting their forward commitments. However, over the past 6-7 years, with other producing countries in South and Central America we have seen many changes. Production has decreased, and when available has been erratic. One must remember that when a manufacturer uses a certain grade of cocoa in his formulations, if that grade of cocoa becomes unavailable to him on a continuing basis then he will change his formulations to preclude this particular growth. This loss of a buyer for these particular goods will directly affect the price paid to the producing country. Likewise, if a dealer is committed to using a certain grade of cocoa, and that cocoa is not available to him at the time of delivery because of inconsistent production or shipping procedures, then the dealer will have to try and recompense himself for the monetary losses incurred. This will have an adverse affect on future prices paid to that particular shipper or origin.

One of the main problems we have in Central America is shipping. It is an unfortunate fact that bulk shipments of cocoa from Central America are not always available, and the shipper must ship his goods in containers. If done correctly, container shipments should not cause any problem, but it is also a fact that many shipments are not done correctly and a number of disputes have arisen due to quality when goods arrive at port of destination. If goods are incorrectly shipped, then quality problems will certainly occur. Containers must be ventilated to allow cocoa to breathe and to continue their fermentation process without going moldy. It is up to the shipper to insist that the shipping company provide proper containers for cocoa shipments and thus avoid a quality problem.

I hope that what I have said has given some insight into what we do in the market place, and a few of the problems which we have to face.

Thank you.

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PANEL V

MARKETING

AN EXPORTER'S POINT OF VIEW
(Original document: English)

Steven Aronson

Serious forums like this one -- where issues of production, consumption and government policies are discussed, rarely include exporters. It is not surprising, as we generally have little new to say: our role is principally reactive, rather than creative, as we must deal with the realities that result from the carefully thought-out plans of producers, consumers, and governments. These realities often have the nasty habit of acting quite differently than planned and sometimes, in fact, exactly contrary. The business of marketing a volatile commodity like cocoa, where it is fairly routine to have daily market fluctuations vastly in excess of a normal commission, requires us to surrender our illusions as a price of staying in business.

The Granex team has been a principal bean exporter in Ecuador for the past 12 years and has acted as buyer and exporter in Costa Rica for the past 10 years; so we have had ample opportunities to shed illusions.

At the beginning of the 1970s conventional wisdom among cocoa traders was that profitable short positions could be established if the market reached the astronomical levels of 500 per ton. By the midto late 1970s this wisdom had been tested rather severely as the market breached the 5,000 per ton level. Perhaps this influenced the thinking of the Ivory Coast caisse in its initial refusal to join the Buffer Stock (BS) agreement in the 1980s due to the low intervention point of around 2,000 per ton.-- a price so ludicrously low that the BS Manager promptly spent his entire budget in about one year, filling the warehouses in Rotterdam with cheap cocoa. Shortly after he fulfilled his mission, several of the major international firms spent a year working particularly in the New York and London markets, planning to profit from the deficit in cocoa created by the combination of drought in the Ivory Coast, flood damage in Ecuador, and the diversion of cocoa to Rotterdam by the buffer stock scheme. Surplus stocks in New York rather rapidly reached record levels.

Throughout this period of price volatility, we have observed that the governments of the two countries where we work decided, quite rationally, to encourage a move-up market by subsidizing the development of local processing industries. The transformation of cocoa beans to liquor and subsequently to cake and butter would shield producers from market volatility and at the same time allow the exporting countries to obtain the foreign exchange and multiple benefits that flow from marketing semi-finished goods instead of raw materials. As soon as these industries were well established, the price of origin-produced cocoa liquor, a tone of which is obtained by roasting, melting, and packing 1,270 kilos of raw cocoa beans, dropped to an average 15 percent premium over the international price of beans.

The experience of Ecuador is an interesting case study in the costs, benefits, and unwanted side effects of a cocoa industry built on subsidies.

Ecuador, until 1975, was well known in the cocoa world as a producer and exporter of a high quality flavor grade bean with a relatively low fat content. Ecuadorian beans consistently traded at substantial premiums to basis grade cocoas, and the finest grades were among the most costly cocoas in the world.

In the mid-1970s the Ecuadorian government, through a series of subsidies which totalled approximately 40%, encouraged the development of a local liquor industry which reached at its peak, around 1978, a grind capacity of about 150% of the total crop.

This excess capacity created several problems:

1. Fierce competition on the part of the industries to place their product in a market that was in no way ready for such ample supplies of Ecuadorian liquor. This competition drove the liquor ratio down at one point to as low as even the exchange FOB. This in effect amounted to a direct transfer of the subsidy to the consumer.

2. A local price squeeze, which drove up the price of the beans internally to levels at which bean exporters could no longer export beans at market prices.

The result of this untenable situation was a rather long process of conflict between industry, government, exporters, and producers in which everyone came out net losers:

THE PRODUCERS--lost as the industry, in an attempt to defend itself, tried and almost succeeded prohibiting bean exports. During this process, the industry formed a buying cartel with local quotas and fixed prices. This cartel, which most closely can be characterized as a conspiracy in restraint of trade, was supervised by a major US auditing firm which reported quantities of cocoa bought to the cartel office on a daily basis.

THE INDUSTRY--since the processors were unable to stop bean exports, they were forced to continue to ride the wild horse they had mounted, and many were thrown off -- the list of bankruptcies and closed factories include some of the best known names in the Ecuadorian cocoa trade.

THE GOVERNMENT--in addition to the loss of the subsidy, which in many cases financed the purchase of equipment and the construction of factory buildings which today are idle assets on bankers' balance sheets, also lost large amounts of foreign exchange as some industries invented quite elaborate under-invoicing schemes in order to stay alive.

THE EXPORTERS--were forced to abandon their traditional customers due to lack of consistent supply. In some cases, the abandonment was mutual as the consumers turned to the much cheaper liquor as a less-than-desirable substitute for beans. In other cases, especially in the cover-ture industry, where consistency of flavor is of paramount importance, consumers simply changed their formulas as they found it impossible to use liquor which they were unable to roast and blend themselves.

The sad ending to this story has not been written. Although since August 10, 1986, subsidies no longer exist, the surviving industries, which represent about 30 percent of the original installed capacity, have moved strongly up market to chocolate or semi-exclusive supply contracts and still are pressuring the government to reinstate a subsidy.

The damage to Ecuador's position as an exporter of quality flavor grades seems to be fatal. When Ecuadorian shippers try to find their old premium buyers, many of the doors are closed, and as a result, the ship-pers' role in the 1980s has changed from a quality preparer and control-ler to a technical and financial intermediary between cocoa producers and the New York or London terminal markets. Ecuadorian cocoa has become part of the world's floating trading stock and is often tendered and retendered on the terminal markets until it no longer grades.

The events of the past two decades must have complicated the life of the long-term planners in both producing and consuming countries. For-tunately, as exporters we do not have to concern ourselves with these larger issues. However, we cannot avoid having certain opinions about cocoa marketing that appear to have remained valid for our countries, irrespective of changing markets:

1. Cocoa producers are price takers, not price makers; we have no con-trol over international price movements and can never hope to control them. This implies a very simple marketing strategy: try to supply what the market wants, when the market wants it. Our only participation in the market is as producers. This means that our principal interest is satisfying our customers so that they buy more.

2. Cocoa consumers are very quick to adapt to changing market condi-tions. Changes in supply, either in quality or quantity are quickly ad-justed to. Therefore, periods in which prices are vastly in excess of cost of production will be increasingly short-lived over the coming years.

Governments should give exporters and producers the tools to act aggressively in times of price booms, including facilities to make for-ward sales of unharvested crops.

3. Subsidies don't work. They hide the true price signals from the producers while at the same time distorting the consumer's perception of the market. The only subsidies that make sense to the producer are techniques to lower costs of production and cooperation in increasing the consumer's consumption.

4. The multiplier effect of a cocoa industry should be in development of infrastructure in the areas of production -- transport, grading, and drying facilities closer to production areas, technification of production on a small farmer level, extension, education, and disease control.

5. Intermediate industries should be encouraged only in two cases:

   a. Export of excess of intermediate products of national consumption -- i.e., Colombia, which has high cake consumption -- so as to be an exporter of butter.

   b. Production of final product which fits in a market niche definitely different from commodity producers -- e.g., Perugina-type ventures in Ecuador or Costa Rica.

These suggestions seem to be in contrast with a very hard-to-eradicate vision of the world that appears to be prevalent among Latin American governments, that we must not sell "cheap" and that we must try to avoid being commodity producers. The facts, however, seem to contradict this vision. In the present economic structure, we are suppliers to the developed world; and as such we are partners with the developed world's manufacturers in producing what consumers want.

As long as we are not owners of the Hersheys, Nestles, Mars, or Cadburys of the world and of their all-important distribution and marketing systems, we are better off dealing with reality and making the most of it.

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PANEL V

MARKETING

THE EARLY YEARS IN JAMAICA
(Original document: English)

Fitz Shaw

INTRODUCTION

The Early Years

The marketing of cocoa was undertaken by a number of produce Merchant/Exporters/Importers who had established contacts/linkages in the United Kingdom, USA, Canada and other destinations to which the beans were exported. Cocoa was only one of the many agricultural commodities marketed. Others included pimento and other spices, as well as coffee, rum, kola, etc.

-Produce Merchant/Exporter
-Produce Dealers
-Local Suppliers
-Shopkeepers
-Farmers

The significant factors of the system were: (1) the role each functionary played, and (2) the financing credit programme process.

Role of Functionaries

Cocoa Suppliers

Cocoa production is carried out on farm units most of which are under 5 acres. These units are multi-cropping mixes, characteristic of subsistence agriculture. Features include small farm size, hilly land where the soils of moderate natural fertility have been badly eroded. Beside the disadvantage of the very small size of most of the farms, there are unsatisfactory features of land tenure and extensive fragmentation of farms.

Farm production of any one commodity was usually very small and it was the combined output of the many crops that constituted the total income. Cocoa's contribution in such a mix of crop was usually very small and the national production was realized only from the very large number of very small farmers supplying small quantities of beans.

TABLE I

NUMBER OF FARMS AND AREA OF LAND OCCUPIED

BY SIZE GROUPS AND FARMS, 1954

SIZE GROUP (ACRES)	NUMBER OF FARMS	ACREAGE OF FARMS	PROPORTION OF TOTAL: NUMBER OF FARMS	PROPORTION OF TOTAL: ACREAGE OF FARMS
			(PER CENT)	
0- 1	42,911	18,111	21.5	0.1
1- 5	95,851	230,963	48.2	12.0
5- 10	34,849	238,092	17.5	12.4
10- 25	18,474	264,832	9.3	13.8
25- 100	5,575	232,178	2.8	12.1
100- 200	522	71,875	0.3	3.8
200- 500	436	142,256	0.2	7.4
500 +	350	716,068	0.2	37.4
ALL	198,968	1,914,375	100.0	100.0

SOURCE: DEPARTMENT OF STATISTICS (1957), P.8

Cocoa Supplied

The farmer, having reaped the cocoa pods, usually broke them open, removed the beans and proceeded with drying. The quantities were too small for fermentation, so fermentation was the exception, or incidental as far as post-harvest preparation of the beans was concerned.

Occasionally the shopkeeper accepted cocoa in the pods from farmers and initiated the drying process. The shopkeeper was able to equate a given dry weight of beans with the number of pods supplied by the farmers.

Pricing

The farmer received cash or kind as payment for the produce but the amount finally realized depended on the method of payment and previous commitments to the shopkeeper. When several produce dealers were in competition in an area for the small quantity produced, the offers were usually better and the farmer received more for cocoa supplied to their agents (shopkeepers). However, the farmers might not have been aware of the price offered by different shopkeepers or it is likely that he was unable to take advantage of a better price due to earlier commitment to the shopkeeper. The shopkeeper invariably extended credit for mainly food items with the understanding that payments would be made when the crop matures. When the farmer supplied the produce, all earlier cash or goods advanced to the farmer were deducted from the proceeds and the balance paid to the grower.

Finance and Credit Process

The system operated on the basis of cash advance and reimbursement of the crop purchased. For example, the produce merchant provided cash funds obtained from the banking system or his own reserves to the dealers, who in turn extended the facility to the local shopkeeper who procured the produce from the farms. The system was not unique to cocoa purchasing, but applied to most agricultural commodities.

Constraints

An analysis of the system revealed serious constraints in the area of marketing, with consequences for the individual and national development.

Farmers' Welfare

The individual farmer was affected by the socio-economic dependency created by the method of credit procurement at the shopkeeper's level. The more committed he found himself in terms of advance credit for supplies,the less he was likely to argue for prices or seek to sell the produce to the highest bidder. The farmer stood to be disadvantaged/ exploited by the system.

Along the procurement channel, the participants are rewarded by a margin and profits from the volume purchased and price paid to the farmers. The least paid for the most could be considered the maximum of the market channel.

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As far as the price realized on the export market for the produce was concerned, only the produce merchant/exporter was aware of the units. The lack of market information may have been due to the unjustifiable nature of the channel and the low level of literacy among the participants.

It is worth noting that the produce merchants and dealers were among the most financially successful businessmen during the period, with some recorded as millionaires. The small farmers remained at the subsistence level.

Industry Development

Bean quality then could be considered as variable as the large number of small farmers supplying dried cocoa. Unfermented beans are of very little use to manufacturers. They are seldom required and fetch substantially lower prices than fermented cocoa beans.

Most farmers were not aware of how to ferment the beans, or even sought to do so. Beans were sundried on any available materia includ- ing zinc sheeting, concrete barbecues, lumber, or the ground. Risks from contamination and the resulting off-flavours in cocoa was very high. Insect and mould infestation were rampant, as not all beans were allowed to dry to the moisture content desirable for good quality beans. Often as many as 20-30% of the beans became infested by insects and mould.

Because the low prices and method of payment provided only for subsistence existence of the small farmers (who had the high consumption characteristic of the group), generation of excess funds for reinvestment in crop development was not possible. Deteriorating field conditions and low production was evident everywhere.

The Turbulent Years

The decades of the 1930s and the 1950s were marked by social, economical, and political unrest, war, and natural disasters. The 1938 uprising in the country pushed the Colonial Government into taking a close look at the socio economic realities of the masses at that time. The Moyne Commission and the subsequent Wakefield Report of 1944 emphasized the need for a new social and economic order for the peasantry.

By 1944, World War II was a reality. All shipping activities during the war years were controlled by the central government, bringing all exports and imports under the office of the competent authority. It would seem that this was the first time that central government involvement in commodity trade was rendered. There was not much opportunity for the implementation of the recommendation of the Moyne and Wakefield Reports. However, these years saw the establishment of the two major trade unions - National Workers Union and Bustamante Industrial Trade Union - and the two major political parties - the Peoples National Party and Jamaica Labour Party - as well as the introduction of adult suffrage.

These major social and political changes in Jamaica were accompanied by extensive economic assistance in the form of grants from the United Kingdom for economic activities at all levels, in particular, agriculture.

Government Involvement in Commodity Trade

I. Hurricane of 1951 and Farm Recovery Programme

The hurricane of 1951 wreaked havoc with Jamaica's agriculture. Massive funding for crop rehabilitation and expansion was provided by the United Kingdom. Such programmes as the cocoa rehabilitation and expansion programme, 1951, and the farm development schemes were implemented.

Two other activities were implemented simultaneously with these programmes:

1) The Organization of Farmers by the Jamaica Agricultural Society - The Farmer's Organization - into commodity groups.

2) The establishment of the Cocoa Marketing Board on March 1, 1952.

II. Cocoa Marketing Board 1952 - 1957

The cocoa marketing board was principally concerned with the preparation and marketing of cocoa beans produced in the island.

Additionally, the board was intended to secure the most favourable arrangements for the purchase, grading, export and selling of cocoa produced in the island, to purchase such cocoa and to sell or export the same; and to assist in the development of the cocoa industry of the island, including the manufacture of cocoa products for the benefit and prosperity of the industry.

The membership of the board constituted seven persons appointed by the Governor in Executive Council. Of these:

a. Two were officials of the government, one of whom was the chairman;

b. of the other five persons:

   i. One had special knowledge of agriculture and marketing of agricultural produce;
   ii. One was a person actively engaged in the business of the purchase and sale of cocoa;
   iii. Three were persons actively engaged in the growing of cocoa.

III. Cocoa Industry Board Law 1957

This law replaced the cocoa marketing law of 1952 and provided for wider powers for developing and controlling the industry, including the cultural, processing and manufacturing stages.

The composition of the new board, like the former board, provided for seven (7) members appointed by the Governor in Council and included someone having special knowledge of agriculture and the marketing of agricultural produce; another person actively engaged in the barriers of purchase and sales of cocoa; and three persons actively engaged in the growing of cocoa.

Functions

The board's functions continue to be:

a. The promotion of the interest and efficiency of the island's cocoa industry, assisting in its development and promoting the welfare of persons engaged in that industry;

b. Securing the most favourable arrangements for the purchase, handling, marketing, sale, importation and exportation of cocoa.

To carry out these functions, the board has been provided with very wide powers, chiefly the following:

i. To establish and operate cocoa nurseries, and to distribute, export, or otherwise dispose of, cocoa seedlings or cocoa plants;
ii. To cultivate, purchase, prepare for market, sell or export cocoa and to manufacture cocoa products;
iii. To establish research stations for investigating the cause, incidence, prevention, control or eradication of diseases and pests likely to be prejudicial to the interests of the cocoa industry;
iv. To license operators of cocoa nurseries and cocoa walks, cocoa dealers and special cocoa dealers;
v. To control the purchase, sale and export of cocoa beans and cocoa products produced on the island;
vi. To make regulations with the approval of the ministry (at that time the member of the Council of Ministers charged with responsibility for the cocoa industry.), providing for the control of other aspects of the industry -- including the prices to be paid for cocoa, and for cocoa products manufactured in the island.

IV. Farmer's Role in Industry

Reference was made earlier in this presentation to the organization of farmers into commodity groups by the Jamaica Agricultural Society. An all island association of cocoa growers' was formed in 1957, and consisted of some 5,914 growers, comprising 209 project groups located throughout the main cocoa growing areas.

The groups were responsible for collecting and supplying cocoa to the board. The organization grew rapidly and by 1970 was fully structured as a grower's co-operative with 14 affiliated cocoa growers' co-operatives. This organization was then the J.A.S. Cocoa Grower's Co-operative Federation Limited.

The individual co-operative through its group structure, collects cocoa from the farms and sells the product to the cocoa industry board.

Cocoa Fermentation and Processing

During the early years of the cocoa marketing board and the cocoa industry board, cocoa was bought by the board from merchants/dealers licensed by the board to purchase cocoa on its behalf. The cocoa bought was of varied quality. The board therefore had to batch and send samples to manufacturers' agents overseas. On confirmation that the cocoa was of acceptable quality, the price was set and shipment made.

As part of the product development activities, the board began experimenting with fermentation and drying of wet cocoa and by 1957 the encouraging results satisfied the board that the direction it had taken was the right one.

Richmond fermentary, in St. Mary, started operation on October 3, 1957, and processed 115 tons for that fall crop, (4,036 boxes of 64 lbs. each). The dry outturn was 42 tons. Samples of this cocoa was sent overseas for assessment of quality and the reports were most encouraging.

Following these reports, two small parcels of 100 bags of 200 lbs. each were sold to Canada and Belgium and prices realized were equal to the then world market price for the best quality Accra cocoa.

This was the beginning of the move towards central fermentation and reduction of the "ordinary" cocoa, sales production of which used to far outstrip fermented cocoa. For the year ending March, 1958 cocoa sales amounted to 2,245 tons, of which 2,199 tons represented ordinary cocoa and 46 tons fermented cocoa.

T A B L E II

Jamaica Cocoa Sales,
for the Year April 1957 - March 1958

	FERMENTED COCOA		ORDINARY COCOA	
DESTINATION	TONS	VALUE	TONS	VALUE
Canada	9	L 3,043	203	L 42,341
Belgium	9	3,005	-	-
Local Manufacturers	28*	9,213	1,996	413,353
	46	L 15,261	2,199	455,694

* Includes 4 tons fermented by a private grower.

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Ordinary Cocoa Decline

Subsequent years saw the gradual phasing out of the production of ordinary cocoa stimulated by the introduction of central fermentation of wet cocoa and improved quality due to standardization of the product.

By 1971, only 9 tons (.6% of total production) of ordinary cocoa were produced in the island - mainly by farmers who found themselves with small amounts of cocoa to reap between the crops.

There are now four central fermentaries, one in each of the major cocoa growing areas of the country. National production is beans, and supplies both local and export demands exclusively.

T A B L E III

JAMAICA'S YEARLY INTAKE OF COCOA
BY ALL FERMENTARIES, 1978 - 1984:

CROP YEAR	NUMBER OF BOXES (No.)	WET WEIGHT (Lbs.)	OUTRUN OF DRY BEANS (Tons)
1978/79	182,002	10,307,424	1,793
1979/80	136,377	7,721,209	1,369
1980/81	183,127	10,465,821	1,184
1981/82	143,082	8,157,916	1,426
1982/83	278,528	16,132,556	2,738
1983/84	269,210	15,580,160	2,710

There are some 24,000 farmers supplying cocoa to the industry. Over 90% of these farmers own less than 5 acres of land and cultivate other crops besides cocoa.

TABLE IV

DISTRIBUTION OF COCOA GROWERS BY SIZE, 1977

NUMBER OF ACRES OF COCOA ON FARM	NUMBER OF GROWERS	PER CENT OF GROWERS
Under 1	10,439	43.5
1 to less than 2	7,534	31.4
2 to less than 5	4,887	20.5
5 to less than 10	873	3.7
10 to less than 20	199	0.8
20 to less than 50	27	0.1
Over 50	2	Neg.
	24,011	100.00

On the output side, the indications are that these yields are very low.

TABLE V

DISTRIBUTION OF OUTPUT BY GROWERS SIZE, 1977

No. OF ACRES OF COCOA ON FARM	(A) NUMBER OF GROWERS	(B) TYPICAL YIELD (Boxes P/Acre)	(C) TYPICAL AREA (Acres)	(D) TYPICAL OUTPUT (Boxes '000)	% SHARES
UNDER 1	10,000	3	0.33	5	2
1 - 2	7,500	5	1.20	22	9
2 - 5	5,000	10	2.50	163	26
5 - 10	900	15	6.00	41	18
10 - 20	200	30	13.33	80	34
20 - 50	27	33	22.00	20	9
OVER 50	2	40	50.00	4	2

A. Rounded for estimation purposes;

B. Typical is defined as most common, not average;

C. In case of farms below 10 acres, only 50% of area is assumed to be planted to cocoa; hence the typical outlook is only 50% of calculated level;

D. The total - 235,000 boxes - is on the high side and probably reflects in the main the over-generous estimation of yield per acre.

Farm Size and Cocoa Yields

In terms of production, types and size of farms and cocoa yields in Jamaica, not much has changed with the years.

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PANEL V

MARKETING

COCOA PRODUCTION AND MARKETING PROJECT IN HAITI

(Original document: English)

Martin J. Bracken *

Introduction

The Cocoa Production and Marketing Project began in Haiti in 1982 as a strategy for economic assistance to peasant farmers. An inactive cooperative was reorganized to buy cocoa, marketing links were established with Hershey Food Corporation, and funding sought for expansion of the project. Thus began the involvement of the Mennonite Economic Development Associates (MEDA) in Haiti.

MEDA is a North American association of 1,500 business and professional people who are committed to the integration of their Christian faith with their work lives. Approximately 20% of MEDA's annual budget goes to domestic programs and services, while 70% goes to programs of international development. Currently MEDA has international projects in six countries, focusing on small business development and/or marketing assistance. In Haiti MEDA's work includes both a Small Business Development Project for the microenterprise sector and the Cocoa Project.

Project Phase I

Start-up funding for the first phase of the Cocoa Production and Marketing Project was provided by the Canadian International Development Agency (CIDA) along with MEDA, and in March 1983 the United States Agency for International Development (USAID) awarded the project a 2-year operating grant to attempt replication of the model in up to six other centers located in cocoa-producing areas of Haiti. Each center was to provide cocoa-related services and inputs, including production improvement training, to member producers. A key part of this first phase of the Cocoa Project was the participation of Hershey Food Corporation, which provided the project with an international market for Haitian cocoa, as well as technical research services.

* Delivered by Larry Kurtz, Technical Advisor, MEDA/Haiti

Project Phase II

Phase II funding for the period 1985-1989 is shared by CIDA and MEDA. An integral part of the project design is the intention that the cocoa cooperatives should be able to manage their own administration and marketing services by 1989. Therefore, Phase II comprises a significant educational component in addition to the production and marketing components.

At present there are about 1,700 members in eight cocoa cooperatives, with three more coops in the formation stages. The coops are split between cocoa-producing areas in the north and south of Haiti (See Fig.1 - Map of Haiti).

National and Economic Conditions

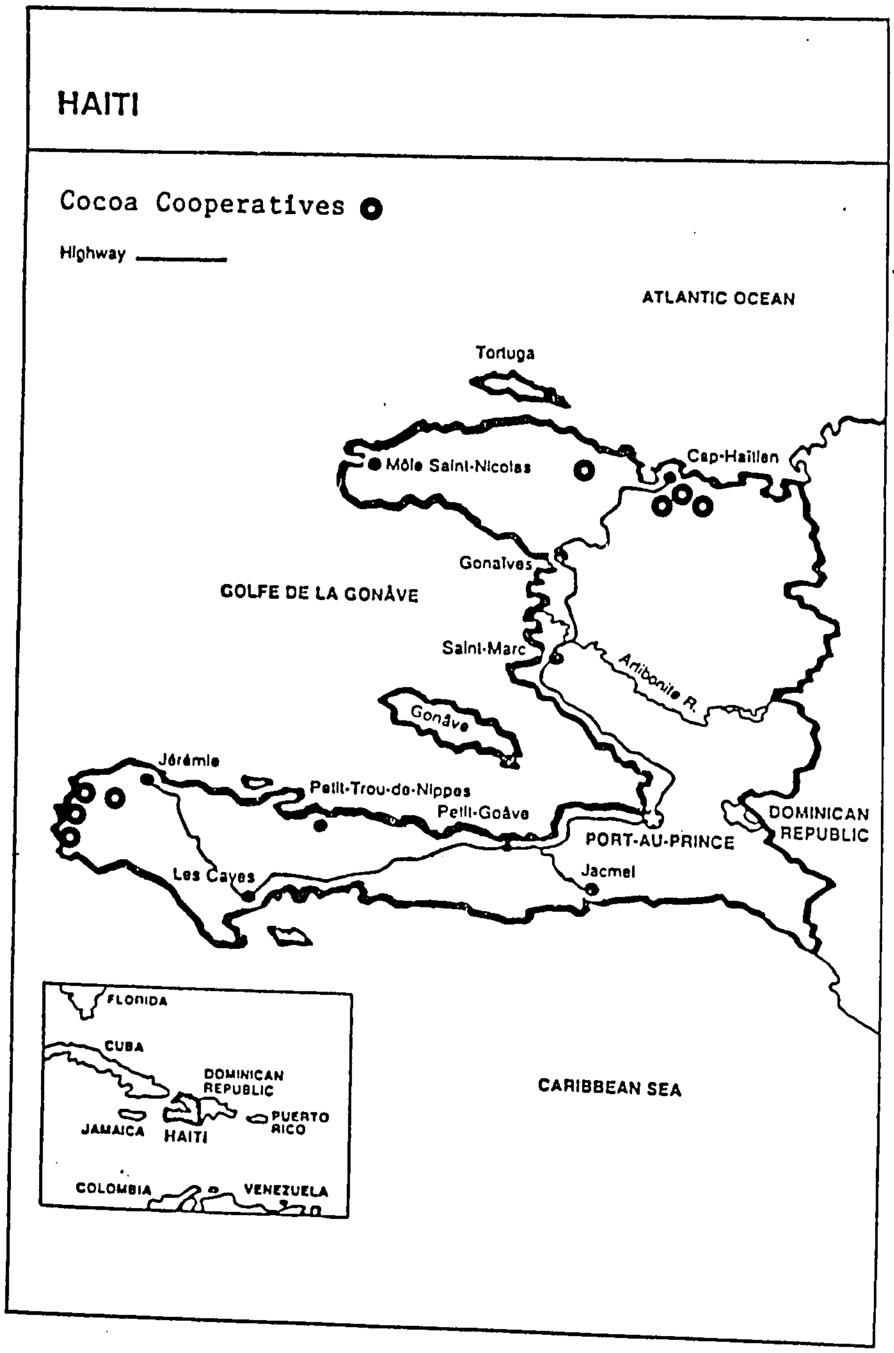
The target population for the Cocoa Project is rural peasant farmers. A few indicators of their quality of life may be instructive. Haiti has an estimated population of 5.5 million on a very mountainous land area of 28,000 square kilometers. Approximately 74% of the population is rural and dependent on agriculture for its livelihood. Average per capita income is US$300 (1982), but distribution is highly skewed: it is estimated that 0.4% of the population is the beneficiary of 44% of the national income, while over 80% receives less than US$150 per year.

Other indices of the quality of life are no more encouraging. Life expectancy is 54.7 years, while neighbouring Jamaica boasts an enviable 73 years. Infant mortality is 110 per thousand; in the Dominican Republic it is 65 and in Jamaica 10 per thousand. Malnutrition is pervasive, with only 25 per cent of rural pre-school children achieving a "normal" nutrition rating. Adult literacy hovers around 20 per cent, and in the rural areas, the teacher-to-school-age child ratio is 1,550, a statistic already benefiting from the many (66 per cent of total) private, usually church-sponsored schools. Poor education is but one example of the severely limited social services and enabling infrastructure supplied to the citizens of Haiti.

Population pressure, farming practices and weather conditions have led to neglect of the land base and deforestation that have been so severe as to cause very serious erosion - possibly as much as 5% of the topsoil per year. The average Haitian farmer has 1.4 hectares of land, held in a variety of tenure arrangements and often without legal deed. National patterns of producer-borne taxation and monopolistic market forces have stripped producers of incentive and accelerated rural-urban migration. Rural infrastructure is very weak, further reducing productivity.

The Creole garden is a complex mix of interdependent plantings. Environmental and economic risks are spread out over a number of crops. Cash crops play an important role in the economy of the farmer and the nation, but because of the farmer's overall strategy of riskminimization, cocoa is not mono-cropped. This makes calculation of yield per hectare difficult. The most reliable studies estimate average yield at 200-250 kg/ha with a density of about 240 trees per hectare. The farmers themselves usually do not know the number of trees they have in production.

FIGURE #1


HAITI
Cocoa Cooperatives
Highway
ATLANTIC OCEAN
Tortuga
Môle Saint-Nicolas
Cap-Haïtien
Gonaïves
GOLFE DE LA GONÂVE
Saint-Marc
Artibonite R.
Gonâve
Jérémie
Petit-Trou-de-Nippes
Petit-Goâve
DOMINICAN REPUBLIC
PORT-AU-PRINCE
Les Cayes
Jacmel
CARIBBEAN SEA
FLORIDA
CUBA
DOMINICAN REPUBLIC
PUERTO RICO
JAMAICA
HAITI
COLOMBIA
VENEZUELA

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Cocoa Production and Exports

Cocoa currently occupies about one per cent of Haiti's cultivated area and cocoa also accounts for about one per cent of the country's agricultural exports. In most places, cocoa suffers the same benign neglect as most trees in the Creole garden: it is welcomed as a source of cash, and even as security against a loan, but generally is not given the careful attention needed to maximize productivity.

Serious attention is often limited to harvesting from old, existing plantings. Beans are then dried with only casual care to control quality. Selective pruning, shade control, and pest and diseases control are not standard practices.

Perhaps the relatively minor role that cocoa has played in the national economy explains why it has escaped restrictive tax levies. Taxes applicable to cocoa until recently amounted to US$0.13 per kilogram or about 8 per cent of export value. The tax was based on weight rather than value. In October 1986 this tax was eliminated to provide incentive to the producers.

Haiti does not export premium quality, fermented cocoa; rather it exports sun-dried, unflavoured cocoa beans. Markets are readily available for this quality of product. Haiti currently exports about 3,000 metric tons per year. (The reliability of this statistic is difficult to ascertain.) How much cocoa is consumed in the domestic market, primarily by very small basic processors, is difficult to ascertain, with estimates varying widely from a negligible amount to 20 per cent of production. At any rate, demand locally is insufficient to establish a floor price for the reference of export sellers.

The traditional cocoa marketing mechanism in Haiti is sale to local speculators or agents who channel the cocoa to six major exporters who sell mainly to the European market. It is estimated that the cultivator has less than $50 a year available to spend on his family and invest in increasing productivity, so he frequently resorts to loans at usurious rates of interest. The traditional cocoa marketing system is difficult to alter because the speculators are often the only source of credit available in a community.

Phase II Project Framework

As mentioned elsewhere, the three major components of Phase II of the Cocoa Project are Production, Education and Marketing. Each will be described in more detail below.

Production

Within the cocoa sector, a number of factors were identified as limiting existing or future production levels. Seed supplies came from two senile government-managed hybrid gardens which were not being cared for or regenerated. There was no system of nurseries to produce good seedlings for outplanting. Existing trees rarely produced well because of poor farming practices and pests. There were few training or advisory services available to cocoa producers. And finally, the price paid to farmers through the traditional marketing system was limited to 25-35% of world price.

The technical team of the Cocoa Project now oversees a series of initiatives geared to production improvement for producer-members. A Technical Advisor, two Haitian agronomists and two coordinators direct the work of 25 extension agents. These agents are responsible for conducting training sessions on ten production improvement techniques including harvesting techniques, shade control, pruning, pest control, etc. They give field demonstrations to small groups of member farmers and conduct training sessions at the coops.

A network of 48 nurseries has been established, and a total of 180,000 seedlings have been outplanted to date. Also this year, a clonal garden was established with funding from the World Bank to our largest cooperative in the north. Management of the garden is being provided by MEDA personnel, and the supply of hybrid seeds should be sufficient to meet program needs as well as to provide excess seed for sale. It is anticipated that the revenue derived from the sale of seed will be sufficient to finance the operation of the garden into the future. Grafting materials for six varieties of cocoa were donated by the Mata Larga Research Station in the Dominican Republic.

The production improvement programme calls for very few inputs: training, labour and vertebrate poison. No fertilizers are used. Some herbicides and pesticides are used in the nurseries to counteract damage caused by insects and diseases.

Two manuals have been developed for use in the production programme; one on growing cocoa, and the other on nurseries. These manuals are in Creole, the spoken language of the rural population, and contain numerous drawings to facilitate understanding by the illiterate. MEDA also produces a cocoa newsletter in Creole 4 times a year which circulates production-related information to the coops. These documents represent the first attempt to reach cocoa farmers in their own language and are used as educational materials at the coops. Any technical resource material was previously written only in the official language of French.

Education

Initially, training sessions in the coops stressed production improvement techniques. However, technical training alone will not ensure the long-term viability of the Cocoa Project. Many of our cooperatives were constituted expressly for the purpose of reaping the economic benefits of association with MEDA, without an initial grounding in the philosophy and management of cooperatives. The Education program aims to develop these skills in the coop membership so that economic benefits to the farmers can continue after the life of the project.

The MEDA Education Team consists of a Haitian Cooperative Education advisor and 2 Field Trainers - one in the north and one in the south. They work closely with all other MEDA personnel in order to coordinate technical and cooperative training sessions at the field level. They are responsible for developing lesson plans and teaching materials, and also for increasing the teaching skills of the agents who meet the members face-to-face. Coop members themselves identified a great need and desire for literacy education, so the Education Team is assisting the coops to find local resources to meet this need.

Few of the existing coops operate in a truly democratic way. In fact, the history of the country is very much that of the dominating and the dominated, so very basic cooperative education is necessary: coop principles, roles of the various members and committees, how to conduct meetings and organize elections, etc. Another major emphasis of the Education programme is coop mangement: planning, leadership, legal requirements, financial management, etc. With the help of coop personnel, MEDA staff developed a standardized bookkeeping package in Creole for all the cocoa coops and are training people in its use.

Another vital function of the Education team is to facilitate the development of regional unions of cocoa cooperatives. These unions bring together decision-makers of neighbouring coops and provide a forum for discussions of common issues, such as transportation and marketing. In addition, a degree of motivation and peer pressure comes out of meetings with other coop groups. Most important, the unions are beginning to identify what steps they need to take in order to carry on when MEDA is gone from the Cocoa Project.

Marketing

Haiti produces about 0.15% of the world's cocoa (approximately 3,000 metric tons annually). The Cocoa Project currently exports about 10% of Haiti's total cocoa exports.

Since the inception of the Cocoa Project in 1982, the coops have exported 545.5 metric tons of cocoa in 31 shipments at an average contract price of $US2,111 for a total value of over $1.15 million. (See Table 1 - Summary of Cocoa Shipments, 1983-86). All of this cocoa has been bought by the Hershey Food Corporation at market prices established by the New York Coffee, Sugar and Cocoa Exchange. Since the Cocoa Project's production levels have been fairly predictable, MEDA's strategy has been to take futures contracts for half of the production, and spot contracts for the other half.

In addition to marketing the cocoa, MEDA also administers a revolving loan fund for the coops. Funds are advanced to the coops for purchasing cocoa, and they send their bagged cocoa by boat or truck to a warehouse in Port-au-Prince. When 18 metric tons of cocoa is accumulated from the various coops it is put together and shipped in a container. Once payment is received from Hershey, MEDA reimburses the revolving loan fund for advances made to the coops plus interest, then the balance is forwarded to the coops and divided according to MEDA's calculations among coop expenses, the required coop funds and bonus payments to farmer members. (See Figure 2 - Average Cooperative Shipment Cost Breakdown).

Since the beginning of the cocoa project, return to the farmer members has averaged 65-75% of world price. This represents a significant increase from the 25-35% return prior to MEDA's involvement. In the areas where MEDA has cooperatives, the speculators in the traditional buying chain have been forced to increase their gate price as high as 55% of world price to attract cocoa, so clearly non-members as well as coop members have benefited from MEDA's presence.

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In 1986, MEDA struck contracts from a high of US$2,300 to a low of $1,780/metric ton. The wide range of $520/metric ton shows the volatility of the market during this period. However, the lowest price passed on to producer farmers was $1,910/metric ton. When world price dipped, several contract prices were averaged together in order to pass on a more equitable distribution of benefits to the various cooperatives who shared in the shipments.

MEDA has already begun its phase-out, which is expected to be completed in June, 1989. At that point it is expected that the coops will have formed a structure to carry out the marketing and administrative functions that are currently handled by MEDA. This is an ambitious undertaking for a short time-line, but early indications are that it is achievable.

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TABLE 1
SUMMARY OF CACAO SHIPMENTS 1983-1986

PERIOD	NUMBER OF SHIPMENTS	AVERAGE CONTRACT PRICE $US/METRIC TONS	WEIGHT SHIPPED METRIC TONS	VALUE SHIPPED $US
Aug. 83 - June 84	3	2235	41.55	94,194
July 84 - June 85	8	2175	144.00	312,565
July 85 - June 86	11	2110	198.00	417,960
July 86 - Dec. 86	9	2014	162.00	326,250
TOTAL	31	2111	545.55	1,150,969

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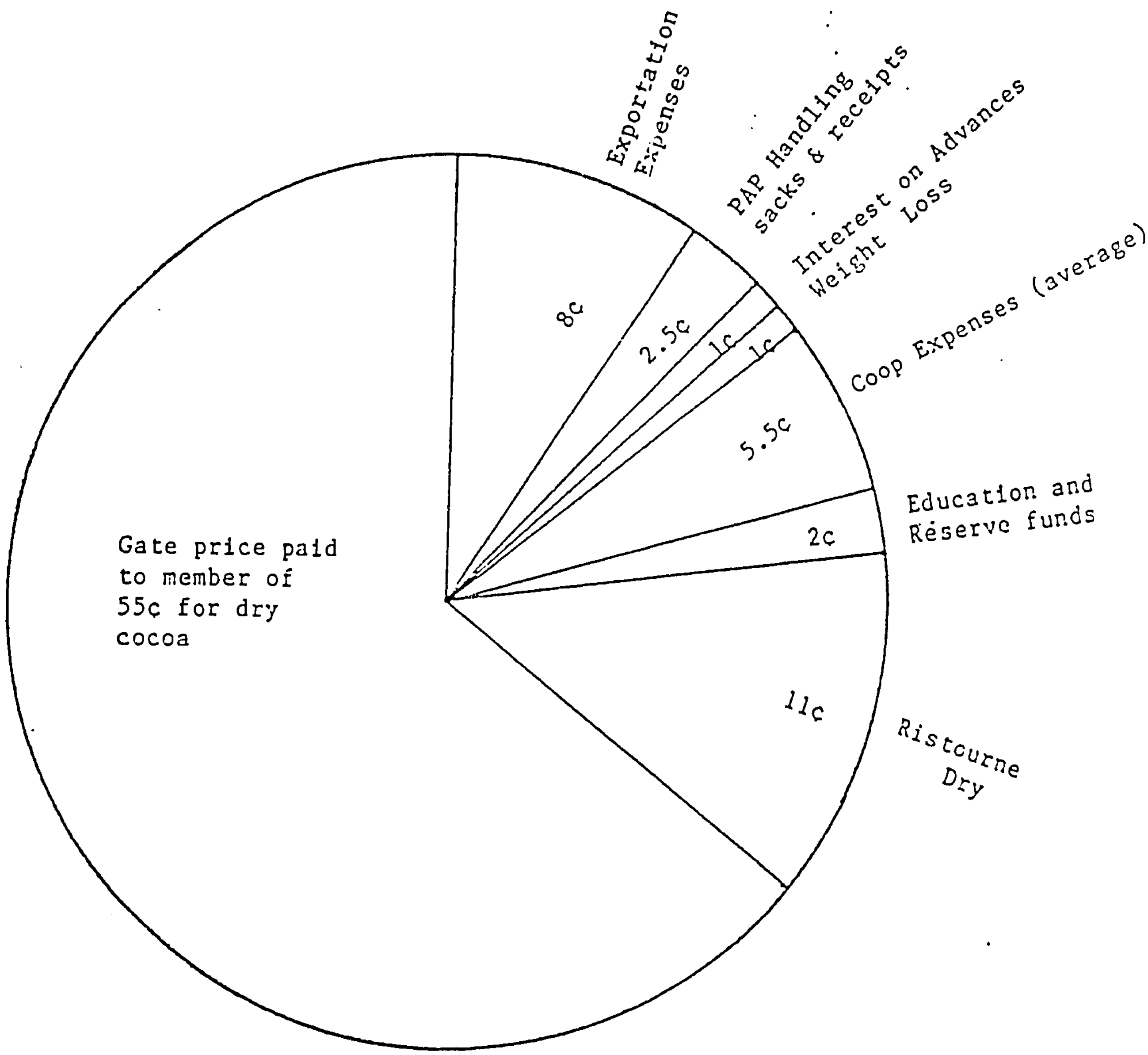
FIGURE #2

AVERAGE COOPERATIVE SHIPMENT COST BREAKDOWN

Cost breakdown based on the current world price of $1900 per metric ton or $0.86/lb



This chart shows the expenses to get the cocoa to market for each pound of dry cocoa shipped. The total equals $0.86 which is the current world price as of October 1986.

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PANEL VI

AUGUMENTING COCOA PRODUCTION INCOME: INTERCROPS, BY-PRODUCTS

(Original document: English)

Whereas it is generally recognized that the large cocoa farmer is mainly concerned with productivity, Dennis Johnson of USAID noted that the small farmer has different concerns and special interests. The small farmer seeks to minimize risk by multicropping and maximum land utilization. Until now research has tended to focus on the large cocoa farmers' needs. However, future efforts should address the application of research results to smallscale farms and extract the results most applicable to these needs from existing research information.

Ernesto Ruiz, Jr., Costa Rican entrepreneur, presented three cocoa production models to examine the economic viability of cocoa with intercrops. A review of the Costa Rican experience produced figures for the internal rate of return (profitability of investment) as follows:

- Traditional model, using CATIE technology: 24%.
- Short-term model, using a banana technology package, fumigation to control Sigatoka, and producing 300 boxes per hectare: 35%.
- Long-term model, with ASBANA technological package, and MAYPAN hybrid coconut seeds: 29%.

He urged that fixed costs for intercropping not be increased unless they benefit cocoa production and that associations be selected which enhance the profitabililty of each crop.

Glenn Trout, agribusiness consultant, recommended that fresh cocoa pods can be used profitably as animal feed after wet seeds are removed.

He projected that 3,000 pounds of beans could generate 4,800 pounds of pods which could increase the farmer's income by 27%. Because farmer has little access to cocoa shells generally derived from the roasting process, research on the utilization of this by-product has focused on the large animal industry. It has been reported that the shells blend well in compounded animal feeds. Mr. Trout further observed that recovery of additional income from these by-products in no way confiicts with other aspects of cocoa production.

Pat Scott of Belize's Hershey Hummingbird Farm expressed the view that the purpose of renovation and application of technology is profitability. All features of rehabilitation of old plots must be considered in terms of manageability, since returns on cocoa production are in direct proportion to management applied. He also observed that management practices should be geared to the objectives of the farmer.

There was interest in the impact of different crop associations on cocoa yields and on the total investment. The participants were told that treatment of pods for feed was nothing more than drying (same as for beans), chipping (as for cassava), and grinding with a hammer mill.

There appeared to be general agreement that ecological conditions and small farmers' interests should be the key determinants for intercropping combinations.

Harold Jones,
Rapporteur

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PANEL VI

AUGMENTING COCOA PRODUCTION INCOME: INTERCROPS, BY-PRODUCTS

THE POTENTIAL CONTRIBUTION OF AGROFORESTRY SPECIES TO SMALL FARMER COCOA GROWING

(Original document: English)

Dennis V. Johnson

Introduction

Moderate to large cocoa plantations provide the bulk of the world's commercial production. Shade tree species are a common feature of this agricultural system, and in some instances catch crops may be planted in the field during the first year or two of a newly established plantation. The eventual goal of these new commercial plantations is to maximize cocoa production; therefore, no serious consideration is given to the possibility of permanent intercrops or to the uses of shade trees for other products.

In contrast, small cocoa growers traditionally practice mixed farming, cultivating a complex combination of perennial and annual crops, often closely linked to small or large livestock raising. Rather than striving to maximize cocoa production, the motives of the small cocoa farmer are to minimize risk by not being overly dependent on any one subsistence or commercial crop. The small farmer views his plot of land in terms of its total productivity of all crops, instead of being concerned with individual crops. As a result, a single-commodity approach to cocoa growing among small farmers does not address their reality or their needs.

Agroforestry is a new term for an ancient practice. In simple terms it refers to a land system whereby annual crops, trees or tree crops and livestock exist simultaneously or in rotational sequence on the same plot of land. Many small farmers around the world have been practicing agroforestry for a long time. The primary objective of this new discipline is to better understand how these integrated systems function and how they may be improved upon to achieve greater farm productivity. Major concern is for the well-being of the small farmer who has been overlooked by the agricultural advances of recent decades.

The purpose of this paper is to draw attention to the special needs of small farmers as current and potential cocoa producers in Latin America and the Caribbean. An agroforestry approach to the subject seems highly appropriate.

Planted Shade and Windbreaks for Multiple Use

A wide choice of tree species is available for planting as direct shade for cocoa, or to provide necessary protective windbreaks. Through the selection of multiple purpose trees, these primary objectives can be met while at the same time providing the small cocoa farmer with one or more of the following: green manure, livestock forage, polewood, lumber and fuelwood. If the tree species chosen are also nitrogen-fixers, soil building will represent yet another benefit to the farmer.

More than one hundred permanent shade species have been used with cocoa. Therefore we have a wide choice of species from which to choose. However, general recommendations cannot easily be made because local ecological conditions and the needs of individual farmers are variable. The only shade or windbreak species to be avoided are those that may significantly decrease cocoa productivity through competition or serve as hosts for cocoa pests or diseases.

Compatible Food Crops in New and Rehabilitated Cocoa

Small farmers in particular require a source of income from new or rehabilitated cocoa plantings until cocoa production begins. Temporary food crops for either subsistence or cash purposes fill this requirement. In many cases, these temporary food crops provide shade for cocoa until shade tree species reach sufficient size to do the job. Among the common crops thus employed are bananas, plantains, cocoyams, pigeon peas, papaya and manioc. It is interesting to note that Wood and Lass in COCOA (1985) make the statement that planting bananas or plantains is a disadvantage because farmers are reluctant to cut them out as the cocoa matures. The authors' bias toward large scale production is obvious.

In practice, so-called temporary food crops may persist within cocoa plantings on a more or less permanent basis. From the small farmer's point of view, having his own source of food products for family consumption, or to generate cash income, more than outweighs any reduction of cocoa production resulting from intercropping. Again, the choice of particular crops should be left to the farmer to decide, the sole limitation being to omit those that may significantly and adversely affect cocoa growing.

Compatible Fruit, Nut and Spice Trees as Permanent Intercrops

The permanent intercropping of trees with cocoa is a bit more complicated agronomically because of the competing needs of the intercrops and cocoa, but it possesses advantages from the standpoint of stable, long-term, diversified production. Obviously, fruit, nut or spice trees can provide cocoa shade and serve s windbreaks. Moreover, if for any reason the trees are felled, their wood products can be put to good use by the farmer. Local ecological conditions, and to an even greater degree the local or international market conditions for the products, will determine which trees are most appropriate. Because of their multiple utility, furnishing both commercial and subsistence products, palms as a group have considerable potential as permanent intercrops.

In very intensive agroforestry systems, it is commonplace to find permanent intercropping of trees with cocoa, and in addition an understory consisting of some annual food or industrial crops. With such a variety of products there would be generated a number of byproducts suitable for primary or secondary livestock feed.

Examples of Existing Intercropping with Cocoa

Examples of all of the foregoing suggestions of cocoa intercropping can be found in practice somewhere in the humid tropics. A brief sampling of these systems can demonstrate the range of production systems found in different geographic regions. In the search for these examples, I was aided by data provided by the International Council for Research in Agroforestry in Nairobi, Kenya, and by CATIE.

Central America. This region scarcely needs to be discussed given the venue of this conference and what will be seen on the field trip. Most noteworthy are the widespread use of madre de cacao (Gliricidia sepium) as shade, soil-builder and wood source; and the planting of laurel (Cordia alliodora) as a shade and timber tree and poro (Erythrina peoppigiana) as shade and to provide green manure.

Caribbean. The cocoa producing islands of this region possess some of the best examples of cocoa agroforestry. The most intensive system I am aware of is found on small farms of moderate-to-steep slopes in Grenada. Nutmeg, mango, hog plum, citrus and breadfruit are permanently intercropped with cocoa; in addition, the farmers grow bananas, cocoyams, pigeon peas and other food crops. Grenada also has examples of the intercropping of coconut, cocoa and bananas in coastal areas. Similar intensive patterns can be seen in Jamaica. In the Dominican Republic, cocoa is intercropped for shade with Catalpa lingissima, a tree also providing wood products, and mango and avocado for fruit production.

South America. Although dominated by large-scale production in Brazil and Ecuador, there are a few examples of cocoa agroforestry. Cocoa is successfully intercropped with rubber in Brazil (Bahía), and there are some small farmers who cultivate combinations such as clove and cocoa. Venezuela (Miranda Province) is promoting cocoa growing as a small farmer crop and has conducted experiments with various combinations that show promise. These are: coral tree, banana, and cocoa; coconut, cocoa and cassava; and mahogany, cocoa, pineapple and beans.

West Africa. Large-scale production is also the rule in the major countries of Ivory Coast, Ghana and Nigeria. Food crops (bananas and cocoyams) are grown in the early years of new cocoa plantations for temporary shade and to generate income. Kola is permanently intercropped with cocoa in some locations, but should be avoided since it serves as a host for cocoa pests. By and large, there is apparently little regard for the multiple utility of shade trees.

South and Southeast Asia. The general intensive character of agriculture in this region is also reflected in cocoa growing. Permanent intercropping of coconuts and cocoa is practiced in Papua New Guinea and

Malaysia. Cocoa is planted in Malaysia within old coconut groves as part of a general program of coconut rehabilitation, and in Sri Lanka in a similar way in old rubber plantations. The arecanut palm in India is another successful example of permanent intercropping. Also in India, a multistoried crop combination of coconut, cocoa, black pepper and pineapple can be seen. Agronomic research in the respective countries has substantiated the productivity of these various combinations.

Cocoa Agroforestry in Agricultural Policy and Land Use Planning

It seems obvious that the promotion of small farmer cocoa growing and agroforestry are interrelated. From my review of the cocoa literature, especially the proceedings of the various international cocoa conferences, it is also obvious that nearly all of the published material is derived from and aimed at large-scale cocoa production, wherein shade trees are accepted as being necessary but where permanent intercropping of annual or perennial crops is discouraged because it competes with cocoa. The problem that we face, then, is one of trying to identify those aspects of modern large-scale cocoa production which are suitable to the special conditions and needs of small farmers.

This requires some rethinking of objectives. Cocoa production must not be viewed in isolation, but as just one part of the small farmer's income-generating activities. The value of multiple purpose species for shade must be recognized. In addition, the fact must be accepted that small farmers will seldom if ever be able to adhere to optimal densities of shade species to maximize cocoa productivity.

I believe that the greatest potential for helping small farmers increase their cocoa productivity can be found in (1) making available improved planting materials for rehabilitating old cocoa orchards, and (2) the manipulation of existing cultivation patterns and practices to benefit cocoa. For example, it may be feasible to have farmers relocate fruit or spice trees to border plantings and carry out some judicious pruning of them to reduce excessive cocoa shade.

It must be emphasized that no single, general approach can be applied to small cocoa farmers. In order to be successful, proposed changes must be tailored to the respective geographic areas. Moreover, for any one area, farmers ideally should be presented with several options to improve cocoa production, so that they can choose a particular set of recommendations most appropriate to their immediate needs. To achieve this end, we must reach out for successful examples wherever they can be found and test their suitability to the conditions existing in the Latin American and Caribbean region.

Considerable benefit will be derived if the efforts to improve small farmer cocoa productivity makes use of the growing body of agroforestry literature, for within that approach lie the most workable solutions to helping small farmers in both general terms, and with respect to particular crops like cocoa.

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PANEL VI

AUGMENTING COCOA PRODUCTION INCOME: INTERCROPS, BY-PRODUCTS

ANALYSIS OF INTERMIXED CROPS
(Original document: Spanish)

Ernesto Ruiz, Jr.

Purpose

To establish if it is profitable to incorporate crops associated with cocoa.

METHODOLOGY OF ANALYSIS OF COCOA PRODUCTION MODELS

1. Traditional Model
2. Short-Term Model, banana association, cocoa, Poró.
3. Long-Term Model, coconut association, Pelipita.

BASIC ASSUMPTIONS

Traditional Model

1100 cocoa trees
Application of CATIE technological package
Prices: According to World Bank
Yield: 1150 kg/ha

Short-Term Model

Cocoa equal to Traditional Model
Banana: Technological package for banana with spraying for Sigatoka control
Price: $5.00 F.O.B. box of 24.04 kilos
3 years production
380 boxes per hectare (= 9135.2 kg/ha)

Long-Term Model

COCOA
900 trees per hectare
Production up to 900 kilos
Coconut: ASBANA technological package
MAYPAN hybrid seed
Production up to 3 ton, per hectare

FINANCIAL ANALYSIS

Entries

- Total Costs

- Statements of gains and losses
- Net profits after taxes
+ Depreciation

Internal Cash Flow

+ Investments

Project Cash Flow

- T.I.R.
- V.A.N.

REQUIREMENTS FOR INTERMIXED CROPS

- Reduce payment period.
- Produce a positive cash flow (funds in the short or long term).
- Increase the project profitability.
- Do not increase fixed investments which are not utilized by cocoa.
- Intercrops must be cultivations needed for cocoa (temporal and permanent shade).
- Intercrops must produce a margin of contribution to the project.
- Intercrops must contribute to the cost reduction in the cocoa plantation.
- The association must improve the individual yields of each cultivation.

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CUADRO No. 1

MODELO TRADICIONAL

ANALISIS FINANCIERO SIEMBRA DE CACAO.

AÑO	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
No. Has.	100	100	100	100	100	100	100	100	100	100
PRECIO	123	130	137	146	160	177	194	214	235	250
RENDTO.	0	0	300	400	650	900	1000	1150	1150	1150
TOTAL PROD. KG	0	0	30000	40000	65000	90000	100000	115000	115000	115000
INGRESOS										
	0	0	4124400	5826800	10418850	15900300	19422000	24555950	26977850	28725850
EGRESOS										
MANO OBRA	4412777	2046920	1445400	1620600	1620600	1620600	1620600	1620600	1620600	1620600
MATERIALES	3783475	1005000	1010000	1190000	1190000	1190000	1190000	1190000	1190000	1190000
SUB-TOTAL	8196252	3051920	2455400	2810600	2810600	2810600	2810600	2810600	2810600	2810600
IMPREVISTOS 10%	819625	305192	245540	281060	281060	281060	281060	281060	281060	281060
G. COSECHA	0	0	300000	400000	650000	900000	1000000	1150000	1150000	1150000
B. PROCESO	0	0	79380	105840	171990	238140	264600	304290	304290	304290
COSTOS DIR. PROD	9015877	3357112	3080320	3597500	3913650	4229800	4356260	4545950	4545950	4545950
INDIRECTOS	902880	902880	902880	902880	902880	902880	902880	902880	902880	902880
INVERSIONES	783640	1639320	404320	1083640						
DRENAJES	410000									
DEPRECIACION			319684	319684	319684	319684	319684	319684	319684	217500
TOTAL EGRESOS	11112397	5899312	4707204	5903704	5136214	5452364	5578824	5768514	5768514	5666330
UT. ANTES IMP.	-11112397	-5899312	-582804	-76904	5282636	10447936	13843176	18787436	21209336	23059520
I.S.R. (25%)	0	0	0	0	1320659	2611984	3460794	4696859	5302334	5764880
UTIL. NETAS	-11112397	-5899312	-582804	-76904	3961977	7835952	10382382	14090577	15907002	17294640
DEPRECIACION	0	0	319684	319684	319684	319684	319684	319684	319684	217500
FLUJO FONDOS	-11112397	-5899312	-263120	242780	4281661	8155636	10702066	14410261	16226686	17512140
F F ACUM	-11112397	-17011709	-17274829	-17032049	-12750388	-4594752	6107314	20517575	36744261	54256401

T.I.R. : 24

V.A.N. : 1654480

CUADRO No. 2

MODELO DE CORTO PLAZO.

PLATANO-CACAO-PORO

AÑO:	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
INGRESOS										
CACAO	0	0	4124400	5826800	10418850	15900300	19422000	24555950	26977850	28725850
PLATANO	12782250	12782250	10091250							
TOTAL INGRESOS	12782250	12782250	14215650	5826800	10418850	15900300	19422000	24555950	26977850	28725850
EGRESOS										
CACAO :										
COSTOS DIR.PRO	9015877	3357112	4080320	3597500	3913650	4229800	4356260	4545950	4545950	4545950
COSTOS INDIREC	902880	902880	902880	902880	902880	902880	902880	902880	902880	902880
INVERSIONES	783640	1639320	404320	1083640	0	0	0	0	0	0
DEPRECIACIONES			319684	319684	319684	319684	319684	319684	319684	217500
TOTAL EGR.CACA	10702397	5899312	5707204	5903704	5136214	5452364	5578824	5768514	5768514	5666330
PLATANO :										
COSTO SIEMBRA	3192500									
COSTO PRODUC.	5728320	5214400	4059040							
COSTO EMPAQUE	3022205	3022205	2385951							
TOTAL EGR.PLAT	11943025	8236605	6444991							
EGRESOS TOTALE	22645422	14135917	11152195	5903704	5136214	5452364	5578824	5768514	5768514	5666330
UT.ANTES IMP	-9863172	-1353667	3063455	-76904	5282636	10447936	13843176	18787436	21209336	23059520
I.S.R.(25%)	0	0	765864	-19226	1320659	2611984	3460794	4696859	5302334	5764880
UTIL.NETAS	-9863172	-1353667	2297591	-57678	3961977	7835952	10382382	14090577	15907002	17294640
DEPRECIACION	0	0	319684	319684	319684	319684	319684	319684	319684	217500
FLUJO FONDOS	-9863172	-1353667	2617275	262006	4281661	8155636	10702066	14410261	16226686	17512140
FL. F. ACUM	-9863172	-11216838	-8599563	-8337557	-4055896	4099740	14801806	29212067	45438753	62950893

T.I.R. : 35

V.A.N. : 8248921

MODELO DE LARGO PLAZO
ASOCIACION DE CULTIVOS
COCO-PELIPITA-CACAO

CUADRO No. 3

AÑO:	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996
INGRESOS										
CACAO	0	0	4124400	5826800	10418850	15900300	15900300	15900300	15900300	15900300
COCO	0	0	0	1265940	3881768	8288280	11129040	12862395	14126288	15133950
TOTAL INGRESOS	0	0	4124400	7092740	14300618	24188580	27029340	28762695	30026588	31034250
EGRESOS										
CACAO :										
COSTOS DIR.PROD	8975377	3316612	3039820	3557000	3873150	4189300	4315760	4505450	4505450	4505450
COSTOS INDIREC.	902880	902880	902880	902880	902880	902880	902880	902880	902880	902880
INVERSIONES	783640	1639320	404320	1083640						
DEPRECIACIONES			319684	319684	319684	319684	319684	319684	319684	217500
TOTAL EGR.CACAO	10661897	5858812	4666704	5863204	5095714	5411864	5538324	5728014	5728014	5625830
COCO :										
COSTOS PRODUC.	850400	502691	502691	702493	834118	1035943	1141243	1185118	1202668	1202668
TOTAL EGR.COCO	850400	502691	502691	702493	834118	1035943	1141243	1185118	1202668	1202668
P.PELIPITA :										
SIEMBRA (M.O)	83100									
SIEMBRA (MAT)	277000									
TOTAL EGR.PELIP	360100									
EGRESOS TOTALES	11872397	6361503	5169395	6565697	5929832	6447807	6679567	6913132	6930682	6828498
UT.ANTES IMP	-11872397	-6361503	-1044995	527043	8370785	17740773	20349773	21849563	23095905	24205752
I.S.R (25%)	0	0	0	131761	2092696	4435193	5087443	5462391	5773976	6051438
UTIL. NETAS	-11872397	-6361503	-1044995	395282	6278089	13305580	15262330	16387172	17321929	18154314
DEPRECIACION	0	0	319684	319684	319684	319684	319684	319684	319684	217500
FLUJO FONDOS	-11872397	-6361503	-725311	714966	6597773	13625264	15582014	16706856	17641613	18371814
FL.F. ACUM.	-11872397	-18233900	-18959212	-18244246	-11646473	1978791	17560805	34267661	51909274	70281088

CUADRO No. 4

ANALISIS FINANCIERO CULTIVO DE PLATANO.

AÑO	1987	1988	1989
No. Has. :	100	100	100
PRECIO/CAJA:($)	293	293	293
RENDTO.(CAJAS)	380	380	300
TOTAL CAJAS	38000	38000	30000
TIPO CAMBIO:	58.5		
INGRESOS			
VENTA	11115000	11113000	8775000
CAT(15%)	1667250	1667250	1316250
TOTAL INGRESOS	12782250	12782250	10091250
EGRESOS SIEMBRA			
MANO OBRA	957500		
MATERIALES	2235000		
SUB-TOTAL	3192500	0	0
EGRESOS PROD.			
MANO OBRA	2046920	1533000	1010320
MATERIALES	3681400	3681400	3048720
SUB TOT.PROD.	5728320	5214400	4059040
EGRESOS EMPAQUE	3022205	3022205	2385951
EGRESOS TOTALES	11943025	8236605	6444991
FLUJO FONDOS	839225	4545645	3646259

ANALISIS FINANCIERO CULTIVO DE COCO.

AÑO	1987	1988	1989	1990	1991	1992	1993	1994	1995
No. Has. :	100	100	100	100	100	100	100	100	100
PRECIO/T.M:				31649	33755	36036	38376	40833	43466
RENDTO.T.M/HA.:				0.400	1.150	2.300	2.900	3.150	3.250
TOTAL T.M COPRA				40	115	230	290	315	325
TIPO CAMBIO:	58.5								
INGRESOS				1265940	3881768	8288280	11129040	12362395	14126288
EGRESOS									
MANO OBRA	352800	329551	329551	388973	388973	388973	388973	388973	388973
MATERIALES	497600	173140	173140	243320	243320	243320	243320	243320	243320
RECOL/SECADO				70200	201825	403650	508950	552825	570375
TOTAL EGRESOS	850400	502691	502691	702493	834118	1035943	1141243	1 85118	1202668
FLUJO FONDOS	-850400	-502691	-502691	563447	3047649	7252337	9987797	11577277	12923619

"CUADRO DE FLUJO DE FONDOS COMPARATIVO"

AROS:	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996

ODELO TRADICIONAL

NALISIS DE SIEMBRA DE CACAO

lujo de Fondos	-11112397	-5899312	-263120	242780	4281661	8155636	10702066	14410261	16226686	17512140
I. F. Acum.	-11112397	-17011709	-17011709	-17032049	-12750388	-4594752	6107314	20517575	36744261	54256401
.I.R.:	24									
.A.N.:	1654480									

ODELO DE CORTO PLAZO

LATANO-CACAO-PORO

lujo de Fondos	-9863172	-1353667	2617275	262006	4281661	8155636	10702066	14410261	16226686	17512140
I. F. Acum.	-9863172	-11216838	-8599563	-8337557	-4055896	4099740	14801806	29212067	45438753	62950893
.I.R.:	35									
.A.N.	8248921									

DELO DE LARGO PLAZO

SOCIACION DE CULTIVOS COCO-PELIPITA-CACAO

ujo de Fondos	-11872397	-6361503	-725311	714966	6597773	13625264	15582014	16706856	17641613	18371814
. F. Acum.	-11872397	-18233900	-18959212	-18959212	-11646473	1978791	17560805	34267661	51909274	70281088
I.R.:	29									
.N.:	6295365									

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PANEL II

PRODUCTIVITY FACTORS

B. CROPPING SYSTEMS AND CULTIVATION PRACTICES:

SELECTION AND USE OF BOTH TRADITIONAL AND INTENSIVE PLANTING SYSTEM IN THE DEVELOPMENT OF A NEW COCOA INDUSTRY IN HAWAII

(Original document: English)

Jim Walsh

Summary

Comparatively high labor costs and taxes, limited land availability, agricultural uncertainties, and other problems are given as reasons not to develop a cocoa industry in Hawaii.

Several unexpected successes in cropping systems and farmer programs combined with a changing society have created a window of opportunity. By viewing the industry from demand terms, Hawaii Cocoa was formed to grow cocoa as a means of providing a source of supply for its ultimate product - chocolate products. Various cropping systems are being tested on a large scale basis with an eye toward providing a dependable source of independent supply.

The choice of Hawaii asa new site for cocoa growing appears initially to be misguided. In addition to the questions whether the crop can grow in Hawaii's climate, soil, and wind conditions, there is the overriding question of how it can be economical with such high labor rates. Hawaii thrives as part and parcel of the U.S. service economy. It has high labor rates, substantial worker's benefits, and adversarial labor unions. It also has predatory workman's compensation and unemployment taxes as well as discouraging taxes on profits. Eighty percent of usable land is controlled by five major sugar growers --all with real estate development ambitions. Due to these conditions and a small population base, there exists little or no domestic capital for agriculture expansion.

Innovation does not have to be technological but it does not need to change the yield of resources and it should be defined in demand terms rather than in supply terms. The marriage of Hawaii and cocoa illustrates the value of such innovation. We have searched for changes and determined what opportunities these changes provided for social and economic innovation.

Many old farms have trees too tall to be managed. In many instances climbing of trees has to be done at harvest. This is a bad practice because this destroys the flower cushions on the productive area of the tree. Also, if an attempt is made to control disease with fungicides, it is difficult to spray the tops of the trees. Harvester performance of these tall trees is very low: his neck begins to ache, and this will slow him down. Many of the good farm practices cannot be performed on the old trees. In theory it should be a simple matter to encourage farmers to practice good husbandry, but the majority of the world's cocoa farmers are small-holders, who need a considerable amount of guidance and assistance for this to be achieved. They need a viable well-informed and well-equipped extension service. They must have readily available inputs and an effective marketing system for their produce. Any program to encourage good husbandry must tackle all these aspects at the same time in order to achieve success, and all too often one or more of these essentials is missing.

Rehabilitation of old farms will bring the trees to a manageable size and to a plant population which will show the farmers that there is profit in cocoa.

Intercropping

The name of the game is dollars per acre. Farming is a big business, and the way to success is to maximize the income per acre. According to Wood & Lass, the practice of interplanting mature coconuts with cocoa is attractive because the cost of establishing cocoa under coconut is low, the income per acre is substantially increased, and the cost of maintaining the coconut area is reduced (p.139). Farmers need to look carefully at the location and marketing of economic trees adapted to cocoa shading. (1) "There is, therefore, a considerable variety of trees and palms used as windbreaks; it is also reflected by the value of any crop it might produce."

The value of land is climbing, and the net income from farms has to reflect this. Because of this uncontrollable rise in land value, the farmers need to find all the means necessary to expand output per acre. Intercropping should be studied carefully to give the farmer a higher standard of living. This will be the extra income which the farmers look forward to getting. Intercropping is of major importance in areas where land is limited and expensive. Intercropping needs more study.

Cocoa farming as a viable money earning activity for the farmer is a reality. Cocoa adapts itself to many companion short term-crops like plantain in the early establishment of new orchards. Plantain trees have to be pruned and treated with fertilizer, insecticides, and fungicides. The companion crop is part of the cocoa farm and the same emphasis should be placed in growing this short-term shade tree. One big problem is removal of temporary shade when it has served its purpose. To continue maintaining it for a few pennies more of income after cocoa trees are in production will be a fallacy. Over-shading will encourage Black Pod in the cocoa farm. Also, Pigeon Pea fits this togetherness in establishing a young cocoa farm. There are many other short term crops that can make early money for the farmer.

Management is the key to all good cocoa farming which includes the cocoa and temporary shade. We need to know the agronomic requirements of the temporary trees and the life span of these trees. However, this is the early stage of the young cocoa tree.

One must also look at the life of the cocoa farm and the types of permanent shade trees that are to be grown with the cocoa trees. Small farmers at Ringtail Village in Belize, Central America are using Custard Apple, Sour Sop and Golden Plum as permanent shade. There is great demand for these fruits on the local market. These trees should be managed by the farmer from early stages of growth. Any type of shade tree in a cocoa farm, whether on big or small holdings, should be taken care of as part of the cocoa farm. This means pruning, fertilizing, insect control and fungicide control as necessary.

With good planning and management, income per acre of cocoa land can match any other orchard crop. This will require help from an efficient and well-trained extension service. The cocoa farmer wants money in his pocket at the end of the season. This desire will give him the drive to keep his farm at a very high standard.

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PANEL VI

AUGUMENTING COCOA PRODUCTION: INTERCROPS, BY-PRODUCTS

INCREASED REVENUE FOR THE COCOA GROWER THROUGH THE USE OF BY-PRODUCTS

(Original document: English)

Glenn A. Trout

Summary

The idea of recovering additional value from the fruit of the cocoa tree by making use of the by-products has been considered for at least a century. Most of the early research centered on the shells, which are removed after the roasting of the cocoa bean. This cocoa shell has been evaluated as a fuel, as a horticultural mulch, and as an animal feed; it has had only limited use for these purposes.

Additional studies have demonstrated the successful production of jelly and alcohol from the juice produced in the early hours of fermentation of the wet beans. These products also have had limited use.

Using the fresh pod which remains after the wet seeds are removed has generally been limited to leaving it to decompose at the site where it was opened.

It is now recommended that it be used as a feed for pigs, poultry, dairy cows, steers, and other animals. It is further recommended that the valuable manure from such use be returned and used for the cocoa trees as plant nutrients and as a soil conditioner.

With the production of this year's world cocoa crop of nearly 2,000,000 metric tons of cocoa beans, there could be produced more than 3,000,000 metric tons of high quality animal feed in the form of cocoa pod meal. The cost of its production and harvesting has been paid. There is left only the additional cost of preparing it for use in the feed. It need only be fed in a well-balanced ration to make this process sucessful. It has been shown that cocoa pod meal can replace corn on a pound-for-pound basis. Done skillfully, this practice can add 10-20% additional income to the cocoa grower. It has an additional value in that it allows an equal amount of corn to be used as human food. All of these practices are being used successfully in most cocoa growing countries, so implementing these changes could proceed rapidly.

The theme of this forum is the suitability of using the production of cocoa beans as a means of earning a living. I think the five panels have done an excellent job in searching for the best ways to produce cocoa beans using the existing technology.

This panel is now addressing the possibility of increasing income through use of intercropping and by-products. The use of agricultural by-products has interested me for many years. The dominant use in the United States and Europe has been to use waste from the milling of cereal grains, the processing of fish and meat, and the residue from fermentation and distilling processes as ingredients in compounding animal feeds. Although there exists a great deal of knowledge to support the practices, that has not been the case for tropical crops, especially the cocoa bean.

Although research on cocoa by-products was conducted as early as 100 years ago, research activity during the early days was primarily for the use of cocoa shells. The shell supply was almost entirely in Europe and the United States. With good research facilities and extensive use of mixed feeds and concentrates, it was natural that the dry, easily stored cocoa shell was considered. However, poor digestibility and the presence of theobromine were limiting factors in its use. It is just in the past decade that the beneficial effects of theobromine at low levels has been studied. A United States patent was granted in 1978 to the author and associates on the use of theobromine in cocoa wastes (1, 2) as an appetizer for ruminants. Some feeders now prefer it to molasses and certainly it is simpler to blend. This same feeding trial adds to our knowledge of acceptable levels of theobromine in rations.

There is now a body of evidence showing other beneficial effects of including cocoa waste in animal feeds. An increase in butter fat in milk was noted in 1924. This has now been confirmed by Dr. Larry Chase, Cornell University (work still to be published). Eight commercial dairy farmers in Central Pennsylvania are successfully using this knowledge in adding cocoa shells to their rations. The improved production of butter fat is documented in their Dairy Herd Improvement (DHIA) results. It follows closely the increases reported by Cornell. This commercial use was started in late 1985 and results continue to look good. Most of the cocoa shells are still produced in non-growing countries. All of the cocoa pods remain in the producing country and thus can be used to increase the cocoa producers' income. An increasing amount of work directed at this goal has been conducted in the past decade.

Papers presented at the 9th International Cocoa Research Conference by Adomako (3) and Lopez (4) summarize this activity in Ghana and Brazil. The uses reported range from production of jelly and alcohol from the sweatings to using the potash in the ash for manufacturing soap. However, I think that the reports of the use of cocoa pods for feeding poultry and animals may be the most significant, as it provides a use for the major by-product. The next largest by-product, the shell of the cocoa bean, is less than 1/10 pod weight. The pod is generally abandoned on the farm where the seeds are removed for fermentation and drying. The pod contains over 80% moisture and rots quickly. If it is in the forest, it can supply food for the plants. If it is along the roadside, most of the nutrients will be in the water that runs off. Only a very small amount of the pods is used for any other purpose. Thus there is produced in the world each year three million metric tons (dry weight basis) of valuable animal feed that is largely wasted. Research work has shown that the pod is as valuable as corn when used in feeding poultry, pigs, and dairy cows (5, 6, 7). While corn is plentiful and relatively low cost in the United States, it is rather scarce and costly in many cocoa-growing nations. Additionally, corn is widely used as human food. Thus there is real opportunity in using cocoa pods as animal feed, increasing income from the crop, and sparing the supply of corn for use as human food.

The potential increase in revenue from using cocoa pod meal is the sum of the value when sold for feed manufacturing or used on the farm less the cost of drying it. The cocoa farmer produces 160 pounds (dry weight) cocoa pod meal with each hundred pounds of dry cocoa beans. The following table illustrates this relationship on three cocoa farms of 5, 15, and 50 acres:

Farm Size (Acres)	Cocoa Beans	Valued at $.60/lb.*	Cocoa pods	Valued at $.10/lb. *
5	3,000 lbs.	$1,800	4,800 lbs.	$ 480
15	9,000 lbs.	$5,400	14,400 lbs.	$ 1,440
50	30,000 lbs.	$18,000	48,000 lbs.	$ 4,800

This is based on YIELD of 600 lbs, cocoa beans/acre sold at $.60/lb., and cocoa pod meal at $.10/lb.

* All values are in U.S. dollars

The added revenue from sale of the cocoa pod meal is very significant (26.6%). The possibility of achieving these results is real. However, you may wish to take a more conservative view. Under any circumstance, it is well worth further development.

I think there is enough interest that some development work will be done as funding becomes available, probably done in the public and private sectors. In the past 18 months, several pig feeding trials were conducted in Belize using cocoa pod meal dried on fixed bed-dryers for 72 and 96 hours. Rations contained 15% cocoa pod meal and were quite satisfactory. We hope to be able to conduct more trials and have reports published to enable wide use.

Research that has been reported provides a satisfactory body of knowledge on which to develop commercial use. This second phase can be done cooperatively with existing feed manufacturing and animal growing groups, and there need not be a large capital requirement. The prospect of having an additional source of high quality, high energy feed ingredient for pig and poultry rations locally would interest most feed manufacturers.

This approach has been used satisfactorily in developing Cassava as a feed ingredient in Colombia. Since Colombia could produce over 60,000 metric tons of cocoa pod meal yearly, it is a likely candidate for such a strategy. Mexico and the Dominican Republic produce an equal quantity of cocoa beans as Colombia, while Ecuador has twice this amount and Brazil ten times this volume.

These five large cocoa bean producing countries produce over 90% of the total in the Western Hemisphere. I would recommend the same strategy in all five countries. However, the possibility of capitalizing on using cocoa pod meal in pig and poultry rations exists in any area where a supply can be produced and offered for sale on a continuing basis. Wherever poultry is grown for meat and eggs, there probably are one or more suppliers of feed who would consider buying cocoa pod meal. This certainly includes Jamaica with its well developed broiler industry and Belize with its production of eggs and broilers.

Conclusion

There has been an interest in using by-products of cocoa beans for 100 years. Most of this interest led to research work which adds, as its objective, the use of cocoa shells. Since cocoa shells were available at processing factories in Europe and North America, efforts were directed toward using cocoa shells for poultry and livestock feeds marketed in those countries. This program has had limited success. Limitations have been the low feeding value (especially for non-ruminants) and concern about the theobromine content of the cocoa bean shells. The relatively small supply of shells discouraged support for additional research, which could have revealed a higher value for animal feeding.

In recent years research has revealed more fully the beneficial effects of theobromine (especially as an appetizer), whether supplied from feeding a natural product (cocoa shells or cocoa pods) or in more concentrated form after extracting it from the cocoa shells (1, 2).

The largest by-product of the cocoa bean crop is the pod (husk). Since there is a scarcity of good animal feed in many cocoa growing countries, there has been increased interest in learning the value of pods and developing the best way to use them. Published reports now provide a basis for proceeding with developing the use of cocoa pods as a feed ingredient in rations of pigs, poultry, and dairy cows. Pods can also be used fresh by steers, dairy cows, sheep, goats, and other animals.

It is recommended that further development work, including commercial feeding, be done to optimize the economic return from this under-utilized material.

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PANEL VII

RESEARCH RESULTS, TRANSFER OF TECHNOLOGY
(Original document: English)

Dr. Gustavo Enríquez of CATIE reported that the life cycle and other biological aspects of Monilia are better understood than they were a few years ago. Hopefully the disease organism will soon be identified as either a new genus or one that causes other diseases, and more effective control measures will be developed.

Research also is being aimed at other means of reducing disease control costs for small farmers. Fifteen cultivars have shown some resistance to Monilia and it is hoped that highly resistant hybrids can be developed from these. Chemical control of Monilia is not economical for small farmers at this time. Research is in progress on biological control aimed at preventing or inhibiting development and dissemination of Monilia spores.

Many countries have problems in transfering cocoa technology to farmers because the latter are pod collectors rather than bean producers. New technology must transform them into producers.

Jesus Sánchez, FHIA/Honduras Cocoa Advisor, presented the opinion that efforts to transfer research results through extension to the farmer, combined with essential feed-back communication, have been generally ineffective, and believes both research and extension are at fault. Scientists and extensionists must interact more with each other and with the farmer. They must go out to the fields and see what the real problems are before they can produce and transfer results that respond to the farmers' problems.

Dr. L.H. Purdy, International Witches' Broom Project, presented a model developed for a survey to collect data and design control measures for Witches' Broom. At sites in Brazil, Colombia, Ecuador, Trinidad, Venezuela, and possibly soon Grenada, data is being collected including temperature, relative humidity, leaf wetness, rainfall, basidiospore production count, and places where infection can occur due to favorable conditions and in relation to total infections' level and type of infections (whether they are vegetative brooms, cushion brooms or are infecting pods).

Tests with chemical control have shown Bordeaux mixture to be the most effective when applied to growing brooms, diseased pods, dry brooms and soil. A demonstration on plant health control (pruning) will be given at the international cocoa meetings program in the Dominican Republic in May, 1987.

Local personnel are being trained in data analysis and how to utilize it. After two years the data will be transmitted to a central point for evaluation.

This control model is unique in that local researchers or technicians are implementing it in coordination with the Witches' Broom Control Project Committee. Results of the project will be published in English and Spanish. This model appears to be appropriate for similar control investigation programs in black pod rot and Monilia.

Dr. Paul Fritz, Pennsylvania State University, spoke on the use of DNA studies in plant breeding, isolating DNA from various sources and identifying their differences, and identifying and cataloguing cocoa genes.

In response to questions, Dr. Purdy said: (a) eventually farmers should check those sites where Witches' Broom disease does not develop to determine the environmental factors which favor or inhibit the disease; (b) there is more than one race or strain of the Witches' Broom fungus (two are now known) but the project is doing no work specifically on races of the fungus or on Witches' Broom - resistant cocoa germplasm; (c) there is work on this subject being conducted in other programs; (d) Bordeaux mixture is being used in spray programs, rather than some of the never compounds, because Bordeaux has proven to be more effective.

Oleen Hess, Rapporteur

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PANEL VII

RESEARCH RESULTS, AND TRANSFER OF TECHNOLOGY

PATHOLOGICAL PROBLEMS OF COCOA
(Original document: Spanish)

G. A. Enriquez

There is no doubt that one of the important factors limiting cocoa production is the impact of diseases worldwide. In general, it is estimated that each year from 10 to 25% of production is lost in most countries.

Black Pod Disease

Perhaps the most destructive disease is Black Pod, caused by the fungus Phytophthora spp. This disease is present in all producing countries.

Several species of Phytophthora have been found to cause Black Pod disease of cocoa in different parts of the world. The most commonly destructive species has been found to be P. megakarya, identified and described in Cameroun and some other West Africa countries. The specie P. megasperma has been described in Venezuela but it has not been found on cocoa in other places. Three species, P.citrophthora, P.capsici and P.palmivora have been found in Brazil, of which the last, P.palmivora, has also been found to cause Black Pod in most countries in South America, Central America and the Caribbean.

Research centers in America have worked for several years to develop effective methods for control of the diseases, and to develop low-cost methods to be used by all types of farmers, small or big.

One of the most economical methods of control which has been developed, and perhaps the most important, is incorporation of disease resistance into the hybrids or clones which the farmer uses for planting. In most of the crosses many of the resultant hybrid seedling plants show a high-to-moderate level of resistance which allows the farmer to more easily practice integrated control using pruning for sanitation, light control, drainage, and in some cases use fungicidal sprays which help to protect the cocoa pods during critical periods of greatest susceptibility.

Studies have allowed us to understand the genetic system and the gene composition of some cultivars, resulting in better planning of the new hybrids now being tried in the field. Those new hybrids carry several types of resistance to more than two organisms, through proper combination of genes. In 1985, CATIE distributed seeds of P. palmivora and otherhybrids to some nearby countries with the purpose of testing the adaptability of some of these crosses, including resistance factors against up to three diseases.

Besides genetic resistance, some hybrids have been developed some hybrids which have their main production periods more spread out, occurring at different times from those of the area's normal cropping period. This allows many pods to escape the disease because spores of the causal fungus pathogen are less abundant in the off-peak period.

CATIE has at least 15 cultivars with high resistance and at least two which escape disease by concentrating production in periods of the year different from normal peak harvest. We know how resistance factors are passed to progeny for 53% of this material, 30% is now being tested in the field, and we still have to work with the remaining 17%.

Besides these genetic investigations, research is in progress lower the cost of chemicals used in disease control. New agrochemicals just appearing on the market also are being tested. At present, a package of operations for integrated control of this disease is producing excellent results.

Witches Broom

The second disease of importance in tropical America is Witches' Broom, caused by the fungus Crinipellis perniciosa, present in most of the countries of South America, part of Panamá (east of the Canal) and some the Caribbean Islands. It is assumed that the disease is endemic in High Amazon regions.

The organism attacks most of the plant organs, in many cases destroying them or affecting them to such an extent that they die or are no longer useful from the economic point of view. Abundant rainfall after a dry season induces production of spore-producing structures of the fungus on previously killed plant tissue. Some five weeks later fungus spores infect the newly expanding vegetative buds and the developing small new fruit tissues. Infections are not limited to the early part of the rainy season, but also occur abundantly in other seasons and throughout the year. A highly susceptible tree may be totally destroyed.

Only very limited sources of resistance to the C.perniciosa have ever been found. One very good source, the Scavina selections, was found by Dr. Pound in Amazonia, but in Ecuador these were found in 1960 to be no longer resistant -- a new train of fungus apparently accounted for this. In some cocoa zones, however, Scavina selections still are being used as resistant parents in breeding programs. The Scavinas have high combining ability, but produce seeds that are smaller than commercially desirable. Therefore, careful selection of parents for crossing with Scavinas is necessary with a view to overcoming small seededness in the progeny.

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Other sources of disease resistance in the hemisphere have been little exploited. Mostly, there has been only local selection work -- selections that give excellent results locally but not widely distributed like those mentioned above. A program is needed to bring together these materials, and through crossings (doubles, triples, etc.) to concentrate genes for resistance in hybrids with good yield which then can be distributed to growers as part of a technology package for integral disease control.

Control of this disease with chemicals has not been effective, not so much because the chemical is not working, but because of difficulty in protecting every growing point of the plant during most of the year. Presently, chemicals are being used as part of an integrated control program where the most important components of the package are genetic resistance and timely sanitary pruning, suited to the local climate.

Mal de Machete

Another disease which quite often appears in catastrophic form is the so called "Mal de Machete" or "Llaga Macana", caused by the fungus Ceratocystis fimbriata. This disease is found throughout some countries of Central and South America. The disease appears in epidemic form for certain periods in regions where it is present, giving the impression that, when it attacks, it destroys all the most susceptible population. Later the outbreak subsides to a minimum for a more or less long period. This has been consistently observed in several zones of Central America.

In Ecuador, its impact in the Clementina Farm was discussed in another part of this Forum. In other places, it has had catastrophic economic consequences for the affected areas.

In the last few years, it has seemed in Costa Rica that the organism may have rapidly changed, because research results obtained 15-20 years ago cannot be repeated, plant materials which earlier showed great resistance are not the same today, and it is not possible to reproduce such results with the present strains of the pathogen. However, from the point of view of the population of tested materials, one can observe that there are great differences in susceptibility even if this does not concur absolutely with past observations.

CATIE is continuing work with the most promising clonal materials, testing them in crossings and evaluating them in the field with a view to including them with hybrids destined for the farmers.

It is necessary either to study the disease-inducing organism and its natural evolution or to study it through artificial methods. At present, no Center that I know is carrying out such work with this organism, which we all know is potentially one of the most destructive pathogens of cocoa.

Controlling the disease by chemical means has been practically useless, because the plant dies soon after the first symptoms are noticed. Most farmers only notice the problem when the plant is already almost dead and is showing the typical symptoms. By this time it already has become a source of contamination for other plants.

The best way to prevent the disease is through care in the managing of tools and care in protecting any wounds inflicted on the tree during pruning, harvest or weeding through proper disinfection of the tools.

The role played in this disease by insects of the genus Xyleborus is not yet fully clear. Presence of Xyleborus in infected or dying plants is very common. The quantities of insect frass found in diseased trees is large and seems to be related more to dissemination of the organism itself and not to the direct inoculation and penetration of the tree. More studies on these points are needed. Better understanding would help with disease control.

Moniliasis

Another disease which has seriously ravaged both South and Central American cocoa is Moniliasis, caused by the fungus Moniliophthora roreri (formerly Monilia roreri). When it appears in a new place, it always has a strong economic impact, because the farmers, unprepared for this disease, often abandon the plantation, thinking that it is not possible for it to be salvaged. This happened at the beginning of the century in Ecuador, during the 1980s in Costa Rica, and in western Panama where, sometime after the disease was discovered, production was reduced approximately to one-fifth.

When Moniliasis reached Costa Rica, very little was known about the genetic resistance of the varieties. Most information came from Ecuador, where it had been found of lesser incidence among some cultivars as compared with others much more susceptible, but this fact was not properly used.

CATIE, in collaboration with the University of Costa Rica, developed a methodology which has been improved year by year, that has enabled us to detect twelve cultivars with promise of resistance or reduced susceptibility. Thes were quickly used to make crossings among the twelve and with other cultivars of known combining ability. Some of these materials were distributed in some countries of the area, as mentioned earlier.

CATIE continues research on chemicals to provide economical protection of cocoa pods, the only organs attacked. However, till now nothing has been found that will give economic protection or that can be integrated into the cultural system to give efficient control of this disease.

CATIE is working on biological control of the organism. Three types of bacteria have been identified which protect the pods by inhibiting germination of the fungus spores on the pod surface. This method, which would also be cheaper or would improve the integrated control of the disease, is on the way to being perfected to make it available to the farmer. However, it must be made clear that, even though preliminary tests are spectacular, it is necessary to carry out more research before passing on this technology to the farmer.

Once we have gone through several tests and extensive experiments, we will make available all the pertinent information to other institutions or research centers.

Another matter being investigated by the University of Costa Rica and CATIE is the possible utilization of certain substances or metabolites extracted from diseased pods, so as to reproduce symptoms in an artificial way. This would create, as an advantage, the possibilities of resistance studies with cocoa populations in places where the disease has not yet appeared, and of carrying out early improvement work without risk of spreading the disease.

Finally, I wish to present some comments on the work, which is presently being initiated in the little known parts of the life cycle of the organism. These studies, well advanced, will allow us to correctly locate the organism within its proper taxonomic position among the fungi, and perhaps also to have at hand more tools to look for better ways of controlling the disease caused by the organism.

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Panel VII

BIOLOGICAL EXPERIENCE IN TRANSFER OF TECHNOLOGY ON MONILIASIS
(Original document: Spanish)

Jesús A. Sánchez

I shall refer very briefly to some questions related to biology: Research - Results - Transference. I will mention here some experience in the process of transferring technological practices to the farmer, specifically related to the handling of Moniliasis in cocoa plantations in Colombia.

We all know that research and extension go hand in hand, and that one depends on feedback and support from the other. So when one fails the other is left orphaned, and the result cannot be what was hoped for.

We see nowadays the need for more and more research, since research is a dynamic process which is retro-fed, or gets its feedback from the results, experiences or needs of extensionists. But it is proper to ask: have results of cocoa research over the last 10 or 20 years really reached the extensionist? Has the extensionist digested and adapted them and passed them on to the cocoa grower?

I believe that for many the answer is no, and for others it is only partially affirmative; reasons are many. We know the limitations of the extensionist when carrying his message, which are even more severe when getting the users to understand it and adopt it as a component of the technological package which the grower has already partially applied to his farm.

We accept all these limitations or "bottlenecks" as they are known, but it is proper to raise two or three questions.

First: What is the blame of the researcher in the interruption of the process: research - results - transference? Much data and reports remain on office bookcases due to laziness or negligence, even if there are also many other reasons. And here, the technical assistant must be included. He is the one who harvests a great deal of field experiences, and if these experiences were widely known it would save much work or years of research.

But, what happened? Agronomists are lazy about writing, although not always poor writers. We think about this and many of us will have to reply, "mea culpa".

The second question: Do we speak down to the farmer when we bring our message? If we wish to take him the message and make him adopt it, and be converted into our ally and collaborator, we must change the pen for the machete, the shoes for swamp boots, the title of engineer or doctor for that of friend, mister so-and-so, etc., with a last name of sweat, fatigue, sacrifice.

The pruning of a tree with the help of a slide, or with chalk on the blackboard, is very different from that done with the machete or the saw, accompanied by 6001 mosquitos under the sun or rain.

This is where the divorce between the farmer and the technical assistant often originates.

It is not possible to carry a clear and convincing message if we do not know how to use the machete, if we are gladdened by the noise of the motorpump and the smell of a pesticide. When mosquito repellent is the tool that is first shown in front of the farmer and then is accompanied by a presentation where we will state a list of things that he already knows by heart our effectiveness will be slight.

To succeed in this work of transference it is necessary to be more like laborers and less like engineers.

I wish to tell you about one experience. When selecting a farmer to establish a demonstration farm to show the good results of the practice of cutting the crops sick with Moniliasis and leaving them on the soil, I found that this person was a non-believer of this control system, saying that the disease was brought by the weather (mainly referring to the rainfall) and with time it would go away. However, he agreed to the use of his farm and to collaborate unconditionally in a weekly revision of the plantation by cutting the diseased fruits.

During the first month, when carrying out this practice was most costly, we had to do it at our own cost and risk. The farmer then started to accompany us in the field more out of curiosity or sorrow than for communication. Starting with the second month, when he began to see the results, when we arrived at the farm, we found that he had already carried out the work and our role was limited to supervision of the work to make sure that the practice had been well executed.

The next year, when a field day was carried out on that farm, we only had to bring up the subject, and that same farmer carried it out. He ended up being one of the most convinced defenders of the practice.

It is worth pointing out that that farm moved from 250 kg/ha to 904 kg/ha, with only the introduction of this complementary practice to what was usually done by the farmer.

The other question or commentary--the lack of uniform plans and advice. Have many of us thought of the harm to the farmer and to our own efforts at transference when we enter into conflict with our colleagues, many times in front of the producer himself? Would it not be more fruitful to reach a consensus beforehand, and then go to the farm with unified criteria?

Another anecdote also involves Moniliasis. A colleague who was convinced of the abovementioned results about the efficiency of the practice of removing diseased fruits, recommended to several farmers in his area of influence to do the same. When his superiors got word of this, because of copies of the records on the farm, they told him in writing that the practice should not yet be recommended. Since enough time had already elapsed so that the results could be seen by the farmers themselves, and they were already convinced of the practice, the colleague had to respond: I am sorry, but many of them are already convinced and they are disseminating it to others, and they are not going to accept another order or recommendation.

I am telling this to raise some anxieties about how many times the producer is convinced before some of the technicians are. For that reason, we may end up reciting only what the grower himself already knows.

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PANEL VII

RESEARCH RESULTS, TRANSFER OF TECHNOLOGY

THE INTERNATIONAL WITCHES' BROOM PROJECT, A MODEL FOR PROGRESS THROUGH COOPERATION

(Original document: English)

Lawrence H. Purdy

Summary

The International Witches' Broom Project (IWBP) funded by the International Office of Cocoa, Chocolate, and Confectionery Sugar (IOCCC) is a unique example of international cooperation among scientists with a common interest. The main objective of the IWBP is to develop improved management practices to reduce economic losses from witches' broom of cocoa, a disease that is caused by the fungus *Crinipellis perniciosa*.* The structure of the IWBP is described, as are some of the data collected at the 11 sites in five countries where the project activity is established. Objectives of the IWBP include a comparative epidemiological analysis of the disease, evaluation of chemicals that might be effective against witches' broom, evaluation of phytosanitary practices, and disease gradient experiments. It is suggested that the IWBP might be a model for future projects that are concerned with problems of cocoa that go beyond the borders of several countries, such as Moniliophthora Pod Rot caused by the fungus *Moniliophthora roreri*, *(Ciferri) Evans*.

Introduction

Witches' broom of *Theobroma cacao L.*, caused by the fungus *Crinipellis perniciosa*, occurs in the Amazonas region of Brazil (but not in Bahia or elsewhere in Brazil), Bolivia, Colombia, Ecuador, Grenada, Guyana, Peru, Surinam, Trinidad, Venezuela, and has recently been reported as being present in Panama and Saint Vincent. This destructive disease can reduce productivity to zero under certain conditions, and some plantings of cocoa have been abandoned because of witches' broom. The devastation resulting from witches' broom prompted the International Office of Cocoa, Chocolate, and Confectionery Sugar (IOCCC) to declare witches' broom a primary research objective for cocoa. In 1981 I organized a small group of interested scientists to begin the development of an international effort to learn more about witches' broom and how to manage it more effectively. Initially, Drs. Paulo Alvim (Brazil), Carmen Suárez (Ecuador), Bryan Wheeler (England) and I exchanged ideas as to what was needed and how we might organize a project. At the 8th International Cocoa Research Conference in Cartagena, Colombia, Dr. Pablo Buritica (Colombia) and Mrs. Cheryl Gonsalves (Trinidad) were asked to join our efforts. The project became better organized and by 1984 a draft was prepared fcr submission to IOCCC. In 1985 IOCCC acted favorably by funding the project in the amount of $700,000 for a 5-year period, and thus the International Witches' Broom Project (the IWBP) was established.

* The name of this organism should be given as Crinipellis perniciosa (Stahel), Singer at this place. Thereafter in the text it can be given as Crinipellis perniciosa.

Comparative Epidemiology

A primary objective of the IWBP is a comparative epidemiological study of witches' broom. Data are analyzed locally and used in whatever way the individual scientists at each location wish. Also, a data set is sent to Dr. Stephen A. Rudgart, the IWBP Liaison Officer located in London, England, for computer storage, analysis by site, and for the comparative epidemiological analysis that includes data from all sites.

The (IWBP) is now established at 11 sites - four in Brazil, three in Colombia, two in Ecuador, one in Trinidad, and one in Venezuela. At nine of these sites four groups of data are collected: (1) certain weather parameters (temperature, relative humidity, rainfall, and leaf wetness); (2) incculum production by the fungus in old dead brooms and other diseased plant parts; (3) the number of infection courts (locations on the tree where infection can take place); and (4) the amount of infection that occurs (vegetative brooms, the number of infected pods, the number of cushion brooms) by methods agreed to by participants. There are two check sites, one in Bahia, Brazil and the other in Santander, Colombia, where witches' broom does not occur. Data similar to that collected at the nine witches's broom sites will be collected at the check sites, except data about the witches' broom disease itself.

Chemical Evaluation

Evaluation of chemicals for their efficacy against witches' broom is an additional objective of the IWBP. Fungicidal chemicals that are registered for use on cocoa or other crops will be evaluated under "controlled conditions" and in the field. A close relationship has been established with several European fungicide producers to begin development of chemicals with some specificity against basidiomycete fungi, the class of fungi to which Crinipellis perniciosa belongs. Chemical evaluation will take place at several IWBP sites. Targets for applications of chemicals include flushing vegetative growth, developing green vegetative and cushion brooms, dry detached brooms, and pods at varied stages of development. Bordeaux mixture will be the fungicide standard for control of the disease. Evaluation will be conducted for a minimum of two years.

Phytosanitation

Two years of data from each site is needed for the comparative epidemiological analysis, and after this period the experimental objectives

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will focus on phytosanitary experiments to define more precisely the effect of the removal of brooms and diseased pods on disease incidence. The "pruning" of the diseased plant parts is a way to reduce the amount of inoculum and manage disease effectively. Pruning is practiced by growers in the Tomé Acu area of Pará, south of Belem, Brazil and in the Uruba region of Colombia. However, where disease pressure is high, such as in the area around Quevedo, Ecuador, pruning or broom removal has not reduced disease incidence. For these reasons, comparisons of phytosanitary practices will become part of the IWBP with the hope that in areas where pruning is demonstrated to be effective against the disease, removal of diseased plant parts will become a useful management practice.

Disease Gradient

Attention is also directed at disease gradient studies to establish the distance inoculum can travel and still cause disease. A disease gradient study is in place at the INIAP - Estación Experimental Tropical "Pichilingue", near Quevedo, Ecuador. Other similar disease gradient experiments may be established at other IWBP locations.

Scientific Progress

One complete year of data collection from all sites should be available for analysis by July 1987 and for discussion in September 1987 at the next meeting of the scientists involved in Belem, Brazil. It is expected that the comparative epidemiological analysis of data from almost all sites will be completed for Year 1. Improvements in management to reduce the losses caused by witches' broom will be proposed if justified. Decisions will be made regarding protocols for phytosanitary experiments and locations where they will be established.

Discussion

There have been other projects similar to the IWBP (the Black Pod Project and the Capsid Project) both were located in West Africa. What is different in the IWBP structure compared with these two Projects? There are several differences, but perhaps the most important are the varied locations in five different countries, and the individuals who are doing the work in the field, namely local scientists. Also, for each country there is a coordinator who has responsibility for all sites within the country, and the data collected can be used for local purposes. The obligation to IOCCC is that a data set must be sent each year to the Project Liaison Officer for inclusion in the comparative analysis.

The structure of the IWBP was developed to gain the most from the funds allocated by IOCCC, along with the obligation to provide the IOCCC with an accounting of the utilization of the funds and an assessment of the scientific progress. The first of these responsibilities is carried out by the Project Management Committee (PMC) that is chaired by Mr. R.A. Lass, of Cadbury Schweppes, Bournville, England, and the Cocoa, Chocolate, and Confectionery Alliance of England. Membership of the PMC is made up of representatives from the various member countries of the IOCCC.

Scientific progress is the responsibility of the Project Scientific Committe (PSC) chaired by Dr. L.H. Purdy, American Cocoa Research Institute (ACRI) and the University of FLorida, Gainesville, FL, USA. Membership of the PSC is formed by the country coordinators and representatives from certain other countries involved with the IWBP, and includes the following individuals and their respective institutional affiliations.

<u>Project Scientific Committee</u>

- L. H. Purdy, Chairman, ACRI, Plant Pathology Dept., University of Florida, Gainesville, FL, USA
- Paulo Alvim, CEPLAC, Itabuna, Brazil
- Teklu Andebrhan, CEPLAC, Belem, Brazil
- Pablo Buritica C., Instituto Colombiano Agropecuario, Bogotá, Colombia
- Allen Maddison, INIAP, Pichilingue, Quevedo, Ecuador (ODA England)
- T. N. Sreenivasan, Cocoa Research Unit, University of the West Indies, St, Agustine, Trinidad, West Indies
- R. A. Schmidt, Department of Forestry, University of Florida, Gainesville, FL, USA
- Carmen Suárez, INIAP, Pichilingue, Quevedo, Ecuador
- Hillie Toxopeus, Foundation for Agricultural Plant Breeding, Wageningen, The Netherlands
- B. E. J. Wheeler, Imperial College, Silwood Park, Ascot, Berks, England
- S. A. Rudgard, the IWBP Liaison Officer, and R. A. Lass, Chairman of the PMC are Ex-officio members of the PSC.

An IWBP coordinator for Venezuela has not been named yet, but Dr. Humberto Reyes and Dra. Lilian de Reyes, CENIAP, Maracay, Venezuela, have been involved with the IWBP.

A Special Committee of the PSC has been appointed to plan publication of the results and information generated by the project activity. Thus, improved management practices that can be developed as a result of new information generated about witches' broom will become available for grower use as soon as possible as the various phases of the IWBP are completed.

The IWBP is truly unique in that it is funded by the IOCCC for a 5-year period, research in the field is done by local scientists using methodology they developed and agreed on, data can be used locally to improve cocoa production, data from all locations will be compared and analyzed together, publication of results obtained will be timely and available in three languages (Spanish, Portuguese, and English), and extension of information to growers is a planned objective that will take place as soon as information is available.

The structure of the IWBP, besides being unique, is a model for future projects that address problems that extend beyond the political boundaries that separate countries. Moniliophthora Pod Rot, for example, occurs in several countries in South America and in Costa Rica and Nicaragua in Central America, and it probably will spread to other countries in both regions. This serious disease is a candidate for future attention by a centrally funded project similar to the IWBP. Excellent results for improved management of Moniliophthora Pod Rot have been generated in Costa Rica. It might be prudent to use this information as the base on which to build an international project to study the epidemiology and improved management of this disease to include scientific activity in Costa Rica, Colombia, Ecuador, Venezuela, and other countries where the threat of this disease is great. The objective of such a project would be to improve disease management and to develop and utilize effective resistance to reduce economic losses from Moniliophthora Pod Rot that is caused by the fungus Moniliophthora roreri.

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PANEL VII

RESEARCH RESULTS, TRANSFER OF TECHNOLOGY

Theobroma Cacao, DNA AS A MARKER FOR PLANT BREEDING
(Original document: English)

Paul J. Fritz

Research is underway in this laboratory to apply recently developed methods of analysis at the DNA level to the problem of identifying and classifying germplasm of Theobroma cacao, L.

Specifically the project objective is to use restriction fragment polymorphism (RFP) analysis to develop a fingerprinting technique that would be useful to cocoa breeders in determining the genetic status of their germplasm.

When perfected, this method of cocoa germplasm identification will allow small quantities of potential germplasm to be assayed for desirable properties before being propagated in nurseries, resulting in a saving not only of time, but also in the cost of planting and maintaining potentially unsuitable material until it has reached its bearing age, when it may be evaluated by conventional methods. Development of this method of germplasm assessment should benefit breeders in all cocoa growing regions. Besides the possibility of rapidly identifying new, high yielding, material through RFP analysis, there is also the great hope that germplasm showing resistance to diseases such as "Witches Broom" of Central and South America, and the ubiquitous "Black Pod" disease, will be found and correlated with DNA patterns.

More than 50 years ago the Dutch were experimenting with hybrid vigor on cocoa plantations in Java (1). They compared the results of self-pollination and cross pollination and selected as breeding stock, trees exhibiting qualities that modern day cocoa breeders still seek - (a) high yield, (b) disease resistance, and (c) bean quality. Since those early days, progress in cocoa breeding has been steady but understandably slow, given that the time to examine succeeding generations is measured in years, in contrast to weeks, for such well-studied crops as maize, wheat, and rice.

With increased understanding of molecular genetics over the past thirty years, it has become possible to go beyond phenotypic and morphologic characteristics in assessing the results of genetic crosses.

Since proteins are the product of gene expression and can be analyzed accurately and with relative ease, they became the first molecular markers in plant breeding. The most widely used protein markers in plant breeding are isozymes. Isozymes are multiple molecular forms of enzymes distinguishable by electrophoretic separation and specific enzyme staining. Genetic studies of isozymes from more than 30 crop species, not including cocoa, have been reviewed in the book, Isozymes in Plant Genetics and Breeding (2).

In work sponsored by the International Board for Plant Genetic Resources and the Ghana Cocoa Growing Research Association, Whithers and her co-workers investigated isozyme analysis as a means for characterizing cocoa germplasm (3). Of 24 enzyme systems screened, 17 were detectable and 7 showed reproducible variation in a limited number of genotypes examined (4). These results show that molecular markers can be used for characterizing cocoa germplasm and give promise that they will be useful for cocoa breeding programs, especially if some of the enzyme variations can be correlated with phenotypic traits. Further, these results encourage the belief that more sensitive recently developed methods, involving DNA, are likely to be successful. Among several limitations of isozyme analysis is the fact that not all genes code for enzymes, and much of a plant genome is composed of non-coding regions. These limitations are removed when DNA is used as a molecular marker.

DNA markers, first described as tools for genetic analysis in 1974 (5), and later used in linkage studies and in monitoring genetic traits in humans (6), are now being used successfully in higher plants (7-11). The method depends upon the ability of restriction endonucleases to catalyze cleavage of DNA at specific recognition sites yielding polydeoxynucleotides of defined length. The method has been called restriction fragment length polymorphism (RFLP) analysis. Restriction fragments can be separated by electrophoresis in agarose gels and visualized by fluorescent dye binding. When plant nuclear DNA is cleaved by restriction endonucleases, many different sized fragments are produced and discrete bands are generally not seen on the gel. Instead, a continuous spectrum of high to low molecular weight pieces of DNA are observed. Sections encoding specific sequences from within a large and complex populaton of DNA fragments can be detected with the use of an appropriate probe labeled with either radioisotopes or biotin.

Differences among individual plants in lengths of a particular restriction fragment could result from (a) single or multiple base differences resulting in altered recognition sites, or (b) insertion or deletion of blocks of DNA within a fragment to alter its size. It is important that probes represent a section of DNA present in only a single or a few copies in the complete genome because if it represents highly repeated DNA it would reveal a large and bewildering array of unlinked sequences. It is not necessary to isolate specific genes for this method to be successful. Any unique DNA sequence will suffice as long as it hybridizes with some part of one of the DNA fragments formed after endonuclease digestion. Libraries of plant genes have been used as sources of probes in previous studies. DNA libraries are useful because most genes transcribed as poly A containing messenger RNA are present in low copy number. Plasmid libraries constructed from short DNA inserts have the advantage that they contain sequences from throughout the genome, they are unbiased by differential gene expression as would be the case in DNA libraries, and they are easily handled.

The usefulness of RFPs in plants was evaluated by Helentjaris and his group, who developed a maize linkage map based entirely on RFPs and compared it to the well developed conventional maize genetic map (9). They concluded that construction of a complete linkage map using RFPs was feasible, and that with present technology, a skilled worker could complete a genetic map of approximately 100 RFPs on a previously undescribed genus within two years. Uses of RFPs in assessing genetic polymorphism for varietal and parentage identification and in protection of breeder's rights have been discussed (12), as have more general applications to plant breeding, including (a) strain identification, (b) measure of genetic diversity, (c) mapping and monitoring quantitatively inherited traits, and (d) controlling the level of heterozygosity/homozygosity (13).

Presently, the ACRI Cocoa Molecular Biology Laboratory at the Pennsylvania State University is in the early stages of developing RFP analysis methodology for application to the cocoa plant. When perfected, we expect to share our methods with cocoa breeders everywhere.

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PANEL VIII

SOURCES OF ASSISTANCE
(Original document: English)

Brian Rudert, U.S. AID agricultural officer, said that in meeting the range of needs for technical and capital assistance, AID seeks to strengthen institutions, the private sector, and policies, working through private voluntary organizations (PVOs, NGOs) whenever possible. AID projects begin at the local USAID level, and participants should develop "perfect projects", including credit at positive interest rates. Latin American prospects for increasing production, farmer incomes, export earnings, and stronger institutional bases for cocoa cultivation and marketing are good. Constraints are the lack of long-term credit at appropriate terms, and the inefficiency of technology transfer in really transforming extractive farmers into market-oriented producers.

Existing AID cocoa projects are benefiting Belize (PADF, Hershey, VITA), Honduras/APROCACAHO (VITA, PADF, Hershey), FHIA research and processing capacity (Center for Industrial Development), Haiti farmer coops (MEDA), Grenada, Dominica, St. Lucia, St. Vincent (PADF, Hershey), Panama research (IDEA), seed development (CATIE), and cocoa as a substitute for coca in Peru. Other AID projects under consideration may benefit some 400 cocoa farmers in the Toledo area of Belize, CAAP in Costa Rica with some 10,000 new hectares and an EARTH regional education project in Ecuador.

Robert Bronkhorst, World Bank agricultural officer, reviewed the Bank's lending practices, co-financing of tree-crops, and the project cycle. Analysis of cocoa stocks and declining world prices have affected World Bank funding of cocoa projects. Cocoa has benefited from 14 loans to Latin American countries, raising production by about 50,000 MT. A Costa Rican Atlantica Cocoa Project will begin when two final problems are negotiated, and other agricultural credit and rural development projects may improve plant material and strengthen government or private sector institutions engaged in cocoa. Agroecological assessment will help select new project countries with the best prospects for production, using new technologies and the tools Latin America and the Caribbean have at hand to support the regional challenge of increasing its competitive position in the world market.

Louis Miller, Peace Corps Training Officer in Belize, described the support that Peace Corps Volunteers (PCVs) are giving the Ministry of Agriculture and PADF in the cocoa development project. In responding to government requests, PCVs are often especially effective in achieving transfer of technology, helping create viable economic units, and using extension to assure mechanisms to sustain improved production and planning capacity.

Ing. José Soto Angli, Head of Agricultural Marketing at the Inter-American Development Bank (IDB), noted that although cocoa per se has not received loans, it has been included under agricultural cooperation projects, technology transfer, international research institution support, and global credit loans. IDB funds agricultural inputs, equipment, travel and training of member countries and regional institutions. IDB is helped by IICA to prepare countries' proposals. The Small Projects window (up to US$500,000) is easy to use and benefits farmer organizations.

Peter Fehr, who manages CIDA's Grenada Cocoa Project, noted CIDA's other cocoa assistance in Haiti (MEDA). CIDA includes cocoa in multilateral assistance to regional institutions. Bilateral projects provide technical, material, financial, and training assistance to work with a sound local institute willing to accept designed expatriate assistance until local skills are in place. New Grenada efforts will help the Cocoa Growers computerize data, renew fermentary capacity, and probably provide an incentive to farmers for production in excess of expectations. Training will benefit producers and researchers, managerial, and clerical staffs. So far, successful cooperation with AID through PADF is primarily at the extension and farm level.

Lewis Townsend, PADF Vice President, noted that PVOs (NGOs) can operate as facilitators for aid agencies, function with more agility at the farm or microproducer level, and weave a series of inputs into a cohesive effort, as in this Forum. PADF cocoa projects in Belize, Dominica, Grenada, Honduras, St. Lucia and St. Vincent carry out the Foundation's mandate to create jobs, improve incomes and strengthen local institutions (especially in the private sector). It can train, manage credits (like National Development Foundations), be a "service PVO" to local PVOs and groups, and catalyze effective local arrangements with official organizations like Development Finance Corporations.

The panel was challenged by several participants. Project proposals do not need to follow rigid formulas, but are evaluated broadly against standards for technical, economic, financial, and agronomic effectiveness. There was a call for flexible application of the agencies' mandates. Speakers from the floor called for an adequate price spread to sustain farmer interest in applying new cocoa technologies. The agencies agreed that subsidized interest rates are unwise, although the IDB allows rates for low income borrowers at slightly below commercial rates, so long as they remain positive.

Phoebe Lansdale
Rapporteur

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PANEL VIII

SOURCES OF ASSISTANCE

AID COCOA DEVELOPMENT PROGRAMS IN LATIN AMERICA AND THE CARIBBEAN

(Original document: English)

Brian Rudert

The Agency for International Development (AID) is supporting a variety of cocoa development activities in the Latin America and Caribbean (LAC) region. In order to understand the types of cocoa activities that AID finances, one has to understand AID and its mandate.

<u>AID's Mandate in the LAC Region</u> - AID is an agency of the government of the United States of America responsible for implementing foreign assistance programs mandated by the Congress of the U.S.A. Most programs are implemented bilaterally through treaties signed between the U.S. and a specific country that is the recipient of the foreign assistance. AID has to request congressional approval for all projects, and it generally takes two years to develop and approve projects. AID also implements projects through Operational Program Grants (OPGs) or Cooperative Agreements to Private Voluntary Organizations (PVOs) that implement projects in recipient countries.

In the field of agriculture the basic mandate of AID is to raise incomes of the rural poor on a sustainable basis. AID proposes to achieve this objective through institutional development to create and sustain indigenous capability to manage and promote development; development of the private sector and its increased utilization in achieving developmental goals; technology transfer as a means of increasing productivity; and policy dialogue in order to improve the policy environment in which long-term sustainable growth can occur.

In the LAC region AID implements two special programs. One is the Caribbean Basin Initiative (CBI) and the other is the Central America Initiative, also known as the Jackson Plan, which grew out of the Kissinger Commission's report. The fundamental purpose of the CBI is to strengthen and diversify the production and export base of the countries of Central America and the Caribbean. Under the CBI, the United States is granting preferential one-way free trade for 12 years with some exceptions to enable CBI countries to work and earn their own way to development through trade.

The Central America Initiative is a broad-based program intended to address the root causes of poverty and social unrest, foster equitable development, and support democratization in Central America. The specific goal of the plan that directly relates to agriculture is building a foundation for long-term economic growth by supporting improvements in economic policy and the infrastructure needed for efficient production and diversified exports. AID also seeks to contribute to a 4 percent agricultural growth rate in Central America under the program.

AID undertakes projects in twelve LAC countries in addition to regional programs in Central America and the Eastern Caribbean. There are approximately 117 active agricultural development projects undertaken by AID in the LAC region with combined resources of approximately 1.2 billion dollars. AID also administers resources provided for balance of payment support and PL 480 food aid. Both programs generate large amounts of local currency resources that are also programmed for agricultural development purposes.

Cocoa and AID's Mandate - Cocoa has excellent potential as a small farmer crop even though it has a traditional association with plantation agriculture. It is fairly easy to handle and market as compared to other more perishable crops. It can also be labor intensive and provide a more favorable available cash flow throughout the year as compared to a crop that is only harvested one time during the year.

As an export crop, cocoa fits well into AID's mandate to promote increased exports from the region. It has a relatively stable long-term market perspective. It does not compete with U.S. farmers and the tropics obviously have a competitive advantage in its production.

Reports suggest that the LAC region has the potential to triple or even quadruple cocoa exports through improved management of existing cocoa plantings. There is also vast potential for new plantings as the region shifts out of traditional crops such as sugar for which long-term market perspectives have changed. Such potential production increases would represent important gains in export earnings to LAC countries, yet would not have enough impact on world production levels to seriously affect prices. It is interesting to note that while cocoa is one of the oldest cultivated crops in the LAC region, some of the lowest productivity levels are found here and most countries ironically categorize cocoa as a nontraditional crop.

Cocoa has a tremendous potential for productivity increases and drastic reductions in per unit production costs. Very few other crops have so much existing on-the-shelf technology ready to be implemented. There is a tremendous genetic potential in existing varieties and hybrids that is simply not being used to the best advantage. Some reports suggest that by employing proper genetic material, plant spacing, and management, cocoa can be produced for as little as 85 cents a dollar per kilogram. Yields of at least 1,000 kgs. per ha. seem to be the minimum level of productivity mentioned as necessary for the success of the "new" technology.

The capital base of the industry is the tree - the proper genetic material with the proper plant population per hectare. The appropriate capital base in cocoa is very similar to other industries such as automobiles or steel where newly industrialized far-eastern countries with a more recent and more efficient capital base employing computers and robotics are outcompeting the older more traditional producers who have not modernized or replaced their factory capital base. New entries into cocoa production will enjoy a competitive advantage over older producers with an outdated capital base. Investment in modern cocoa production is also something that stays in the country and will last 20 to 30 years.

The LAC Region has the advantage of premier cocoa research development institutions such as the University of West Indies in Trinidad and the Central American Tropical Agricultural Center for Training and Research (CATIE). CATIE's hybrid seed production service has provided invaluable assistance to countries establishing new plantings and in developing their own indigenous seed production capability. Hershey Food Corporation also chose the region when it established its production demonstration facility at the Hummingbird Farm in Belize.

Cocoa is a crop with significant value added and agribusiness potential. Many countries are looking at the development of domestic confectionary industries that utilize domestic cocoa, milk, and sugar supplies. The export of chocolate liquor and other cocoa products is also a potential. The step from export of beans to export of liquor is not an easy one and involves a shift to different, more rigorous export requirements and a skeptical, if not unreceptive international market that may be difficult to penetrate. Countries are best advised to concentrate initially on increasing production and reliability in the quantity and quality of bean exports and to slowly enter the more sophisticated market of higher products as production experience and the market permit. The LAC region has too many white elephant cocoa processing facilities that failed because production declined and was unreliable.

Cocoa is grown under the same ecological conditions as many other crops and could play an important role in diversification programs as a substitute for those crops with decreasing market demand. It also is an excellent crop for agroforestry and soil conservation programs, due to its deep roots, perennial nature and shade or windbreak requirements.

Constraints to Cocoa Sector DevelopmentThe constraints to improved cocoa production are many and not easy to overcome. The two primary ones are related to technology and credit. The lack of technology transfer mechanisms to work with farmers in implementing the proper management technology is particularly acute. A national research capacity is necessary to take advantage of the resources available at institutions such as CATIE, and to undertake site specific problems resolution.

In development terms, it may be easier to work with new plantings of cocoa and with farmers that have never worked with cocoa, than with traditional cocoa producers. Many traditional cocoa producers would more appropriately be characterized as cocoa "gatherers" as they are so firmly

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entrenched in a low input - low output management system. Such producers are at the complete mercy of nature as to the level and quality of their production.

Part of the challenge of the technology transfer system is how to transform small cocoa producers into market oriented entreprenuers. This means being responsive to available markets by producing a consistent and reliable quality product.

There is also the problem of diseases, such as Moniliasis, which have greatly reduced or virtually eliminated production in some humid areas. There is a need for continuous attention to Moniliasis and other diseases, through disease monitoring, cultural control, proper use of fungicides, and development of resistant varieties.

Establishing or improving the cocoa capital base is the second primary problem. The lack of long-term investment credit with appropriate terms suitable to a perennial crop with a considerable lag time before the income stream begins is not an easy constraint to overcome. Not only does the credit scheme have to take into account what the farmer will live on until the trees start producing, but also how to extend credit at positive rates that attract commercial banks and still allow the farmer to make a profit. This income stream problem is reduced somewhat, however, as new more precocious varieties and hybrids are introduced.

There are also many processing and marketing constraints that could be listed but they are more appropriately and easily dealt with when adequate production levels are achieved.

<u>AID Cocoa Projects</u> - AID currently supports cocoa development activities in the following LAC countries:

Belize - A grant to the Pan American Development Foundation (PADF) to develop cocoa in conjunction with Hershey Hummingbird Farms. Development of the new Toledo Project will assist cocoa development in the Toledo area for approximately 400 farmers who are expected to establish approximately 1,000 has.

Honduras - A contract with PADF and Volunteers in Technical Assistance (VITA) to assist the Honduran Cocoa Producers Association (APROCACAO) develop a private sector cocoa extension system and rehabilitate 1,000 has. and establish plantings on 1,000 has. Assistance is also provided to the Center for Industrial Development (CDI) to develop improved processing facilities. The Honduran Agricultural Research Foundation (FHIA) is receiving AID support for cocoa research activities.

Costa Rica - Assistance will be provided through CAAP for the establishment plantings of cocoa on 10,000 has. New support for the establishment of a Regional Agricultural School for the Humid Tropics (EARTH) which will include training in cocoa in its undergraduate level education program.

Eastern Caribbean - A grant to PADF to provide assistance for cocoa development activities in Grenada, St. Vincent, Dominica and St. Lucia.

Panama - Support to Panamanian Agricultural Research Institute (IDIAP) to conduct cocoa research.

Central America Region - Budgetary support to improve and expand the cocoa hybrid production and research facilities, and support to cocoa pest management research through an Integrated Pest Management Project. Continuing support to CATIE for general institutional and program development.

Peru - Support of cocoa activities as a substitute crop for Erythroxylon coca.

The above list is not all-inclusive. AID Missions may be supporting cocoa development with local currency generations from PL 480 or other programs as well. What is interesting to note is that AID tends to implement cocoa development through small programs with the private sector.

Multinational donors such as the World Bank and the Interamerican Development Bank are undertaking much larger agricultural credit projects that AID can finance. They will probably remain the major sources of credit assistance for cocoa development in the region. AID support will complement such efforts and attempt to make sure that technological development and the small farmer are not left out of development programs.

AID's Interest in New Cocoa Activities - In general AID is receptive to financing new cocoa activities but depends upon each individual AID Mission's assessment of the project's potential and their level of available resources, giving great importance to market analyses. It should be pointed out that "through AID/Washington is consulted and coordinates receiving congressional approval for all projects, the decision point for investment in projects is at the individual Missions and not in Washington.

Although it is easy to describe the attributes of an ideal project that would be attractive to an individual AID Mission, designing that ideal cocoa development project will not be an easy task. I would challenge this group to try to identify projects with the following characteristics and present them to AID for consideration.

If credit is involved for new plantings or rehabilitation it is important that such credit be extended at positive interest rates. Credit that is extended should benefit more than the initial recipients, and the reflows should have the potential to expand so that the fund does not decapitalize over time. Ideally the credit scheme should be viable enough financially to attract private banks as part of the project.

An even harder task will be to design a technology transfer system that is self sustaining, free of political influence, and managed by the cocoa producers.

Summary - Cocoa has excellent potential as a small farmer crop and fits well into AID's mandate of increasing and diversifying exports from the LAC region. The LAC region has a definite comparative advantage, is blessed with already established premier cocoa research institutions, and the availability of excellent off-the-shelf technology. The task before the LAC countries is to develop sound projects that overcome the constraints of adequate technology transfer mechanisms and appropriate positive credit schemes.

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PANEL VIII

SOURCES OF ASSISTANCE

WORLD BANK ASSISTANCE AND COCOA PRODUCTION
(Original document: English)

Roberto Bronkhorst

I thank the organizers of this Forum for giving me the opportunity to present a general, brief vision of the participation of the World Bank in cocoa development.

However, before I do this, I am going to give a brief description of the Bank policies, a typical project cycle, and the loan policies. The International Bank for Reconstruction and Development (IBRD) known as the World Bank, the International Development Association (IDA), and the International Financial Corporation (IFC) comprise the World Bank Group.

Loans from IBRD are for production purposes and only for governments only. Generally, these loans have a grace period of five years and must repaid in 20 years or less. Interest is variable and presently it is about 8%. IDA concentrates its assistance on the governments as well, but focuses on the poorest countries making soft loans to countries with a per capita annual income of less than US$700 per year. These are loans free of interest, with a grace period of 10 years and for a total term of 50 years, with a service charge of 0.75% instead of interest. To promote development of the private sector, the International Financial Corporation (IFC) supports the private sector through investment and long term loans with commercial interest rates to private companies, or a combination of both. IFC loans have a grace period of three years. During the financial year 1986 IBRD lent $30,200 million, IDA lent $3,100 million, IFC $292 million plus $32 additional millions invested as capital.

IBRD finances each loan with money requested as a loan from the world capital markets, together with retained World Bank earnings and reimbursement of previous loans. Moreover, the Bank emphasizes opportunities for co-financing. The three main sources are official development agencies, both multilateral and bilateral, institutions of credit and export, and commercial banks. The main co-financers of projects for cultivation of trees in recent years are the Development Bank of Asia, the Overseas Development Corporation of the British Commonwealth, the French Central for Technical Cooperation, and the European Development Bank.

Allow me to concentrate on the typical cycle of a project. The Bank mainly lends for specific projects and chooses those which have high priority for the governments, are well designed and with in the global strategies of the sector.

Based on periodic review of the agricultural sectors of each country as a whole, we obtain a basic reference frame within which we locate requests for assistance. The first step in this project cycle is the preparation of a project profile, the "project identification".

In the second step, the government must submit to the Bank a detailed proposal of the project and a loan request. It is possible that specific studies will be required to complete this proposal; when the governments cannot carry out by themselves those studies, then consultants or personnel from our cooperative program with FAO in Rome may be contracted to give support to the governments for preparation of a loan request.

The third step, once a proposal has been finalized, usually a Bank evaluation mission is sent to the field, which may take from two to five weeks.

During the next six months, the Bank prepares a detailed evaluation report, the basis for the fourth and last step: negotiations with the government. These negotiations lead to a loan agreement. Once a loan is approved, it is in operation and funds may be disbursed.

During disbursement of credit funds, typically over four to six years, Bank missions visit the countries to provide assistance and to review progress, usually twice a year. Regular reports are prepared, and a complete report is prepared six months before the project is completed or within six months after completion. There are monitoring, evaluations and follow-up to support project administration, for future orientation of the planners, and for those responsible for the formulation of policies.

Now, I wish to specifically refer to the bank loans for development of cocoa.

During the last few years, financing for cocoa projects has been limited by stagnant demand and by an increase in the inventory of raw material. However, during the period 1974-86, the Bank financed 41 projects in the world. These included one cocoa project supporting increased production estimated at 184,000 metric tons at full production. From fourteen of those 41 projects were in Latin American and Caribbean leading to an estimated increase in production, when production reaches maturity, of about 54,000 metric tons. Four projects were located in Colombia, three in Ecuador, three in Mexico, one in Brazil, one in the Dominican Republic, one in Haiti, and one in Panama.

Projects have various components. A project may be a typical credit project, in which the main component is the credit to the farmer. It also may include support components, by which I mean that perhaps it has a component for development of rural roads or a component to develop improved planting materials or a component to strengthen the institutions involved in the development of cocoa, either government or private sector.

The Bank will back future cocoa development within the limits established by agroecological conditions and, especially, price. Probably, there will be a geographic redistribution of cocoa production, resulting from the higher potential of the new hybrids and the use of technological packages already available plus new ones. There will be a displacement toward countries which have major comparative advantages in terms of soil, climate, freedom from pests and diseases, lowest production costs, and highest yield per hectare.

The challenge facing us is to increase the competitive position of our region. We have all the tools. I believe it now depends on all of us--producers, buyers, and financing agencies as partners in the development--to complete this task.

Thank you.

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PANEL VIII

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CANADIAN SOURCES OF ASSISTANCE
(Original document: English)

Peter Fehr

The Canadian International Development Agency (CIDA) provides assistance in agricultural development in several ways. Multilateral assistance is provided in the form of financial assistance to international institutes such as IICA. This is normally long term and general. Cocoa development benefits from this type of assistance only if these institutions have cocoa in their programs.

The second form of assistance is bilateral, government to government, generally in the form of specific development projects. The aim of this type of assistance is to strengthen the ability of the country to develop and manage its agricultural industry. This assistance usually includes technical assistance, material assistance, subsidies/incentives, and training.

Generally, CIDA must be assured that an institutional framework exists within which this assistance can be channelled.

Secondly, CIDA wants to be assured that competent management is in place to ensure efficient and effective use of the assistance provided.

Thirdly, there needs to be a willingness to accept expatriate technical assistance in the short term where this competence is not locally available to assist in the implementation of the development program.

Let me give you an example of CIDA's assistance to the Grenada cocoa industry in its proposed, expanded development program. The assistance is in the form of technical, material, financial and training.

Technical Assistance

A recent cocoa industry review indentified serious shortfalls in competence in management and financial control. The proposed Grenada cocoa assistance project will provide assistance in obtaining this competence, either locally, regionally or internationally, and in financing this until competent local personnel are in place.

Material Assistance

The project will provide for capital investment in equipment and facilities to modernize the infrastructure to ensure a basis for efficient operations.

Financial

The proposed project would provide financial assistance in the form of input subsidies and output incentives. The input subsidies are in the form of low cost planting materials at the farm gate. Output incentives are in the form of price incentive for increasing production at the farm level.

It should be noted that development assistance needs to focus on providing incentives for increased production rather than subsidizing inputs. The efficient farmer needs to be rewarded for his efforts.

Training

Training assistance will be provided in all areas including management, finances, clerical research, extension and at the farm level.

The objective is to have competent staff in place that can effectively guide the Grenada cocoa industry as a whole after completion of the foreign assistance..

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PANEL VIII

SOURCES OF ASSISTANCE

CENTRAL AMERICAN BANK FOR ECONOMIC INTEGRATION: ACTIVITIES RELATED TO PRODUCTION, MARKETING, AND INDUSTRIALIZATION OF COCOA

(Original document: Spanish)

M. Ortega

I. General Report

The Central American Bank for Economic Integration (CABEI) is an international organization established by the Constitutive Agreement signed December 13, 1960. Its members include Guatemala, El Salvador, Honduras, Nicaragua and Costa Rica.

Operations started with an authorized capital of 10 million dollars, which has been increased to 600 millions. Its net assets reach 344 million dollars, including paid capital, renovations, reserves and profits.

According to the Constitutive Agreement, the Bank promotes the economic developmment of the member countries and promotes the Central American economic integration, funding infrastructure projects, projects of social character in priority fields related to health, education and rural development, and projects of agricultural and industrial development.

During its 25 years of existence, CABEI has granted loans for a total of 1.686 million Central American Pesos, currency units equivalent to the US dollar and the expenses reach 1.270 million Central American Pesos. These figures indicate an important participation in the external financing of Central America.

To serve the great credit demand of the area countries, CABEI has basically used up its capacity to receive external resources, which today are over 1.300 million Central American Pesos. Of this amount, 48% has been contracted with private international financial organizations, 50% originated in operations with multilateral institutions and official organizations, and 2% from the selling of bonds in the Central American market.

CABEI, as well as other international institutions, has been affected by the behavior of the open international financial environment. To deal with this crisis it has taken a number of actions to maintain its financial presence in the region, which include:

a. To promote an administrative restructuring, which will permit a quick response to the new financial exigencies coming from the open or changing international environment.

b. To finalize new credit operations with the financial sources and to improve the financial conditions of the already granted loans.

c. To reach payment agreements with the member countries to eliminate the moratorium they maintain with the Bank.

d. To open new lines to obtain capital.

e. To authorize the opening of the Bank to Extraregional Members.

The Bank's top authority is the Assembly of the Governors, which is formed by the Ministers of Economy and the Presidents of the Central Banks of the Central American Countries, under which there is a Board of Directors, consisting of the five Directors designated by the Government of each country.

Superior administration is integrated by the Executive President, Executive Vice-President, Financial Manager, Promotion and Studies Manager, and Operational Manager.

The Bank is based in Tegucigalpa, Honduras, and there is a Regional Office in each member country.

II. CABEI Activities Related to Production, Marketing and Industrialization of Cocoa

1. FAO/CABEI Project: Mission for indentification of tropical crops: Cocoa, rubber, coconut and African Oil Palm, with the Investigations Center of FAO.
   The mission consists of four specialists, one for each crop, together with an official of CABEI, to identify climatic areas, projects under execution, and potential areas to develop commercial cultivation.

2. Priorities for CABEI.
   CABEI, assigning priority to the execution of agricultural projects which increase jobs and improve production, both for internal consumption and for exports and the promotion of cocoa, coconut, African Oil Palm and rubber production, tries to improve the production structure of the agricultural sector, resolved to declare as Projects of regional importance, the Global Program of Crops and permanent Plantations, according to Resolution No. 17/75 of the Board of Directors of CABEI.

3. Studies about Present Situation and Perspectives of the Cultivars and Industrialization of Cocoa in Central America.
   Through the Agreement CABEI/CATIE, funded by the EEC and counterpart funds of CABEI, CATIE prepared a study about the present situation and perspective of cocoa growth and industrialization in Central America, which gathers information about the crop and the industry of

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cocoa in the area and analyzes the possibilities of the Region to increase cocoa production and industrialization.

4. Projects Financing
CABEI has financed some cocoa projects, mainly in the industrial phase, processing of the beans and manufacture.

5. Cocoa Program
Within the Global Program of Crops and Permanent Plantations, CABEI foresees for years 1987/88 the elaboration and starting of the Cocoa Agroindustrial Program at the Central American regional level.

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CLOSING SESSION

CLOSING STATEMENT BY Mr. NORBERTO AMBROS
FORUM MANAGER AND PROJECT OFFICER
PAN AMERICAN DEVELOPMENT FOUNDATION

I want to convey to you, Mr. Minister, on behalf of the Pan American Development Foundation and our co-sponsors, our profound appreciation to the Government and people of Costa Rica for the quality of hospitality which welcomed us. You have provided a lively mirror of the values which support your country and of the traditional bonds of friendship between Costa Rica and all other countries represented here.

As manager of this First Inter-American Cocoa Forum, I am burdened with the permanent debt of gratitude which the Pan American Development Foundation has assumed to those organizations, institutions, and individuals from the public and private sectors who were critical to the realization and success of this event. As a result, PADF has two responsibilities:

Our first responsibility is to express, publicly and unequivocally, appreciation to all who placed their trust in us, and who provided decisive and generous collaboration and support.

Our second responsibility is much more complex: we must respond clearly and categorically to the need to transform the Forum's results and recommendations into an efficient action program. We must have concrete objectives, realistic tasks, strategies which can be carried out within defined periods of time, and tangible and verifiable results.

This second task requires actions that our Foundation cannot take alone. Unless we can count on support from all of you and the institutions you represent, it will be impossible. We accept the challenge, and we promise that from today forward we will bend our best efforts and PADF's capabilities to achieving the desired result. With you lies the responsibility of accompanying us on this journey.

To fulfill the first responsibility is a great pleasure, as there are many well justified reasons to express thanks.

In the first place, I must thank the key members of the Organizing Committee of the Forum, who in Washington during the period of Forum preparations, and in San Jose invested not only their valuable time but also their wealth of personal and collective experience. Thank you - Dick O'Connell and Rhona Applebaum of ACRI, B.K. Matlick of Hershey, Brian Rudert of AID/LAC, Robert Bronkhorst of the World Bank, José Sote Angli of IDB, Hank Purdy and Bob Fulton of ACRI, Glenn Trout and Jorge Soria, Consultants, Harlan Davis and Gilberto Paez of IICA, and Gustavo Enriquez of CATIE.

To AID/ROCAP which believed in the concept, provided generous financial support, and assured the presence of many participants, many, many thanks.

To ACRI, which through Dick O'Connell, Hank Purdy, Bob Fulton, and Rhona Applebaum provided experience, time, contacts, and financial support, and which helped endow the Forum with broad representation and high technical content, many, many thanks.

To IICA, which shared its facilities in a forthcoming and generous way, offering superb hospitality - to Dr. Martín Piñeiro for making us feel at home; to Harlan Davis for being a friend who believed in the idea and supported us from the start; to André Ouellette, for his always wise suggestions and creativity in solving problems; to Roxana Montero for a rare mixture of patience and efficiency, management skills unstintingly offered, like the star that guides a traveller; to Yanina Camacho and María Antonieta Cordido who, in the Forum's Executive Secretariat, helped us with dedication, a high sense of responsibility and performance standard, and efficiency far beyond expectations, a team of which IICA can be truly proud; to Miguel Martí and his press team; to those who prepared this room daily, managed the sound equipment, brought us coffee during the breaks, tirelessly provided photocopies for document distribution, or prepared the lunches we enjoyed each day; to all these, through you, Dr. Piñeiro, thank you, many times "thank you".

Also to IICA, to the interpreters who from their booths were adroit and able intermediaries who enabled our dialogue to cross the language barriers. To our translators, who day after day accomplished the interpreters's work but in written form.

To CATIE which received us one sunny day when all expected rain, and further made an extraordinary effort for our group which was larger than CATIE's real capacity. To Gustavo Enriquez, who with his distinguished cocoa team were directly responsible for our private visit and the exhibition, to you, Gustavo, and friends at CATIE, many thanks.

To the cocoa industry of Costa Rica, and two of its most distinguished representatives, Costa Rica Cocoa Products and El Gallito Industrial, thank you also for the collaborative spirit and generosity which made possible the delicious chocolate we had yesterday at CATIE and today at IICA. Both participated actively in these panels, and donated the welcoming cocktail party. To Ernesto Ruiz, Sr., and to Alberto Odio, my new friends, thank you, many thanks.

To the IDB, whose generosity calls for recognition, thank you, and especially to José Soto Angli for accompanying us through the organizational stages of this Forum and for being with us in this closing session.

To the office of the Representative of the OAS, which in many ways supported the essential activities of the Forum, thank you to OAS Director Fernando Bravo and Elvio Arias, Administrative Assistant.

To our young conference room assistants, Adriana Bravo and Yanine Jacobson who helped us resolve many problems large and small, always smiling and with a high spirit of cooperation.

Finally, to the personnel of the Pan American Development Foundation who served as rapporteurs in the panels, and to Phoebe Lansdale, Program Director of the Foundation, we extend our thanks.

To representatives of associations, cooperatives, private voluntary organization, to the cultivators, industry, and business, to public and private banks, to international development organizations, to all, our most profound thanks.

To moderators and panelists, whose knowledge and experience in the issues presented contributed to the Forum's high technical level, brought a strong dose of pragmatism and realism. To all, thank you.

Finally, it is you participants who deserve the largest portion of these expressions of gratitude, as you cut across the heterogeneity of this group and the different areas of your work and experience, and at the same time demonstrated homogeneity from time to time in this session. Without you the physical, logistic, and technical effort which we undertook would be wasted. For this, we congratulate you and give you our thanks.

In the name of the Pan American Development Foundation, and in my own name, I wish you a safe return journey to your countries and success in the tasks before you.

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COCOA FORUM PROGRAM:
PROMOTING COCOA PRODUCTION AND MARKETING IN DEVELOPING COUNTRIES OF THE AMERICAS

Monday, January 26, 1987

At Holiday Inn Hotel, San Jose, Costa Rica
Tel. 506-33 7233 (Suite 400), telex 303 3545

Registration of participants, distribution of credentials and documents

Day 1: Tuesday, Jan. 27

7:50 AM	Bus leaves Holiday Inn for IICA

At IICA, Coronado, San Jose (Tel. 506 29-19-08, 29-47-41, 29-02-22 ext. 338)

8:30 - 9:00 AM	Registration, distribution of credentials and documents
9:00 - 9:45 AM	Opening Session
(5)	• Welcome remarks: PADF (Lewis Townsend*, Vice President)
(5)	• Welcome remarks: IICA (Martin E. Piñeiro*, Director General)
(10)	• Address: USAID (Daniel Chaij*, Director, USAID/CR)
(15)	• Principal address: Hershey (B.K. Matlick*, Director of Agribusiness, Hershey Foods Corp.): "WHY COCOA?"
(10)	• Opening address: Alberto Esquivel Bolio*, Minister of Agriculture of Costa Rica
9:45-10:15 AM	Coffee break
10:15-11:15 AM	Presentation: THE COCOA SITUATION IN DEVELOPING NATIONS OF CENTRAL AMERICA, SOUTH AMERICA AND THE CARIBBEAN
(5)	Moderator: Lewis Townsend*, Vice President, PADF
(20)	J. Soria*, IICA cocoa expert (Central and South America)
(20)	G. Trout*, PADF consultant (Caribbean)
(15)	Questions and answers
11:30-1:00 PM	Panel I: COCOA PROSPECTS/PROJECTIONS - AN OVERVIEW (cocoa prices, projections, futures, production)
(15)	• Moderator: Richard O'Connell*, Pres. of the Am. Cocoa Research Inst. and Chocolate Manufacturers' Assn: Industry Perspective

(10)	. Members:	Mathurin Gbetibuou*, World Bank (Cocoa Market - the Next Fifteen Years)
(10)		Mario Amin*, CEPLAC/Brazil (world market overview)
(10)		Ernesto Ruiz, Sr.*, buyer (prospects & projections: Costa Rica, Central America and the Caribbean Basin)
(10)		Max Bowser, US Agriculture Attache to Costa Rica
	. Rapporteur:	Phoebe Lansdale*, Program Director, PADF
(35)	Questions and answers	
1:15-2:30 PM	Lunch break	
2:30-4:00 P.M.	Panel II: PRODUCTIVITY FACTORS	
	A. RESEARCH AND EXTENSION	
(15)	. Moderator:	Dr. J. Soria*, IICA/Ecuador
(10)	. Members:	P. Buritica*, ICA, Colombia (Rehabilitation in Presence of Witches Broom and Monilia; New Areas & Soils for Cocoa Production)
(10)		Dr. Gustavo Enriquez*, CATIE (research results, propagation & micropropagation prospects)
(10)		Dr. Robert H. Fulton*, ACRI (Agrichemicals and Pest Control Management for Cocoa)
		Observations, by Dr. Jorge Soria
	. Rapporteur:	Dr. Alex Lopez*, PADF Cocoa Advisor, E. Caribbean
(45)	Questions and answers	
4:00-4:30	Coffee break	
4:30-6:00	B. CROPPING SYSTEMS & CULTIVATION PRACTICES	
(15)	. Moderator:	Dr. J. Soria*, IICA/Ecuador
(10)	. Members:	Oscar Brenes*, CATIE, Costa Rica (cocoa practices)
		Andre Helfenberger*, Costa Rican cocoa specialist (Costa Rican Cocoa Production, Limitations and Possibilities for Expansion)
(10)		Arturo Lopez*, Philippines (intensive systems)
(10)		Jim Walsh*, Hawaii (selection and use of both traditional and intensive planting systems in the development of a new cocoa industry in Hawaii)
	. Rapporteur:	James Corven*, PADF Cocoa Advisor, Belize
(35)	Questions and answers	

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6:10 PM — Bus leaves IICA for Hotel

7:30 PM — Opening cocktail reception at Holiday Inn
(Please make certain to carry your identification badge)

Day 2: Wednesday, January 28

7:50 AM — Bus leaves Hotel for IICA

At IICA

8:30-9:45 A.M. — Panel III: EXTENSION SYSTEMS ALTERNATIVES

(15 min.) • Moderator: Fitzroy James*, Director Grenada Cocoa Rehabilitation Project

(10) • Members: Jose Martinez*, Dominican Republic large producer (pest management extension training, relaying information to various types of growers, local and imported labor, costs of production)

(10) Jesus Sanchez*, FHIA (Honduras cooperative system)

(10) Dr. Frederico Afonso*, CEPLAC, (the Amazonia experience)

• Rapporteur: Dr. Oleen Hess*, PADF Sr. Cocoa Advisor, E. Caribbean

(30) Questions and answers

10:00-11:15 AM — Panel IV: ECONOMICS OF COCOA PRODUCTION AND MARKETING

(15) • Moderator: Ron Bixler*, M&M Mars Product Devt. Mgr. for Chocolate (Economic Impact of Cocoa Flavor)

(10) • Members: Jonathan Sleeper*, USAID/Grenada ADO (costs of different production systems, breakeven costs)

(10) L.H.Purdy for Russell Jensen (Witches Broom & Cocoa in the Amazon; the Management of Japanese Brazilian Farmers)

(10) Michael Evnin*, US entrepreneur (Components of a Complete Cocoa Investment)

José A. Martinez*, (Local Production Costs and Imported Labor in the Dominican Republic)

• Rapporteur: Jim Corven*, PADF/Belize Cocoa Adv.

(30) Questions and answers

11:15-11:45 — Coffee break

11:45-1:15 PM — Panel V: MARKETING

(15) • Moderator: John Buckley*, Nestle Vice President for Purchasing (The Chocolate Manufacturer and the Market)

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(10)	. Members:	Dr. Alex Lopez*, PADF Cocoa Advisor for E. Caribbean (role of processing in cocoa marketing)
(10)		Noel Smith*, Drexel Burnham & Lambert, cocoa buyer (Dealers' Role in Trading Cocoa and Problems Involved in Buying from the Americas)
(10)		Steven Aronson*, CR, President of Granex
(10)		Fitz Shaw*, Exec. Dir. Jamaica Cocoa Industry Board (marketing by government, role of flavor/processing in price)
(10)		Martin Bracken*, MEDA, Haiti (new farmers' marketing organization efforts)
	. Rapporteur:	Patrick Inkster, PADF Cocoa Institutional Advisor, Honduras
(25)	Questions and answers	
1:15-2:30 PM	Lunch break	
2:30-4:00 PM	Panel VI: AUGMENTING COCOA PRODUCTION INCOME: INTERCROPS, BY-PRODUCTS	
(15)	. Moderator:	Dennis Johnson*, AID Agroforestry Advisor (Cocoa Intercrops)
(10)	. Members:	Ernesto Ruiz, Jr.*, cocoa products buyer
(10)		Patrick Scott*, Belize Hershey Hummingbird Farm Ext. Advisor (Intercropping and Rehabilitation of Cocoa)
(10)		Glenn Trout*, PADF consultant (Increased Revenue for the Cocoa Grower through the Use of By-Products)
	. Rapporteur:	Harold Jones*, PADF St. Vincent Cocoa Advisor
(45)	Questions and answers	
4:00-4:30	Coffee break	
4:30-5:30	RECAPITULATION BY PANEL MODERATORS: PANELS I THROUGH VI	
5:45 PM	Bus leaves IICA for Hotel	
Evening Free	Check for special audio-visual presentation scheduled at the Holiday Inn Hotel	
7:00-7:30 PM	Dr. Frederico Alvarez Afonso* (Associate Secretary General for CEPLAC-Brazil): "Cocoa and the Amazonia Region"	

Day 3: Thursday, January 29

7:30 AM	Bus leaves Hotel for CATIE

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At CATIE, Turrialba, Costa Rica

9:30-10:00	Arrival at CATIE . Moderator: Dr. Rodrigo Tarte, Director CATIE (welcome)
10:00	Audio-visual presentation
10:30-1:00	Guided field visit - CATIE specialists (the collection, experiments, seed production, reproduction, variability, crop management, processing of seeds, industries processing, final products)
1:00-2:00 P.M.	Lunch break and exhibit of Costa Rican cocoa products
2:00-3:30 P.M.	Panel VII: RESEARCH AND RESULTS, TRANSFER OF TECHNOLOGY
(15)	. Moderator: Gustavo Enriquez*, CATIE Cocoa Advisor (Monilia)
(15)	. Members: Jesus Sanchez*, FHIA/Honduras, Cocoa Advisor
(15)	Dr. Lawrence H. Purdy*, ACRI Scientific Advisor (International Witches Broom Project - a Model for Progress through Cooperation)
(15)	Dr. Paul Fritz*, Penn State Univ. Theobroma Cacao DNA as Marker for Plant Breeding
	. Rapporteur: Dr. O. Hess*, PADF Sr. Cocoa Advisor Eastern Caribbean
(30)	Questions and answers
4:00-4:30	Coffee break
4:45	Bus leaves for San Jose
Evening Free	Check for special audio-visual presentation scheduled at the Holiday Inn Hotel

Day 4: Friday, January 30

9:00 AM	Bus leaves Hotel for IICA

At IICA

9:40 -11:10 A.M.	Panel VIII: SOURCES OF ASSISTANCE
(10)	. Moderator: Brian Rudert*, AID/LAC Cocoa Advisor
(10)	. Members: Roberto Bronkhorst*, Agriculturist, World Bank
(10)	Jose Soto Angli*, IDB, Chief, Livestock and Commercialization Section, Division de Desarrollo y Analisis de Proyectos
(10)	Peter Fehr*, Grenada Cocoa Proj.Off, CIDA
(10)	Louis Miller*, Belize Prm.&Trg Off/ Peace Corps
(10)	Lewis Townsend*, Vice President, PADF (PVO technical assistance and project devt).

(30)	Other bilat./intl. donors, questions/answers . Rapporteur: Phoebe Lansdale*, PADF, Program Director
11:10-11:40	Coffee break
11:40-12:00	RECAPITULATION BY PANEL MODERATORS: PANELS VII & VIII
12:00-1:15	CONCLUSIONS AND RECOMMENDATIONS: First Session
1:15-2:30 PM	Lunch break
2:30-4:30	CONCLUSIONS AND RECOMMENDATIONS: Final Session
5:00-5:45	CLOSING CEREMONY
(15)	Feature address: Dr. Jorge Soria*, IICA cocoa advisor (an answer to "Why Cocoa?")
(10) (10)	Thank you's: Norberto Ambros*, PADF Projects Officer Nadine Plaster*, Director, USAID/ROCAP
(10)	Closing Address: His Excellency Jorge Manuel Dengo, Vice-President of Costa Rica
6:00 PM	Bus leaves IICA for Hotel
8:00 PM	Closing Dinner

* - Participation confirmed.

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