

UNCLASSIFIED

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
Washington, D. C. 20523

BELIZE

PROJECT PAPER

COMMERCIALIZATION OF ALTERNATIVE CROPS

AID/LAC/P-244

Project Number:505-0008

UNCLASSIFIED

AGENCY FOR INTERNATIONAL DEVELOPMENT

PROJECT DATA SHEET

1. TRANSACTION CODE

A = Add
 C = Change
 D = Delete

Amendment Number

DOCUMENT CODE

3

COUNTRY/ENTITY

BELIZE

3. PROJECT NUMBER

505-0008

4. BUREAU/OFFICE

LAC

5. PROJECT TITLE (maximum 40 characters)

Commercialization of Alternative Crops

6. PROJECT ASSISTANCE COMPLETION DATE (PACD)

MM DD YY
09 30 91

7. ESTIMATED DATE OF OBLIGATION (Under "B" basis, enter 1, 2, 3, or 4)

A. Initial FY 85 B. Quarter 1 C. Final FY 89

8. COSTS / 1000 OR EQUIVALENT \$1 = BZ (\$2)

A. FUNDING SOURCE	FIRST FY 85			LIFE OF PROJECT		
	B. FX	C. LIC	D. Total	E. FX	F. LIC	G. Total
AID Appropriated Total						
(Grant)	1575	700	2275	4707	2093	6800
(Loan)						
Other: 1						
U.S. 2						
Host Country		680	680		680	680
Other Donor(s)						
TOTALS	1575	788	2363	4707	2773	7480

9. SCHEDULE OF AID FUNDING (\$000)

A. APPROXIMATE PRIOR ACTION PURPOSE CODE	B. PRIMARY TECH CODE	D. OBLIGATIONS TO DATE		E. AMOUNT APPROVED THIS ACTION		F. LIFE OF PROJECT	
		1. Grant	2. Loan	1. Grant	2. Loan	1. Grant	2. Loan
(1) ARDN 140	070			2275		6480	
(2)							
(3)							
(4)							
TOTALS				2275		6480	

10. SECONDARY TECHNICAL CODES (maximum 6 codes of 3 positions each)

11. SECONDARY PURPOSE CODE

12. SPECIAL CONCERNS CODES (maximum 7 codes of 4 positions each)

A. Code

B. Address

13. PROJECT PURPOSE (maximum 480 characters)

To expand the base of economic activity in Belize by developing alternative agricultural products for export and for import substitution.

14. SCHEDULED EVALUATIONS

Interim MM YY 05 88 Final MM YY 01 89

15. SOURCE/ORIGIN OF GOODS AND SERVICES

000 941 Local Other (Specify)

16. AMENDMENTS/NATURE OF CHANGE PROPOSED (This is page 1 of 2 page PP Amendment)

17. APPROVED BY

Signature

Title

Acting AID Representative

Date Signed

MM DD YY
08 14 85

18. DATE DOCUMENT RECEIVED BY AID/W, OR FOR AID/W DOCUMENTS, DATE OF DISTRIBUTION

MM DD YY

UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D C 20523

PROJECT AUTHORIZATION

(Amendment No. 1)

Name of Country/Entity: Belize
Belize Agri-Business Company

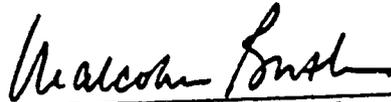
Name of Project: Commercialization of Alternative
Crops Project

Number of Project: 505-0008

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, the Commercialization of Alternative Crops Project was authorized on September 11, 1985 (the "Project Authorization"). The Project Authorization is hereby amended by deleting Section 1 thereof in its entirety and substituting in lieu thereof the following:

"1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Commercialization of Alternative Crops project for Belize, encompassing a grant to the Belize Agri-Business Company (BABCO) and a grant to the Government of Belize (GOB), and involving planned obligations not to exceed Six Million Eight Hundred Thousand United States Dollars (US \$6,800,000) in grant funds ("Grant") over a four-year period from date of authorization, subject to the availability of funds in accordance with the A.I.D. OYB/allotment process, to help in financing foreign exchange and local currency costs for the project. The planned life of the project is sixty (60) months from the date of initial obligation."

2. Except as expressly modified or amended hereby, the Project Authorization remains in full force and effect.



Malcolm Butler
Acting Assistant Administrator
Bureau for Latin America
and the Caribbean

EP 24

Date

Clearances:

GC/LAC:	RBMeighan	<i>RB Meighan</i>	Date	<u>9/18/85</u>
LAC/DR:	ILevy	<i>ILevy</i>	Date	<u> </u>
LAC/DP:	WWheeler	<i>WWheeler</i>	Date	<u> </u>
LAC/DR:	DJohnson	<i>DJohnson</i>	Date	<u> </u>
LAC/CAR:	ECampbell	<i>ECampbell</i>	Date	<u>9/18/85</u>
LAC/DR:	EZallman	<i>EZallman</i>	Date	<u>9/18</u>
LAC/DR:	SRyner	<i>SRyner</i>	Date	<u>9/18</u>
LAC/DR:	BSevern	<i>BSevern</i>	Date	<u>9/18</u>
LAC/DR:	DSteen	<i>DSteen</i>	Date	<u>9/19</u>

PG
GC/LAC: PGJohnson/tim:0201B:9-16-85

- / -
UNITED STATES INTERNATIONAL DEVELOPMENT COOPERATION AGENCY
AGENCY FOR INTERNATIONAL DEVELOPMENT
WASHINGTON D C 20523

ASSISTANT
ADMINISTRATOR

PROJECT AUTHORIZATION

Name of Country/Entity: Belize
Belize Agri-Business Company

Name of Project: Commercialization of Alternative Crops
Project

Number of Project: 505-0008

1. Pursuant to Section 103 of the Foreign Assistance Act of 1961, as amended, I hereby authorize the Commercialization of Alternative Crops project for Belize, encompassing a grant to the Belize Agri-Business Company (BABCO) and a grant to the Government of Belize (GOB), and involving planned obligations not to exceed Six Million Eight Hundred Thousand United States Dollars (US \$6,800,000) in grant funds ("Grant") over a three-year period from date of authorization, subject to the availability of funds in accordance with the A.I.D. CYB/allotment process, to help in financing foreign exchange and local currency costs for the Project. The planned life of the Project is sixty (60) months from the date of initial obligation.

2. The Project consists of technical and financial support to develop the capacity of Belize's private and public sectors to implement significant agricultural diversification in key agricultural areas of Belize.

3. The Cooperative Agreement and the Project Agreement, which may be negotiated and executed by the officer to whom such authority is delegated in accordance with A.I.D. regulations and Delegations of Authority, shall be subject to the following terms and conditions, together with such other terms and conditions as A.I.D. may deem appropriate.

a. Source and Origin of Commodities, Nationality of Services

Commodities financed by A.I.D. under the Grant shall have their source and origin in Belize or in the United States, except

as A.I.D. may otherwise agree in writing. Except for ocean shipping, the suppliers of commodities or services shall have Belize or the United States as their place of nationality, except as A.I.D. may otherwise agree in writing. Ocean shipping financed by A.I.D. under the Grant shall be financed only on flag vessels of the United States or countries included in A.I.D. Geographic Code 941, except as A.I.D. may otherwise agree in writing.

b. Conditions Precedent to Disbursement

BABCO

(1) Prior to any disbursement, or the issuance by A.I.D. of commitment documentation under the Cooperative Agreement with BABCO, BABCO will, except as A.I.D. may otherwise agree in writing, furnish to A.I.D., in form and substance satisfactory to A.I.D., evidence that BABCO has established a separate bank account to control the receipt and disbursement of all Project funds.

(2) Prior to any disbursement for subcontracted technical assistance for production or marketing, or to the issuance by A.I.D. of commitment documentation pursuant to which disbursement will be made, BABCO will furnish to A.I.D., in form and substance satisfactory to A.I.D., the prime contractor's implementation plan and budget for the first year of the Project's activities.

GOVERNMENT OF BELIZE

(3) Prior to any disbursement or the issuance by A.I.D. of commitment documentation under the Project Grant Agreement with the GOB, the GOB shall furnish to A.I.D., in form and substance satisfactory to A.I.D., an implementation plan and budget for the first year of the public sector component activities, including a scope of work for long-term technical assistance.

c. Covenants

(1) BABCO shall covenant that, in addition to the first implementation plan and budget, it will furnish to A.I.D., in form and substance satisfactory to A.I.D., annual implementation plans for project financial activities.

(2) BABCO shall covenant that A.I.D. will brief and debrief subcontractors and consultants financed under the Cooperative Agreement and will be furnished, in form and substance satisfactory to A.I.D., copies of reports produced by such persons.

(3) The GOB shall covenant that, in addition to the first implementation plan and budget, it will furnish to A.I.D., in form and substance satisfactory to A.I.D., annual implementation plans for Project activities.

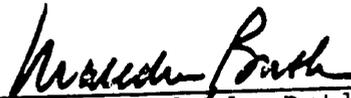
(4) The GOB shall covenant that A.I.D. will brief and debrief subcontractors and consultants financed under the Project Agreement and will be furnished, in form and substance satisfactory to A.I.D., copies of reports produced by such persons.

d. Waivers

(1) The requirement for non-restrictive specifications is hereby waived in order to permit the proprietary procurement of approximately seven (7) Ford vehicles and spare parts, with a value not to exceed One Hundred Seven Thousand United States Dollars (US \$107,000).

(2) The requirement for shipping by U.S. flag vessels is hereby waived in order to permit payment for shipment on vessels registered in countries included in A.I.D. Geographic Code 899, subject to re-examination if a U.S. flag vessel becomes available at a later date. I hereby certify that the interests of the United States are best served by permitting financing of transportation services on ocean vessels under flag registry of free world countries other than the cooperating country and countries included in A.I.D. Geographic Code 941.

(3) The requirement for technical assistance and training from the United States is hereby waived in order to permit the procurement of technical assistance and training from Belize or countries included in A.I.D. Geographic Code 941.



Malcolm Butler
Acting Assistant Administrator
Bureau for Latin America
and the Caribbean

SEP 11 1988

Date

Clearances:

LAC/DR, DJohnson	<u>DBA</u>	Date	<u>8/2/85</u>
GC/LAC, RBMeighan	<u>W. J. [unclear]</u>	Date	<u>8-5-85</u>
LAC/DP, WWheeler	<u>W. J. [unclear]</u>	Date	<u>9-11-85</u>
SER/COM, WSchmeisser	<u>W. J. [unclear]</u>	Date	<u>9-26-85</u>
LAC/CAR, MDagata	<u>E. J. [unclear]</u>	Date	<u>9-21-85</u>

W. J. [unclear]
GC/LAC, PGJohnson/tim:0153B:09-03-85

COMMERCIALIZATION OF ALTERNATIVE CROPS
PROJECT PAPER
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I. PROJECT RECOMMENDATION AND SUMMARY

A. Recommendation

USAID/Belize recommends the authorization of a \$6.8 million grant to support the agricultural diversification and marketing efforts to be made by the private and public sectors of Belize.

B. Summary

Sugar and sugar products are the major source of Belizean export earnings (60%), and an important contributor to national income (20% of GDP) and employment (4,400 farm households and 1,100 factory workers). However, the sugar industry in Belize is in decline, with internal inefficiencies and a shrinking export market. Due to record low prices, the industry recently reduced by 20% prices paid farmers for delivered cane, the lowest price in the industry's history in Belize, and barely adequate to pay the production and transportation costs. In May, Belize Sugar Industries (BSI) announced the closure of one of its two sugar processing plants, which will reduce sugar production by up to 20%. This will have a serious impact on the country's economy and especially on foreign exchange earning capacity.

Because of the decline in foreign exchange earnings from sugar, there is considerable desire in Belize to develop alternative export commodities. The project design team identified fresh vegetables for the U.S. winter market as having the highest potential immediate payoff.

Scarce foreign exchange has traditionally been used to import much of Belize's food and feedstuff requirements including lard and vegetable oil. Development of oilseeds production could replace a portion of the country's lard and vegetable oil imports as well as protein supplement for livestock feed.

The Project will assist the agricultural sector to diversify away from sugar production to mixed farms producing vegetables, oilseeds and grains. To do so, the Project will address several of the constraints to agricultural diversification in Belize. These constraints include a small and easily oversupplied domestic market, limited information on export marketing, limited information on production factors, limited infrastructure for processing, packaging, and storage, and limited research capabilities.

The project goal is to generate increased employment, income and foreign exchange. The project purpose is to expand the base of economic activity in Belize by developing alternative agricultural products for export and for import substitution.

The project consists of private and public sector components. These components are mutually reinforcing. The private sector component will be production oriented. Its emphasis will be on generating adequate information on production alternatives to attract entrepreneurs to invest in the export marketing and/or domestic processing on non-traditional commodities. This

component will consist of creating the Belize Agri-Business Company (BABCO), a Belizean PVO which will be responsible for implementing the other private sector activities: production/marketing of non-traditional export crops; and production/processing/marketing of import-substitution crops.

The public sector component will enable the Ministry of Natural Resources (MNR) to coordinate its activities with BABCO, especially in terms of the research and development work which will be conducted by the MNR on crops for the domestic market. A second activity of the public sector component will focus on the development and implementation of an action plan to carry out the GOB strategy of agricultural diversification.

The Mission will sign a Project Agreement with the GOB and Cooperative Agreement with BABCO. The Ministry of Natural Resources will represent the GOB on the BABCO Board of Directors and will directly and actively participate in the design and implementation of the action plan described above.

The total cost of the project is \$7.5 million. AID will provide \$4.8 million in project grant funds for the private sector component and \$2.0 million for the public sector component. An additional \$480,000 in local currencies from USAID's Economic Support Fund (ESF) balance of payments program will be made available as counterpart to cover local currency costs of the public sector component. The GOB will contribute an additional estimated \$200,000 in local currency in the form of in-kind contributions-salaries and the use of land and facilities. The life of the project is five years.

II. BACKGROUND AND RATIONALE

A. Belize's Macro Economic Situation

Three features stand out in the Belizean economy. First, it is very small. With a total population of 160,000, its domestic market is limited, reducing the scale and profitability of productive activity. Second, it is an open economy with considerable reliance on imports. Nearly all of its investment requirements and a substantial share of its domestic consumption are imported (imports represent, on average, 100% of GDP). Third, its productive economic activity rests on the production of a few agricultural commodities for export. Exports represent some 80% of GDP, and over 80% of its exports are agricultural products. A substantial share of national employment and income derive from agricultural production (45% of GDP, 35% of employment).

These factors combine to make the Belizean economy extremely vulnerable to shifts in world market conditions. Modest shifts can increase its import bill or reduce its export earnings; affect the supply of imported food products and other items into the economy; or force increased borrowing. A reduction in market outlets or prices for Belizean commodity exports reduces employment and income for a sizeable share of the workforce and slows economic growth.

In the past, strong commodity markets, sizeable remittances from Belizeans abroad, and foreign capital inflows have provided a steady flow of foreign

exchange to finance the substantial import bill. In recent years, however, declining commodity prices and a more competitive world market are threatening this balance, jeopardizing the future growth of Belize's economy.

The country's overdependence on sugar is of particular concern. Sugar and sugar products are the major source of export earnings (60%), and an important contributor to national income (20% of GDP) and employment (4,400 farm households and 1,100 factory workers). The sugar industry in Belize is in decline, with internal inefficiencies and a shrinking export market. Due to record low prices, the industry recently reduced by 20% prices paid farmers for delivered cane, the lowest price in the industry's history in Belize, and barely adequate to pay the production and transportation costs. In May, Belize Sugar Industries (BSI) announced the closure of one of its two sugar processing plants, which will reduce sugar production by up to 20%. This will have a serious impact on the country's economy and especially on foreign exchange earning capacity.

The USAID Mission to Belize has targeted these structural economic problems as one of its priorities (April '84 CDSS). Central to the Mission strategy is an effort to identify production alternatives to supplement or replace sugar's role as foreign exchange earner and source of income and employment. Agriculture is the focus for this strategy.

B. THE ROLE OF AGRICULTURE IN THE ECONOMY

Of Belize's estimated 5.7 million acres of land, approximately 2.2 million acres, or nearly 40% are suitable for cultivation, but only about 15% of the total arable land is now being farmed. Expansion of cultivated area is not constrained by physical or legal barriers. More than one million acres of agricultural land is owned by the Government of Belize (GOB), much of it with access to the national road network and available for development by farmers or businessmen, local or foreign, at reasonably low prices.

Of the 354,700 acres of land reported under cultivation, 73,600 acres (20%) are devoted to export crop production. Some 40,100 acres (about 12%) are devoted to basic food production for local consumption. The balance, an estimated 241,000 acres (68% of cultivated area) is in pasture to support cattle production.

The figures below, taken from the recent Agricultural Sector Assessment, indicate crop acreages and production by commodity in 1982.

<u>Commodity</u>	<u>Acreage</u>	<u>Production</u>	<u>Number of Farmers or Farm Establishments</u>
Sugarcane	60,000	1,059,000 long tons	4,400
Citrus	12,000	1,770,000 boxes	360
Bananas	1,600	525,000 boxes	8
Corn	28,000	47,000,000 lbs.	000
Beans	6,200	3,900,000 lbs.	NA
Rice (Paddy)	5,900	17,500,000 lbs.	NA

Expanded crop production is limited primarily by market conditions. Sugar and banana production is directed mostly at protected markets in the U.S. and U.K., as Belizean production of these crops cannot compete with other producers at current and prospective world market prices. Citrus is more price-competitive given current strong world demand, but Belize faces strong competition from Brazil and others for increased shares of that market.

Corozal and Orange Walk Districts have been greatly affected by sugarcane. In Corozal (as of 1980) over half of all households had farms, and 75% of these depended on sugarcane as the main crop. Similarly, 60% of the farms in Orange Walk District depended on cane as the main crop in 1980, while another 27% depended on corn.

Rice is produced both commercially and as a subsistence crop. Other main crops are corn, beans (black and red), sorghum and peanuts. These are produced mainly for home consumption by small- and medium-sized farmers for sale on local markets, although some peanut production is being processed into peanut butter for the domestic market. In general, yields are low resulting in high cost per unit. Some work on yield improvement has been conducted by the Caribbean Agricultural Research and Development Institute (CARDI) on corn and sorghum. Increases in the productivity of these crops would not only improve the incomes of small producers but could also improve the competitive position of the livestock industry.

Given the small size of the domestic market, expansion of production easily leads to oversupply and a sharp drop in prices. The Belize Marketing Board (BMB) was established to help control fluctuations in supply and price levels for certain products (corn, beans, and rice), but has not done so successfully. Export potential for these crops is limited, due to Belize's relatively higher costs of production.

Some adaptive research by CARDI has identified suitable cultivars for soybeans and sesame in Belize. More field testing and on-farm trials are required to determine how such crops might best fit in the farming system. There is potential for local processing of these crops for vegetable oil, and as a byproduct, protein meal for cattle and poultry. This project will fund additional development work on these promising crops.

As a result of these factors, agricultural production has remained concentrated in a narrow range of products. During the period of high commodity prices (through the late 1970's) this product mix offered substantial rewards to Belize. However, in the past several years agriculture has shown no real growth, due primarily to the decline in sugar. At present few products in the sector can compensate for a continuing decline in the sugar industry. While the non-sugar sector has shown some real growth since 1978, it did not keep pace with even the modest growth of the economy as a whole. Limited productive activity in agriculture will continue to limit the sector's growth and capacity to contribute to employment and income.

C. CONSTRAINTS TO AGRICULTURAL DIVERSIFICATION

There is a clear need to broaden the base of economic activity. Given relatively abundant resources in agriculture, that sector can contribute through diversification into alternate crops; Agricultural diversification, however, will not occur spontaneously. There are serious economic and institutional constraints to diversification which include the following:

1. Domestic Market Risk

The domestic market is small and easily oversupplied, which introduces risk in producing fresh fruits and vegetables, for which prices are highly sensitive to changes in supply. Processing for local consumption is limited by diseconomies of scale, and faces price competition from Mexican and U.S. imports. Internal marketing systems are not well organized and are geared primarily to imports. On-farm storage capacity, farm-to-market transport services, and market facilities for fresh produce are all deficient, increasing the risk of marketing losses.

2. Limited Information on Export Marketing

There is very little information available on export marketing opportunities and techniques. Enterprising farmers must rely on outside investors to identify marketing opportunities; this advice has often been unreliable and has led in some recent instances to substantial losses. The very demanding standards for product quality, timing, and price-competitiveness make production for export highly risky.

3. Limited Information on Production Factors

There is a lack of information on the production technologies of non-traditional crops and their respective cost structures. With some two million acres of arable land, information is scarce on what crops and varieties grow well, their performance in different areas and ecological zones of the country, how alternative crops can fit into existing farming systems, and what technologies to use in introducing a new commodity for production and marketing. There are questions concerning what can be produced on a cost-competitive basis. Such information is essential to give farmers and investors the ability to make intelligent planting and marketing decisions. They are not willing to invest in new crops without assurance that their product will find markets at a profitable price.

4. Limited Infrastructure for Processing, Packaging, and Storage

Processing, packaging, and storage facilities are inadequate for many of the export crops being considered for this project. Therefore, facilities for transportation, processing, and local storage must be in place before initial shipments to foreign markets are possible. Belize has had little reason to erect infrastructure for seed-cleaning, produce packing, vegetable freezing, drying or cold storage. Existing exporters of fresh mango, banana, frozen

citrus juice, and beef have their own packing and storage facilities, but these are not situated in the three project target districts.

5. Limited Research Capabilities

The Government of Belize has extremely limited research capabilities. What little research has been conducted in Belize on non-traditional crops has been conducted by CARDI, and has centered on screening and testing of different varieties and cultural practices. While this work has identified some potential productivity improvements in traditional crops as well as some promising varieties of non-traditional crops, it has stopped short of on-farm testing. This work needs to be carried to the next stage in the research-extension process.

6. High Costs of Production

Costs of production are high, not only due to low productivity as pointed out above, but also due to high prices of imported production inputs. The high cost of inputs can be traced first to import duties levied on machinery, fuel, and all agro-chemicals except fertilizer. These commodities are imported in relatively small quantities making volume discount less of a possibility than for larger countries. Because of the small size of the economy, many imports are distributed by a small number of wholesaler/retailers which tends to increase prices. Efforts to structure the economy so as to reduce costs of production, handling, distribution, processing, and export will need to parallel efforts to identify alternative crops which perform well under growing conditions in Belize.

7. Policies Working Against Diversification

In addition, some GOB policies may create disincentives to diversifying agriculture. These include: (a) failure to implement or enforce restrictions on imports of food products which crowd out the small domestic market; (b) ceilings on domestic marketing margins which discourage development of a competitive marketing system for local produce, and may even favor wholesalers and retailers of imports over traders in local products; and (c) granting of exclusive importing privileges to importers of animal feed, fertilizer, and chemicals for crop protection, which have increased costs for these agricultural inputs to artificially high levels.

8. Lack of Production Credits for Non-Traditional Crops

Finally, production credit is not readily available for producers of non-traditional crops, since lenders -- both commercial banks and the state-owned Development Finance Company (DFC) -- require that borrowers first have contracts with marketing agents for sale of their produce. This appears to be directly related to the high perceived risk of cultivating non-traditional crops. Since vegetable production will require irrigation, financing for this will have to be sought. This may become a critical element of USAID/Belize's development credit project or it may be possible for the

U.S. firms interested in marketing the vegetables to supply credit to producers.

Because of these constraints, cultivating non-traditional crops poses substantial risk to any farmer or investor. If Belize is to succeed in broadening its economic base, these risks of diversifying agricultural production must first be reduced.

This project will reduce these risks in several ways designed to put in place, as much and as quickly as possible, direct linkages to the market. First, by developing and providing information on production cost technologies and marketing requirements for which profitable opportunities exist or could be developed. Second, technical assistance will be provided to growers by consultants and experts from the firm(s) who will contract with Belizean growers to purchase their production. Third, the domestic research capacity will be strengthened by providing training and funding for research projects. Fourth, the Government will be encouraged to review their policies and adjust them to support the private sector's accomplishment of diversification objectives, possibly through Balance of Payments support conditionality as described below.

D. Relation to Agency and Mission Program

The AID development strategy with regard to Central America concentrates on four basic elements: economic stabilization, establishment of long-term growth, promotion of equity, and strengthened democratic institutions. The AID strategy for Belize takes into account:

- a relative abundance of undeveloped land resources;
- viable but predominantly low levels of production technology;
- a rural population considered receptive to economic incentives and innovations that will increase farm productivity and income; and
- a favorable investment climate and minimal red tape.

Based on such considerations, the Mission's development strategy (FY 1986 CDSS) focuses on reducing constraints to growth with a program concentrated on economic stabilization in the short run (1984-1986) and on agricultural production and diversification, export promotion and human resource development over the longer term (1986-1990).

Agriculture is the mainstay of Belize's economy. Further economic growth and development of Belize depends on the identification and economic exploitation of crops that will make better use of the agricultural resource base. Further, the Caribbean Basin Initiative (which includes Belize) has provided new opportunities to export non-traditional agricultural commodities to the U.S.

Lack of diversification in the productive sectors is probably the biggest constraint facing long-term economic growth in Belize. This project is one in a series designed to contribute to agricultural development and diversification. The weakest point in the process of agricultural development and diversification in Belize is the market linkage. The project directly addresses this problem in both the private and public sectors. Other Mission projects described in the CDSS and the FY 1986 Action Plan addressing agricultural development and diversification are:

1. Livestock Development, whose purpose is to improve small and medium farmers' production efficiencies in the rearing of livestock and to expand market outlets for the products, primarily through import substitution activities;
2. Rural roads and bridges to improve and maintain current access to markets by farmers;
3. Development credit to establish the rural financial markets and to finance both farm production and agro-industries development.

Another project in the Mission portfolio closely linked to this one is the Export and Investment Promotion Project 505-0027 (EXINPRO), which will build on the regionally funded Project Development Assistance Program (PDAP) and the Mission's small (U.S.\$200,000) export promotion OPG with the Belize Chamber of Commerce and Industry (BCCI). Both are modest efforts in their final phases. PDAP's and the OPG's primary objectives are local institutional development and investment promotion leading to export expansion. Related objectives include employment generation, and diversifying the economic base of the country. EXINPRO will build on and institutionalize work done by PDAP and the OPG to promote agricultural and industrial export development, as well as tourism. Its focus will be on financing searches for investors and new markets, locating joint-venture partners, promoting Belizean products, and carrying out feasibility studies. That project will be broad in scope, encompassing the development of light industry, tourism and possibly fishing in addition to agriculture in order to increase foreign exchange earnings. Although agriculture will be only one of several areas addressed, the design will seek complementarity with this project. For example, while this project will focus on putting in place linkages to the market such as packing/shipping, EXINPRO may promote additional investments/joint-ventures in production to feed into packing/shipping operations. EXINPRO would also assist in extending this project to other areas of Belize.

Another complementary project will consist of an OPG with the Belize Enterprise for Sustained Technology (BEST), an indigenous PVO. BEST will assist and improve cooperatives and associations of producers throughout the country. In the northern districts, this will help to establish linkages to the farmer, as well as provide an institutional base for continuation of activities after the end of this project.

The Mission's Balance of Payments/ESF project 505-0012 includes policy conditionality which addresses policy constraints described above. For

example ceilings on domestic marketing margins will be dealt with by both changes in the Belize Marketing Board (BMB) and implementation recommendations of the ESF grant-funded studies in domestic pricing policy and Belize's trade regime. The Mission conducts ongoing policy dialogue on other constraints, such as the granting of exclusive importing privileges to importers of animal feed, fertilizer, and chemicals for crop protection. Since Balance of Payments support will likely extend beyond the current Agreement (6/30/86), the Mission will have the opportunity to further deal with agricultural policy constraints through conditionality in new Agreements. Balance of Payments conditionality, supported by the AID funded policy analyst, will be the chief vehicle for bringing about improvements in agricultural policy. The public sector component of this project provides little leverage for direct policy changes. However, in improving the MNR's capacity to carry out the GOB's agricultural diversification strategy in general, the project will enable the MNR to implement policy changes leveraged by other projects.

E. Relationship to GOB Agricultural Strategy

The number one priority of the recently elected Belizean Government is to achieve balance of payments by reducing import payments and by earning additional foreign exchange. The government will focus on agriculture, as well as on tourism and mariculture (shrimp farming) to achieve these objectives. Diversification through production of alternative crops for export as well as import-substitution is fully in line with the Government's priority objective.

Of particular concern to the Government is the need to identify crops which can serve as alternatives to sugarcane. Record low sugar prices have substantially reduced the returns from cane production, and farmers' incomes in the cane-growing areas have plummeted in the past two years, putting strong pressure on the Government to respond.

The proposed project is also consistent with the GOB and AID policy of facilitating private sector contribution to national development. The Government strongly supports the private sector's role in developing alternative crops for exports or import substitution. The Ministry of Natural Resources (MNR) considers this project an important one deserving of its full support. During the design process, the Ministry provided a senior Agricultural Officer to assist the Project Paper Team in the design of the project.

F. Other Donor Activities

Belize's major partners in development efforts have been the British Government's Overseas Development Agency (ODA), the Caribbean Development Bank (CDB), the Canadian International Development Agency (CIDA), and the European Development Fund (EDF). Since Independence in 1981, the U.S. Government has established a bilateral aid program with the GOB through the USAID Mission to Belize.

Other international donors include the World Bank, with primarily infrastructural projects, and possibly soon, the International Fund for Agricultural Development (IFAD).

Private voluntary organizations (PVOs) active in Belize include Partners of America (Michigan Partners), Pan-American Development Foundation (PADF), HELP for Progress, BEST (Belizean Enterprise for Sustained Technology), and the National Development Foundation of Belize (NDFB).

Some projects undertaken by the aforementioned donors that relate to this project include:

1. Caribbean Development Bank (CDB)

The CDB has been a major source of development financing in Belize. Currently, the CDB is the source of 65-70% of the on-lending credit portfolio managed by the country's development bank, the Development Finance Corporation (DFC). The DFC was created in 1961 as a fully owned Government statutory corporation to provide medium and long-term development credit. Between 1973 and 1982, loans for agricultural development totaled U.S.\$13.0 million, or 55% of the total loan portfolio.

2. Partners of America - Michigan Partners

The GOB has entered into an agreement with Michigan Partners to upgrade the curriculum of the Belize School of Agriculture (BSA). The goal is to achieve a higher level of competency in the BSA graduates, so that those who are interested could continue and complete BS degrees in agriculture at Michigan State University.

3. HELP for Progress and Belizean Enterprise for Sustained Technology (BEST)

Both of these Belizean PVOs work with agricultural cooperatives to make them viable, credit worthy organizations. BEST activities to be supported by an OPG, beginning early FY1986, will include the northern districts. The BEST OPG will provide this project with linkages to cooperatives, associations, and farmers.

4. Pan-American Development Foundation (PADF)

PADF, with USAID funding, is carrying out a project to assist the GOB in developing a cocoa production industry by expanding small scale cocoa production. PADF is working in cooperation with the Hershey Corporation in transferring the production technology developed at their farm in Belize to small farmers interested in cocoa.

5. National Development Foundation of Belize (NDFB)

The NDFB provides financial resources and technical assistance to small scale entrepreneurs in all walks of life in Belize. During their first six months

of operation in 1984, approximately 15% of their assistance went to agro-business or food processing enterprises.

6. International Fund for Agricultural Development (IFAD)

IFAD has designed a very comprehensive program for the Toledo District of Belize. The Mission is considering becoming involved in the IFAD program through a 'buy-in' arrangement. If it is done, provisions for commercial viability of Toledo farms may be included in the program. While not specifically aimed at agricultural diversification, once the IFAD program and this project are underway, USAID will consider extending this project's activities to the Toledo District.

III. DETAILED PROJECT DESCRIPTION

A. Goal and Purpose

1. Goal: To generate increased employment, income, and foreign exchange.
2. Purpose: To expand the base of economic activity in Belize by developing alternative agricultural products for export and for import substitution.

B. Project Strategy

The primary focus of this project will be on private sector efforts to develop non-traditional agricultural products which will, in some cases replace sugarcane as a crop and in other cases, be added to the cropping system of the farmer. The products to be developed will be both for the export market and for domestic use.

Because of the decline in foreign exchange earnings from sugar, there is considerable desire in Belize to develop alternative export commodities. The project design team identified fresh vegetables for the U.S. winter market as having the highest potential immediate payoff. Other potential products include more exotic products such as ornamental foliage, cut tropical flowers, vanilla, ginger, and any other commodity which may be identified as suitable. There may also be a longer run potential for frozen vegetables and other processed products.

Belize has traditionally imported much of its food and feedstuff requirements including lard and vegetable oil. CARDI has conducted some research work on soybeans, sesame, and other oilseeds, such as corn, which show positive results. Development of oilseeds production could replace a portion of the country's lard and vegetable oil imports, as well as protein supplement imports for livestock feed.

Since the project will focus on the development of non-traditional crops, there are no existing producer organizations with which the project could work. To fill this gap the project design team (composed of Mission, AID/W, GOB, and contracted personnel) proposed that a non-profit private company be organized under the laws of Belize. While the Board of Directors will be

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primarily private sector entrepreneurs, appropriate public sector interests will be represented. This company, named Belize Agri-Business Company (BABCO), has been formed. The private sector component of the project will be implemented through a Cooperative Agreement with BABCO. The terms of the Cooperative Agreement will provide for the engagement of a Prime Contractor who will have overall implementation responsibility.

The Prime Contractor, utilizing several sub-contractors, will be primarily responsible for the identification of potential crops (both for export and import substitution), gathering available information regarding production/processing/marketing of these commodities, developing additional information where required and the organization of these commodities for commercialization. Commercialization involves the transition process between R&D work and marketing at a level with significant positive economic consequences. In the case of export crops, particularly vegetables for the U.S. winter market, commercialization will involve U.S. firms with established markets and in-house expertise working as sub-contractors. The Prime Contractor will be in contact with packer/shippers from the outset of the project in order to obtain their input regarding information required prior to their involvement. Once adequate knowledge is available, it is anticipated that the firms already involved in the project, preferably in coventure with Belizean entrepreneurs or associations of growers, will handle the organization of production and commercialization stages.

The cane farmers in Belize are organized into an association of producers. The members contribute an amount per ton of cane as dues to run the association. The association purchases fertilizer and other inputs in bulk and makes them available to members. The association also represents the interests of members in dealing with the sugar company, the GOB and the banking system. This is one example of a self-supporting producers organization which the project will attempt to foster.

In the case of domestic crops, the Prime Contractor will determine production/processing feasibility and will work closely with the MNR extension service on the production side and with appropriate local businessmen for the purpose of product processing and marketing. It is anticipated that investment credit for such activities will be available either through existing lines (i.e. the Commercial Bank Discount Fund) or from the USAID/Belize Planned Development Credit Project.

The public sector component of the project will focus on assisting the MNR in evaluating its human and financial resources as well as identifying the new resources required to implement and sustain the GOB agricultural diversification strategy of encouraging private sector involvement in domestic and export crop production, processing and marketing. This effort will culminate in the development of a specific plan for MNR strengthening. The project will also provide the requisite funding to put the resulting recommendations into action, including technical assistance, and re-training of personnel.

The principal target beneficiaries of this project are the sugarcane farmers and any other farmers who will diversify their production. Corozal, Orange Walk, and Cayo Districts have been identified, primarily based on climatological data as the most appropriate areas of Belize for the production of the commodities which have been selected for initial work. The vegetable crops will require substantially more labor per acre than sugarcane and therefore will also benefit laborers in these areas. Belizean entrepreneurs

who are willing to invest in agri-business development, for both export and domestic crops will also benefit.

C. Outputs and Inputs

The project consists of private and public sector components. These components are mutually reinforcing. The private sector component will be production oriented. Its emphasis will be on generating adequate information on production alternatives to attract entrepreneurs to invest in the export marketing and/or domestic processing of these non-traditional commodities.

The public sector component will involve assisting the MNR in the evaluation of its role as the country's agricultural sector moves into the production of new crops. The plan to strengthen the MNR will more clearly define the role of the public sector. This will likely include expansion of protection for public health and safety activities, establishment of grades and standards, and initiation of market intelligence services and market conduct activities. It is through these support activities that the MNR will assist Belizean and foreign entrepreneurs in the assessment of new investment opportunities.

1. Private Sector Component

a. Outputs

i. Activation of the Belize Agri-Business Company (BABCO)

The Belize Agri-Business Company (BABCO) has been established as an independent organization capable of fulfilling the necessary requirements for implementation of the private sector component of the project. BABCO is registered under the laws of Belize as a company limited by guarantee and not having share capital, which parallels the standard non-profit corporate structure in the United States. The Articles and Memorandum of Association are attached in Annex 7.

The stated objectives of BABCO are to mobilize Belizean resources, both public sector and private sector to:

- facilitate development and commercialization of Belize agricultural products for export as well as import substitution.
- provide technical assistance to new and existing agri-businesses involved in the commercialization of Belize agricultural products and agricultural production inputs related to the agricultural diversification effort.
- facilitate the promotion of Belize agricultural products for both domestic and international markets.

The project will provide funding to support a cooperative agreement between USAID/Belize and BABCO designed to achieve the above objectives. These funds

will be used for contract services, commodities, and training through a Prime Contractor.

BABCO will be governed by a Board of Directors composed initially of four private sector members and three public sector members as follows:

Permanent Secretary, Ministry of Natural Resources - alternate - Chief Agricultural Officer

Director of Economic Affairs (Office of Economic Development) - alternate - Senior Economist

General Manager, Development Finance Corporation - alternate - Head of Agricultural Division

Members of the Private Sector were recommended to be the Secretary of the Belize Cane Farmers Association, a representative from the Belize Investment and Export Promotion Unit, as well as two private sector members at large.

BABCO will be a private sector organization, however, public sector interests will be represented. BABCO's by-laws provide that a quorum for any meeting of the Board of Directors can only be established if a majority of the Board members present represent the private sector. The Articles of Association provide for adding private sector members to the Board but limit public sector membership to the initial composition. It is anticipated that as producer's associations are established around the new commodities which will be produced, they will be considered for membership on the Board.

Since the primary focus of this project will be the northern districts, an office will be established in Orange Walk. The Prime Contractor will work out of the Orange Walk office.

ii. Production/Marketing of Non-Traditional Export Crops

As mentioned above, a significant portion of the funds made available under the Cooperative Agreement with BABCO will be used to contract the services of a Prime Contractor. This contractor will have overall responsibility for project implementation and will carry out an initial reconnaissance in country. In consultation with the sub-contracted marketing expertise (packers/shippers and brokers) and knowledgeable Belizeans, the contractor will select potential crops. After the potential crops have been selected, the contractor will encourage the involvement of the same packer/shippers becoming involved in the process of organizing the production, providing fieldmen to assist farmers, handling the packing, shipping, and final sale of produce in the United States. This might be done by packer/shipper alone or preferably in coventure with Belize entrepreneurs. Certainly the contractor and BABCO will encourage coventures. The packer/shipper may purchase the crop on a contracted basis from local farmers or handle the crop on a commission basis.

In either case, packer/shippers, with the assistance of the Prime Contractor, will organize the producers, draw up contracts, and establish planting and harvesting schedules. The packer/shipper will provide an adequate number of fieldmen to assist the growers with production problems such as weed and pest control. The packer/shipper will establish packing location and supply the packing equipment, packages, and shipping containers.

The packer/shippers who will be involved in the field trials and related research work will be sub-contracted by the prime contractor. These same packer/shippers and/or others who become involved in the organization of producers and packing and shipping the produce will not be under contract but rather will enter the venture on their own.

The marketing specialists may indicate to the contractor that additional information or services are required in order to reduce risk. In this case, the contractor will arrange for the generation of this information or service. It is anticipated that this may involve some field trials on farmer's land, an assessment of irrigation potential, soil analyses, availability of land preparation machinery, etc. The exact sequence of events will vary for each target commodity because there will be varying information gaps and perceived risk. Based on guidance from the BABCO Board and USAID, the contractor will endeavor to eliminate the constraints to the profitable production and marketing of non-traditional export crops.

It is estimated that at least two commodities will have been developed to the commercial stage by the end of the project. These commodities will be produced on approximately 3,000 acres and will be generating U.S.\$15 to U.S.\$20 million of foreign exchange for Belize.

iii Production/Processing/Marketing of Import Substitution Crops

The objective of this project is to not only diversify agriculture from a national point-of-view but also from the perspective of the individual farmers. It is not anticipated that the farmers benefiting from this project will become mono-culture vegetable producers. The Prime Contractor and BABCO will also focus attention on non-traditional crops with import substitution potential. Soybeans and sesame varieties have been screened by CARDI and show promising results. While additional testing on farmer's fields will be required, work on processing both for oil and as a direct animal feed is essential in order to assess the economic feasibility of these crops.

The contractor will arrange for the additional field testing of these promising crops, probably through CARDI. At the same time the contractor will arrange for feasibility assessments of oil extraction and refinement, oil meal production, and processing for direct animal feeding. Once the information is developed and analyzed, if either or both of these products proves feasible economically, the contractor and BABCO will seek local entrepreneurs to enter into processing. The contractor and BABCO may assist in the start-up of such a business by providing technical advice, services, and assisting in acquiring specialized equipment. It will, however, be the responsibility of the local entrepreneurs to raise the required capital for such a venture. Once a viable processing enterprise is in the formation stage, the Prime Contractor will be working closely with the MNR extension service to interest farmers in soybean and sesame production.

The contractor will also assess the agricultural sector for other constraints where technical assistance and research and development is required. The exact nature of these constraints will depend, to some extent, on the results of the other research and development work both on export crops and the oilseeds. It is expected, however, that this element of the contractor's work will involve assisting Belize businessmen and farmers in the multiplication, processing, storage, and distribution of seeds such as soybeans and sesame. It will also involve assisting local wholesalers or producer associations in arranging for the import of appropriate agricultural inputs (vegetable seeds, agro-chemicals, irrigation equipment) for the non-traditional crops being developed.

The contractor will also work with the MNR and CARDI to develop a research program aimed at increased productivity of principal staple commodities for the local market. This will include corn, sorghum, and fruits and vegetables. Many of these crops are currently produced in sufficient quantities for local consumption but yields are below potential, resulting in high cost. The objective would be to improve yields and lower costs.

As pointed out in the Environmental Assessment, this project will in all likelihood promote the use of pesticides in both non-traditional as well as traditional crops. The Prime Contractor will be responsible for insuring that the use of pesticides recommended by any personnel associated with this project is in conformance with AID regulations. This will be included as a provision of the contract and will apply to both sub-contractors and local hire personnel. The Prime Contractor's budget includes resources as outlined in the Environmental Assessment.

It is anticipated that this project output will result in the production and processing of 4,000 acres of sesame and 6,000 acres of soybean. The sesame production from 4,000 acres at 800 lbs./acre would translate into approximately 640 tons of crude oil and 944 tons of 30% protein meal. The 6,000 acres of soybean at 1,760 lbs./acre would translate into approximately 602 tons of crude oil, 4,510 tons of 47% protein meal, and 111 tons of soapstock. The crude oil once refined and acceptable to consumers could replace by volume approximately 50% of vegetable oil and lard imports into Belize. The protein meal once processed and incorporated into stable animal feeds could suffice the present plant protein requirements of the feed industry in Belize.

b. Inputs

The total cost of the private sector component of the project is estimated as U.S.\$4.8 million and will be implemented by a grant funded cooperative agreement with BABCO. The U.S.\$4.8 million grant will fund:

(a) Ten person years of long-term technical assistance through a Prime Contractor which will include a Chief-of-Party, an agricultural economist, and an agronomist. Including support costs, long-term personnel will cost approximately U.S.\$1.75 million.

(b) Short-term technical assistance of approximately 33 months will be utilized to perform specialized consulting services, feasibility studies, system and equipment needs analyses, and other tasks as required by the project (approximately U.S.\$264,000).

(c) An estimated staff of Belize local hires for administrative and technical support to total about 24 person years (U.S.\$319,000).

(d) International travel and per diem by and project staff (U.S.\$155,000).

(e) Purchase of six vehicles for the Prime Contractor's logistical support (U.S.\$92,000).

(f) Operating expenses including fuel and maintenance, office rent, utilities, supplies and equipment plus local travel (U.S.\$178,000).

(g) Subcontracts for R&D processing, field trials, marketing information and services, and related work (U.S.\$615,000).

(h) Administrative costs of project (U.S.\$400,000).

(i) Cost of project evaluation and audit (U.S.\$180,000).

(j) Contingency/inflation factors (U.S.\$848,000).

2. Public Sector Component

a. Outputs

i. Participation in BABCO

As mentioned above, the public sector will be represented on the Board of BABCO by the Permanent Secretary of MNR, Director of Economic Affairs, and the General Manager of the Development Finance Corporation. It is expected that the Permanent Secretary of MNR as the Chairman of the Board will play the lead role for the public sector. This is intended to provide the appropriate linkage between the activities of the contractor, the private sector producers and businessmen, and the MNR. This linkage will be important in terms of the research and development work which will be conducted by the MNR and by CARDI on crops for the domestic market. It will also be important as the MNR analyzes and develops an action plan for agricultural diversification.

ii. Development of an Action Plan

Utilizing resources provided by the project to MNR, the services of a management consultant with experience in the public sector will be obtained to assist in the development and implementation of an action plan for carrying out the strategy of agricultural diversification. This will be a separate and distinct contract from the Prime Contractor described in the private sector component.

It is anticipated that as the agricultural sector diversifies away from sugar production to mixed farms producing grains, oilseeds, vegetables, and other crops, the traditional functions and services provided by the MNR will also need to change. The consultant hired under this component will assist MNR staff in assessing these potential new functions to determine the priority needs, in the context of its current functions, the human and financial resources available, and existing physical infrastructure. This assessment will begin with a zero-based analysis of the MNR role in the agricultural diversification process. This assessment will examine the Agriculture Department of the MNR including the research division, extension service, Central Farm, and Belize School of Agriculture (BSA). The assessment will recommend the program of work to be followed in the first three entities. It will define the MNR role in providing incentives, protecting the public health and safety, grades and standards for agricultural commodities, market intelligence, and market conduct.

Areas to be considered in the assessment of the Belize School of Agriculture may include a program designed to increase emphasis on basic skills (oral and written communications, math, science and economics), management skills (including exposure to microcomputers), and the addition of internships, especially in the private sector. This could provide relevant learning experiences and develop linkages between the school and the private sector.

Because the MNR budget is not expected to increase, it is anticipated that the action plan will require some reorganization and retraining of staff as well as redeployment of other resources.

In addition to the MNR agricultural diversification action plan, a time-phased implementation program will also be developed. The consultant hired under this component of the project will assist the MNR during the implementation phase. This is expected to involve on-the-job training, assistance in the procurement of updated equipment identified in the plan, and short-term expertise to initiate each of the new or modified functions to be undertaken by MNR. It is anticipated that management training will be especially important as MNR moves toward improved operational efficiency.

b. Inputs

The total cost of the public sector component is estimated at U.S.\$2.68 million which will be funded by a U.S.\$2.0 million grant to the MNR and U.S.\$0.68 million of ESF local currency made available by the GOB to MNR. The AID grant will fund:

(a) Approximately two person years of long-term technical assistance and support costs (U.S.\$426,000) during the phase of implementation of the action plan.

(b) 24 person months of short-term staff to carry out the assessment, analysis, and planning services (approximately U.S.\$257,000).

- (c) International travel and per diem for long and short-term staff (U.S.\$80,000).
- (d) The purchase of a support vehicle, fuel and maintenance, and office supplies and equipment (U.S.\$43,000).
- (e) Equipment needed to activate plans developed with MNR (U.S.\$250,000).
- (f) Equipment purchase to strengthen the BSA (U.S.\$83,000)
- (g) Subcontracting of research work, probably through CARDI (U.S.\$300,000).
- (h) Short-term, out-of-country technical training for MNR personnel required to meet project implementation projections (U.S.\$90,000).
- (i) Project evaluation of project (U.S.\$100,000).
- (j) Contingency/inflation (U.S.\$371,000).

The GOB resources will not be allocated to increases in personnel, but mainly to operating expenses to make existing human resources more effective .

The GOB contribution to the public sector component of the project is approximately U.S.\$680,000 to be expended as follows:

- (a) Personnel assigned to project (U.S.\$150,000 in-kind contribution).
- (b) Operating expenses such as fuel and maintenance, equipment installation, travel, and office support (U.S.\$356,000).
- (c) Land and facilities as required for project (U.S.\$50,000 in-kind contribution).
- (d) Contingency/inflation (U.S.\$124,000).

IV. COST ESTIMATES AND FINANCIAL PLAN

This project will total U.S.\$7.48 million, of which U.S.\$6.8 million will be an AID grant, with the remaining funds coming from ESF local currency and in-kind contributions. ESF local currencies (\$480,000) and in-kind contributions for salaries (\$150,000) and land and facilities (\$50,000) total \$680,000 and represent 25% of total project costs of the public sector component. The life of project is five years, from FY85 through FY90. AID funding will be obligated in FY's 85, 86, 87, 88. Annex 10 contains the detailed financial tables for the project, including project expenditures by fiscal year, costing by inputs/outputs, methods of implementation and financing, and unit cost data.

The following is a summary breakdown of contributions to the project, and the specific inputs to which contributions will be made.

	AID FUNDING		GOB FUNDING	LOP	PERCENT
	FX	LC	(U.S. \$000)		
Specific Inputs					
Technical Assistance	2,169	762	0	2,931	39.18%
Local Staff	0	318	150	468	6.26%
Vehicles & Equipment	468	0	0	468	6.26%
Operating Expenses	38	140	406	584	7.81
Sub-Contracts	640	275	0	915	12.23%
Admin-Evaluation/Audit	539	231	0	770	10.29%
Contingency & Inflation	<u>853</u>	<u>367</u>	<u>124</u>	<u>1,344</u>	<u>17.97%</u>
Total Project Funding	4,707	2,093	680*	7,480	100.00%

*\$480 to be funded by ESF local currencies while \$200 will be in-kind contributions.

The largest line item in the budget is technical assistance representing 39% of total project costs. Of this amount 74% is allocated to the private sector component and 26% to the public sector effort. Short-term TA to be subcontracted totals \$915,000 and represents 12% of total project costs. The major focus of the technical assistance will be on production oriented research and development activities related to the production and marketing of non-traditional exports and the production/processing/marketing of imports substitutes - outputs two and three of the private sector component. Local staff, vehicles and equipment, and operating expenses represent 6%, 6%, and 8% of total project costs respectively.

Funds totaling \$770,000 or 10% of total project costs have been budgeted for administration, evaluation, and audit of the project. Two evaluations are planned, the mid-project near the end of year two and the final during year five.

Inflation estimated at 5% compounded while contingencies were included at a flat 10%.

The following table presents summary costs by component:

SUMMARY PROJECT COSTS BY COMPONENT
LOP (U.S.\$000)

	I	II
	<u>Private Sector</u>	<u>Public Sector</u>
Technical Assistance	2,169	762
Local Staff	318	-
Vehicles & Equipment	92	376
Operating Expenses	178	-
Sub-contracts	615	300
Off Shore Training	-	90
Admin-Evaluation/Audit	580	100
Contingency & Inflation	<u>848</u>	<u>372</u>
Total Components I & II (AID Funded)	\$4,800	\$2,000
GOB Funded		\$150
Personnel		\$406
Operating Expense		<u>\$124</u>
Contingency & Inflation		
Sub Total GOB		\$680
Total Component II		\$2,680

Expenditures are expected to occur as follows:

(IN U.S.\$000)

<u>YEAR</u>	<u>AID GRANT</u>	<u>ESF LC</u>	<u>GOB IN-KIND</u>	<u>TOTAL</u>	<u>%</u>
1986	627	48	40	715	10
1987	1,421	55	40	1,516	20
1988	2,154	150	40	2,344	31
1989	1,634	152	40	1,826	24
1990	964	75	40	1,079	15
Total	6,800	480	200	7,480	100

The Methods of Implementation and Financing for this project as currently envisioned by the Mission are discussed in Table 8 of Annex 10. As shown in that table, the Mission proposes to utilize Direct Payment and Direct Reimbursement methods of financing for most project inputs, with the exception of commodity procurement requiring foreign exchange for which it proposes to use the Direct Letter of Commitment method. The reason for using the latter mechanism is that neither the GOB nor BABCO will have hard currency to pay in advance for goods. The use of Direct Letters of Commitment will also permit

AID to review documentation prior to disbursement and achieve greater accountability over payments. Use of this method of payment also minimizes the need for advances.

All AID appropriated funds for foreign exchange costs of the private sector component will be managed directly by AID. BABCO will be charged with the responsibility of sound cash management and fiscal control of all funds, including the detailed accounting and reporting on cash receipts, cash outlays and expenditures by obligating documents (any contract to which BABCO is a party). Provisions will be made in the contract with the Prime Contractor to adequately control, account for, and report the use of all project funds. Forms to be used and procedures to be followed by BABCO for discharging its responsibilities will be established by the Mission for local currency and U.S. dollar financing.

To provide the GOB, BABCO, and the Mission with assurance that adequate financial management practices are exercised in handling resources provided under the project, an independent audit of GOB and BABCO financial records for the project will be carried out annually. The cost of these audits will be funded out of the Evaluation Audit line item.

In regard to the project's recurrent costs, BABCO is not expected to continue beyond the life of the project. If the project is successful, financially viable indigenous alternatives will develop - perhaps through cooperatives and associations and building upon the market linkages established by the project. Additional recurrent costs of the GOB as a result of the project are expected to be minimal. They will mainly consist of salaries of personnel already onboard and operational expenses such as local travel, gasoline, and maintenance of equipment.

V. IMPLEMENTATION PLAN

A. Implementation Responsibilities and Administrative Arrangements

The US\$6.8 million grant will be obligated by a cooperative agreement of U.S.\$4.8 million and a grant agreement with the GOB of U.S.\$2 million. The cooperative agreement for the private sector component (U.S.\$4.8 million) will be negotiated with BABCO which will be the primary implementing entity. The grant agreement for the public sector component will be signed with the GOB and will have the MNR as the primary implementing entity.

The specific objectives, budget, implementation requirements, and responsibilities for each activity will be specified in the approval document related to that activity. The majority of the procurement under the project will be by direct AID contract.

A USAID project review committee will (a) periodically review existing and proposed resource allocation under the project including any need to make major changes in it and (b) review obligating documents, and clear and/or make recommendations to the AID Representative according to normal Mission procedures.

A project review committee consisting of the Permanent Secretary of MNR, the Chief-of-Party of the Prime Contractor, and a representative of USAID Belize will meet quarterly to assure proper coordination and progress of activities.

The Prime Contractor will be responsible for negotiating and managing contracts with local entities as well as with U.S. sources for conducting a variety of technical assistance, research and service activities. All subcontracts entered into by the Prime Contractor will be approved by AID. The USAID Belize project's manager will see that the activities of the U.S. contractor(s) are performed in a manner that is in the best interest of the composite program.

1. BABCO

Detailed budgets and workplans will be submitted and reviewed on an annual basis. Approval for costs consistent with the workplan will be made by Implementation Letters and PIOs. The Prime Contractor will be contracted by a direct AID contract.

2. GOB

Detailed budgets and workplans for activities to be implemented by MNR will be approved by AID and the authorized representatives of MNR. Approval for costs according to the workplan may be made by way of Implementation Letters, PIO/Ts, PIO/Cs or PIO/Ps for the activity.

B. Disbursement Procedures

A variety of standard AID disbursement procedures will be employed, depending upon the complexity of each of the approved activities. AID direct disbursement mechanisms will be normal under the project for financing most inputs and controlled at the Mission level. In addition, direct letters of commitment will be utilized for procurement of commodities requiring foreign exchange.

C. Procurement Plan

The selection of consultants and contractors, procurement of equipment and material, shipping and insurance will be done in accordance with standard AID procedures. For those grant-funded acquisitions for which BABCO is responsible, terms and conditions will be specified in the Cooperative Grant Agreement and subsequent Implementation Letters. Project-funded procurements for the GOB component will, in accordance with the Project Authorization, be done by the Mission or AID/W, except on an exceptional basis where it is determined that sufficient capability exists for a particular host-country contracting action.

Vehicles - final details on other equipment.

TA Contracting Arrangements: One Prime Contractor will be awarded the contract for all three long-term TA positions in the private sector

component. A separate contractor will be selected for the public sector component. The Prime Contractor will have responsibility for selecting and sub-contracting all short-term TA but final approval of short-term contractors will be by USAID/Belize and BABCO for the private sector component and USAID and GOB for the public sector component.

D. Gay Amendment Concerns

Every consideration will be given to minority firms for award of the prime contracts. Project implementation plans also call for completion of 87 person months of short-term technical assistance. U.S.\$521,000 has been budgeted for this purpose. The Prime Contractor, BABCO, and USAID will make an effort to identify competent minority, disadvantaged firms to provide these services. To that end, the Prime Contractor will consult the Office of Small and Disadvantaged Business Utilization for a list of potential contractors.

E. Schedule of Major Events

Disbursement of funds is scheduled over a period of five fiscal years. The Project Assistance Completion Date (PACD) will be 60 months from the date of signing of the Grant Agreements (planned for September 15, 1985).

There is time allowed (9 months) at the beginning of the project for project startup and initiation.

ESTIMATED IMPLEMENTATION SCHEDULE

Major Action	Estimated Project Month	Responsible Organization
<u>Private Sector Component</u>		
--AID/W PP authorization	8/85	USAID
--Signing of agreement	9/85	USAID-BABCO
--Initial conditions precedents met	10/85	BABCO
--Advertisement for TA/Issuance of RFTP	10/85	USAID-BABCO
--TA proposals received	1/86	USAID-BABCO
--TA contract awarded	2/86	USAID-BABCO
--Arrival of TA team	6/86	USAID-BABCO
--Programs initiated	6/86	USAID-BABCO
--Program development, initial assessment of project area begins, research begins	7-12/86	USAID-BABCO
-TA team, packer/shippers meet with farmers, select sites and crops for on farm trials - domestic on farm trials begin	9-12/86	BABCO-Packer/Shipper
--Annual review, submittal of plan and budget	11/86	USAID-BABCO
--Evaluation of planting results		USAID-BABCO
-Marketing/shipping trials		
-crops selected for market potential, domestic & exports	12/86-4/87	BABCO-Packer/Shipper

--Marketing plans developed for next season - rainy season or perennial and domestic plantings continued	5-8/87	USAID-BABCO
-Infrastructure needs assessed		
--Selected crops planted	9-12/87	BABCO
--Annual review, submittal of plan and budget	11/87	USAID-BABCO
--Processing/packing infrastructure in place	12/87	BABCO-Packer/Shipper
--First crop(s) ready for shipment and/or domestic marketing	1-4/88	BABCO
--In-depth evaluation	5/88	USAID-BABCO
--Annual review, submittal of plan and budget	11/88	USAID/BABCO
--Evaluation of crops	5-9/88	BABCO-Packer/Shipper
--Marketing and /or shipping of domestic and export crops underway	7/89	BABCO-Packer/Shipper
--Annual review, submittal of plan and budget	11/89	USAID-BABCO
--Advisors leave	6/90	Contractor
--Independent, in-depth evaluation	6/90	Contractor
--Project termination	9/90	USAID

Public Sector Component

--AID/W PP authorization	8/85	USAID
--Signing agreement	9/85	USAID-GOB
--Initial conditions precedent met	10/85	GOB
--Advertisement for TA	12/85	USAID
--TA proposals received	2/86	USAID
--TA contract awarded	5/86	USAID-GOB
--Contractor begins assessment and preparation of action plan	10/86	USAID-GOB
--Contractor's team leader arrives	10/86	USAID-GOB
--Annual review, submittal of plan and budget	11/86	USAID-GOB
--Short-term training and plans for equipment acquisitions	11/86	USAID-GOB
--Annual review, submittal of plan and budget	11/87	USAID-GOB
--Annual review, submittal of plan and budget	11/88	USAID/GOB
--Prime Contractor's team leader returns to U.S.	11/89	USAID/GOB
--Annual review, submittal of plan and budget	11/89	USAID/GOB
--Independent, in-depth evaluation	6/90	Contractor
--Project termination	9/90	USAID

In addition to the above schedule of major events, quarterly progress reports will be held with USAID/Belize. The Prime Contractor will submit quarterly progress reports.

VI. MONITORING PLAN

A. AID Project Monitoring Arrangements

Project monitoring will be exercised by a Project Manager assigned by USAID's Agricultural Development Office (ADO). The ADO Project Manager will work closely with BABCO and MNR to assure that project implementation plans and objectives are met. In addition the Agricultural Development Officer or his/her designate will be an ex-officio member of the BABCO Board of Directors.

In accordance with Mission policy, project review meetings will be held monthly to review and direct project implementation. The AID Representative will chair the meetings. Representatives from the Agricultural Development Office, the Program and Project Development Office, and Controller's Office will participate in the meetings.

Offices will have the following responsibilities:

1. The Agricultural Development Office will have responsibility for overall implementation.
2. The Program and Project Development Office will monitor project implementation to assure that the terms and conditions of the Project Agreements are met and will assist in carrying out reviews and evaluations.
3. The Mission Controller, who will review disbursement and reimbursement requests for conformity with AID regulations and will ensure that adequate financial controls are exercised.

B. Assessment of AID Monitoring Capability

It is expected that given the level of Mission staff, on-board and planned, that there will be no difficulty in carrying out project monitoring responsibilities.

VII SUMMARIES OF ANALYSES

A. Technical Analysis

1. Agronomic Description

a. Soils

A variety of soils are found in the three target districts and very limited detailed information is available on their characteristics and distribution. From the available information 'Redzina' soils show the greatest agricultural potential.

The Project Paper team identified 'Louisville Clay', a 'gumbo' black clay overlying limestone as the best distributed soil in the Corozal District. An

important soil found in the Orange Walk District is the 'Lazaro Sandy Clay' which is usually 18 inches deep, underlain with soft limestone which weathers quickly. In the Cayo District two types of soil predominate. The 'black soil' is a shallow clay soil underlain by weathered limestone and the 'red river soil' is an alluvial, reddish brown, loamy clay soil located near the Belize River.

The pH of soils in the three target districts would range between 7.0 and 8.0, generally decreasing from north to south. Alkaline soils would suggest the possibility of minor element deficiencies. Also, the present fertilization practices indicate a phosphorus deficiency.

In selecting sites for project implementation, soil suitability will be a major consideration. Once sites are selected, existing and potential problems in soil fertility, mechanical properties, etc. will be addressed and incorporated into technological production packages developed for each specific crop.

b. Topography

The topography in Orange Walk and Corozal Districts and in the northern portion of Cayo District can be described as 'flat undulating and rolling land' and few slopes exceed 5%. In the western portion of Cayo District and south of the Belize River, the topography can be described as 'hilly'. Some slopes approach 15-20%. Altitudes vary from sea level in the northern districts to approximately 500 meters in the western portion of the Cayo District. Topography in the target districts in the general concept presents no restrictions to the project. Selected sites depending on soil depth and specific topography may have to be leveled if irrigation and drainage are deemed necessary.

c. Climate and Precipitation

Annual average precipitation in Corozal is approximately 56 inches, in Orange Walk at San Pablo, 53 inches, and in Cayo at Central Farm, 65 inches. Seasons are depicted as (i) 'dry' season which occurs from January to May and (ii) 'rainy' season which occurs from June to December. Slight variation (15-30 days) in these trends are observed frequently. In Orange Walk and Corozal Districts average precipitation greater than 2.5 inches is observed in all months except January, February, March, and April; while in Cayo average precipitation greater than 2.5 inches is observed in all months except March and April.

The months which have the greatest opportunity for fresh vegetable exports to the U.S. are October through April. From available data some irrigation might be needed to supplement average rainfall in the drier months to reduce risks. However, of greater concern is excess precipitation and high humidity which can lead to environmental conditions where economic control of fungal diseases cannot be achieved. Drainage in anticipation of excess precipitation may have to be considered.

Feedgrains and oilseeds are not so sensitive to precipitation, as in fact best yields may be obtained during the 'rainy season'. They could possibly be grown in Cayo from May to December and Corozal and Orange Walk from June to October without irrigation if other agronomic requirements can be met.

d. Irrigation and Drainage

Corozal and Orange Walk Districts and portions of the Cayo District are located in the Coastal Plain and Shelf Groundwater Province. Groundwater in this province is tapped from limestone and is characterized by uncertain supply and/or questionable quality. Some portions of the Cayo District are located in the Campur Groundwater Province and good quality water should be available less than 150 meters deep.

The prevalence of shallow soils, the quantity and quality of available groundwater, the lack of existing irrigation and drainage technology for the scope of this project, the site specific topography, and other relevant factors make the utilization of appropriate irrigation and drainage techniques very challenging. The project will address these considerations as the need arises and specific appropriate schemes developed and implemented.

e. Pest, Diseases and Weeds

Pests and diseases in Belize are not expected to be significantly different from similar environments in neighboring countries. Recent reports and conversations have enumerated particular problems such as Fusarium, Nematodes, virus infestations, bacterial wilts, aphid and worm attacks, and fruit rots.

The presence of Cyperus Rotundus (Purple Nutsedge) has been observed in some fields in Belize. This presence will affect production costs if it is controlled. Confirming the rules and regulations specified in the Environmental Analysis Annex and the guidelines for Belize outlined by the Ministry of Natural Resources, GOB, specific crop protection packages will be developed. All presently identified problems are solvable but the economic cost will have to be assessed by the project.

2. Export Crop Potential

In the U.S. the consumption of fresh produce has been steadily increasing in recent years. Countries in the Caribbean and Central America have increased their interest in the development, expansion, and promotion of agricultural exports, especially non-traditional exports. The variety of fresh fruit imported from the West Indies is greater than from Central America. One reason for this difference is due to fresh produce import restrictions established by USDA/APHIS/PPQ. To be able to import fresh produce from Belize into the U.S., a permit is required from this organization. This is a routine procedure and no problems are anticipated.

Also, each commodity will have a unique production period because of dynamic supply/demand characteristics of the market. Belize will have to be able to produce identified commodities for specific periods.

Important factors in selecting crops for export production include price, production capability, cost of production, allowable exports, ease of production, perishability, availability, and cost of developing processing and transportation networks both in and out of Belize. An initial rank of potential export crops was determined using most of these criteria. (See Table 1). Crops that may also be considered and not ranked primarily because they require a high level of specialized production expertise and contractual market access that would be possible only through long-term commitment by foreign buyers are: ornamental flowers, cut tropical flowers, vanilla, certified seed, frozen vegetables, and dry ginger.

3. Domestic Crop Potential

The project has the potential to significantly decrease the importation of animal feed, lard, edible oil, onion, prepared foods, cabbage, and other minor vegetables. These represent a total import figure of BZ\$13.6 million.

Emphasis will be placed on the promotion of soybean and sesame production. With the projected acreage of 4,000 acres of soybean and 6,000 acres of sesame, it would be possible to suffice the plant protein requirement for local animal feed from the protein meal demand and also replace approximately 50% of the vegetable oil and lard imports. These estimates are made with modest productions of 1,760 lbs./acre of soybean and 800 lbs./acre for sesame. Soybean and sesame varieties have been screened by CARDI and show promising results. Additional testing on farmers' fields under varying environmental conditions will be required along with the assessment of appropriate technologies for processing into oil and protein meal. Once the information is developed and analyzed, if either or both of these products proves feasible the contractor and BABCO will seek entrepreneurs to enter commercial production.

Also targeted are production technologies to increase efficiencies of production for local feed grains namely, corn, beans, and sorghum. With a reduction in production costs and the inception of locally produced protein meal it is believed that animal feed costs will be substantially reduced therefore providing an incentive to livestock producers to increase their production. This could also significantly affect imports by replacing imported processed meats if modern, adaptive processing technology, now addressed in the current livestock project, is adopted by local processors.

Also addressed would be the stimulation of local production of presently imported vegetables which can be grown and are cost competitive. Included in these may be onion, cabbage, carrots, etc. This activity can be coordinated with the development work of export oriented vegetables.

B. Economic and Financial Analysis

The project consists of two components, one of which is production oriented while the other is aimed at institutional strengthening. These two components

are mutually reinforcing. As the agriculture sector moves from the traditional crops currently being grown to those which will be promoted by component I of the project, the public sector role will, in all likelihood, change. The objective of component II (Public Sector) is to facilitate that change.

A separate economic and financial analysis could be conducted for each component of the project. However, since the abovementioned linkage exists, it is assumed that the production projected would not be forthcoming (at least not in the quantity and quality estimated) if the MNR is not strengthened as planned. In addition, the direct benefits resulting from the institutional strengthening activity are, by and large, intangible in nature. Therefore the economic and financial soundness is assessed on the project as an integral activity.

The analysis was initiated in the traditional manner by estimation of farm level, per acre cost of production for the primary crops to be produced as well as for those which may be replaced. Although data is somewhat scarce in Belize, these budgets (presented in Annex 9) were estimated at current market prices for the financial analysis. The prices in these budgets were then adjusted to reflect the value to the nation as a whole for the economic analysis.

The first step in adjusting the market prices to economic values was to remove all direct transfer payments. This involved, primarily, import duties on imported agricultural inputs. These included 70% on pick-up trucks, 20% on irrigation equipment, and 10% on agro-chemicals except fertilizer.

The second step in adjusting the prices was to account for the slightly overvalued exchange rate. This adjustment was applied only to traded goods. The official exchange rate is BZ\$1.9825 to 1 U.S.\$. The shadow exchange rate was estimated at BZ\$2.10 to 1 U.S.\$. An adjustment was made for all imports and exports when prices were converted from Belize dollars to U.S. dollars.

Once the crop budgets were prepared in both market and economic prices, some assumptions were made about the 'without' and 'with' project cases. For the sake of simplicity, it was assumed that crops produced under this project would be grown on land currently under production with no expansion in total productive acreage. This however, will be dependent on the relative profitability of using already cleared land or preparing new land for production. The project will promote the production of fruits and vegetables for the U.S. winter market, and stimulate the production of soybean and sesame for domestic consumption. The analysis assumes that the value of the production of these new crops will result in 3,000 acres of fruits and vegetables replacing 17,000 acres of cane. Also, 6,000 acres of soybean and 4,000 acres of sesame will substitute for 6,000 acres of corn, 5,000 acres of beans, and 4,000 acres of rice. To the extent that the new crops are actually grown on expanded acreage, rather than replacing traditional crops, the benefits would increase.

In addition to the cropping pattern assumptions, the analysis assumed certain yields for each of the crops in both the 'without' and 'with' project cases. In the 'without' project case the most optimistic yields contained in the budget tables were assumed. In the 'with' project case the most pessimistic yields were assumed up to year five except in the case of soybean, in which case 1,500 pounds per acre is the minimum considered acceptable for viable production. If yields of this level are not possible, soybeans will not be produced. From the sixth year, it is assumed that melon and cucumber yields increase to the second levels presented in the budgets. In the 'without' project case, optimistic (high) yields were assumed while in the 'with' project case low but realistic yields are used. Annex 9 presents the crop budgets in both financial and economic prices for the various yield levels as well as the cropping pattern and yield assumptions.

Table 1 of section VII B presents the computation of the financial internal rate of return (IRR) based on the assumptions stated above. The traditional approach of a discounted cash flow analysis is used. The first two columns of Table 1 contain the planned project costs (both components). The next two columns contain the net revenue streams based on the 'without' and 'with' assumptions. These net revenue streams are derived by multiplying the net revenue per acre figures in the crop budgets times the assumed acreages at the assumed yield level. The projects costs and the 'without' project net revenue stream (first three columns) are subtracted from the fourth column to produce the net benefit flow contained in the fifth column. The 'without' project net revenue stream is netted out because the net benefit flow is to represent only the incremental net benefits over and above what would occur without this project. As can be seen from the Table, the financial internal rate of return is adequate at over 24%. Although the IRR was calculated by computer, the discount factor for 25% and the discounted cash flow are presented for reference. No sensitivity analyses were conducted on the financial price data.

This analysis has been conducted from the point of view of the target beneficiary - the farmer. The financial rate of return is one indicator of the expected return on the project resources. It is defined as the interest rate at which the present value of the estimated incremental net benefit flow resulting from the project is zero.

Table 2 of section VII B presents the computation of the economic internal rate of return using the same methodology as above. While the IRR is lower, it remains in the acceptable range at over 11%. This represents the return resulting from the project to the country of Belize.

It should be pointed out that for both the financial and economic portions of this analysis, some of the potential benefits have not been included because it was not possible to quantify them. These included benefits to Belize of the formal and informal training which is planned. As mentioned above, it is difficult to measure the benefits to strengthening the MNR in terms of the public safety, etc. On the production side, time did not permit the consideration of the additional jobs and income which will result from the packing, shipping, and processing of the increased output. There are in all likelihood, other benefits which were not considered. These would, to the extent that all costs have been captured, increase the IRR.

In any analysis of this sort, the analyst is usually asked to defend the validity of the assumptions. One way to test the assumptions is to conduct some sensitivity analyses, i.e. vary the assumptions and observe the change in the IRR. A number of these tests were conducted. The computations are presented in VII B Tables 3, 4, and 5.

Because of the rather high per acre net revenue for the melons and cucumbers, especially compared with cane, the acreage under cultivation is an obvious area of probable sensitivity. Table 3 demonstrates that the economic IRR falls to about 4% if the project only manages to reach a level of 2,000 acres of melons and cucumbers rather than the 3,000 anticipated. The 3,000 acre target is based, on the one hand, on the minimum considered necessary to begin to make the transportation economical, and on the other, the amount required to generate the foreign exchange expected to be lost from sugar exports. Table 4 also assumes an acreage of 2,000 but increases the yield of melon and cucumber to the maximums contained in the budget tables. In this case the economic IRR returns to an acceptable level of over 14%. This exercise demonstrated the critical nature of the acreage assumptions. It will be important in project implementation to strive for the 3,000 acre target. This is considered by the technical personnel of the design team to be within the reach of the project.

Finally, the sensitivity analysis assumes the original acreage and yields for the 'with' project scenario, but assume that sugarcane yields fall to 15 tons rather than 20 tons in the 'without' project scenario. This is a highly realistic assumption, since the current yields are reported to be falling due to low input use and extended rotation between replanting. Under this assumption, the economic IRR increases to nearly 18%.

Based on the above analysis, the project design team concluded that the project will have an overall rate of return to society in excess of 10%. Given the assumptions and data available, it is considered very likely to exceed this rate of return.

C. Social Soundness Analysis

1. Social Context

Historically, Belize has never had an economic or cultural base in agriculture. Small holder agriculture was systematically suppressed as a threat to control the labor force needed for the export of logwood and mahogany. As the logging industry began an uneven decline at the end of the 19th century, small holders began to settle small villages in the countryside where they pursued subsistence agriculture. Small Belizean farmers are concentrated in areas which were once public land and on a few private holdings that were expropriated by the Government in the 1970s for distribution to farmers.

There have been many attempts, beginning in the late 19th century, to establish commercial export agriculture in Belize. The sugar industry was first established in the 1850s by Mayan immigrants from Mexico. It was one of the first such cash crops, and has been the most enduring, though the industry has been progressively concentrated in fewer, larger enterprises since its inception. Other crops, like bananas, ramie, cocoa, coconuts, and rubber have come and gone with fluctuations in world markets. A major barrier to all labor-intensive export crop production over the years is the relative scarcity of farm labor. Because most of the rural population is involved in subsistence farming, they are only available for commercial farm labor on a seasonal basis, and the high cost of living in Belize in general means that labor is quite expensive compared with neighboring countries.

Today the farm population is extremely diverse, scattered widely in small settlements. Average settlement size varies from district to district from about 300 up to 500 persons. The largest rural communities are found in the north, where villages have the best access to social services, electricity, and potable water.

Most farmers use some variant of slash-and-burn farming (milpa) to produce basic subsistence foods (corn, rice, vegetables, and root crops). Community rural life includes many short periods of full- or part-time work on farms or in town, seasonal farm labor, and short-term urban migration, interspersed with periods of residence and work on a family subsistence farm. Most farmers produce some cash crops, but are hindered by local markets that are easily saturated, and by the lack of an adequate system of rural bulking or wholesale markets. There are very few middleman-entrepreneurs who buy at the farm and sell in town. Rural producers must therefore transport and sell the crop themselves, which is expensive and time-consuming for those who are distant from towns.

The cash crop varies widely according to the area of the country and the ethnicity of the producer. In the Cayo and Belize Districts, milpas are turned into rough pasture for cattle after the corn crop. Vegetables and fruits are often grown on a more permanent basis on small mechanized plot. In the north sugarcane is dominant.

2. Project Beneficiaries

The project will work in three districts of the country, Cayo, Corozal, and Orange Walk. In the broadest sense, the entire Belizean economy stands to benefit from this project if it is successful. Direct beneficiaries will be the farmers and their families who are directly involved in crop production.

a. Cayo

Of the three districts to be involved in the project, Cayo is probably the most diverse in terms of farming systems. Included in the area are Mennonite farmers practicing low-technology mixed farming and livestock production; Maya milpa farmers, many of whom have begun mechanized farming of corn and peanuts as cash crops; large Creole, Mestizo, and expatriate landholders who have hundreds of acres of prime farmland under pasture and who often have other sources of income than farming; Creole and Mestizo tenant-farmers who feed themselves and a few cattle on their land but work in citrus, cane, logging or chicle for much of the year; and a scattering of American and European expatriate farmers producing anything from ornamental plants to yoghurt. What they all have in common are the problems of a limited market for their produce. When asked what their problems are in farming, almost all farmers will say "a lack of market for my crops". Other problems of land, technical inputs, credit, and knowledge will surface once a market is available.

There are a substantial number of farmers, perhaps as many as 1,000, who have land, access to mechanized equipment, and sufficient family labor, to participate. The largest and best capitalized farmers are likely to be able to move fastest in taking advantage of the crops developed under this project. Particular attention should be paid to communication channels in presenting the results of the project to the least wealthy and poorest educated farmers. Nevertheless, there are no specific cultural or social obstacles to innovation in crops or farming systems among these farmers.

b. Corozal and Orange Walk Districts

These two districts are culturally homogeneous, being settled mostly by Maya/Mestizo descendants. They are subsistence farmers with some cash producing enterprises like fishing, hog-rearing, work on sugar estates, logging, and chicle gathering. The major change in the economy of the area has been the rapid increase in production of sugarcane, from 4,503 tons in 1955 to 43,400 tons in 1966 to 114,278 tons in 1983 to 105,000 tons in 1984. A major impact of the decline in sugar prices has been the closing of the Libertad sugar factory, which put over 1,000 people out of work.

c. The Sugar Problem

Up until 1972, the vast majority of cane was grown on the large plantation of Belize Sugar Industry (BSI). At that time GOB and BSI agreed to transfer production to small farmers, and established canefields were sold to 220 farmers with eight years to pay. A system of quotas for delivery of cane to

the factory was established, and over the next years many new quotas were issued, reaching to a total of 4,955 licensed quota holders in 1984.

The advent of cane farming as a source of cash caused drastic changes in the culture and social structure of the north, with the changes beginning earlier in Corozal District where the first modern factory was established. A number of studies of the area found some decrease in nutritional standards, less economic autonomy for women, an increase in social and economic inequality, and much strain in the fabric of community and village life. Political opportunism and village factionalism made community action very problematic. On the other hand, the family network proved very durable, and cane production became increasingly a family business as groups of related farmers pooled their labor in farming, and their capital in order to invest in equipment and new technologies for crop production. Other effects of the rise of cane as the major cash crop, was a rapid rise in disposable income and living standards, a rapid decline in food production in the area, and a rise in the price and value of land.

Since the time of the first distribution of quotas (licenses) for cane delivery, a number of changes have taken place in the system which makes it extremely difficult to tell the exact number and nature of the present cane farming population. The net result of these changes today is that there is no longer a close relationship between the statistics available from the Cane Farmer's Association (CFA) on the number of license holders, and the actual number of cane farmers, or the actual acreage or distribution of cane plantings. Some farmers grow cane, but have no license, and thus must sell their cane at a lower price. This number could be estimated at 500 - 1,000. These producers have very small operations, and cane provides their major source of income. The total number of cane farmers at present, subtracting the 20% of quota holders who have no farm, and another 5% for families with more than one quota, and adding 500 - 1,000 who have no quota, would yield a range of between 4,250 and 4,750 active cane farmers. This is not the total number of possible beneficiaries for the present project in the two districts, however. Because of the high price of haulage per ton of cane, and the historical growth of the industry from centers around the two factories, there are a number of villages in the two districts that have never participated fully in the cane boom, though their members may have worked in the fields of other villages. Working from the 1980 census, which lists a total adult male population for the rural areas of the two districts of about 8,400, and allowing for about 10% of rural population not involved in farming, this leaves about 3,100 rural adult male farm population who are not cane farmers. Many of these are undoubtedly day laborers, but many others are subsistence farmers, Mennonites, and other marginal members of the farm population who will be interested in participating in new cash crop opportunities. The net of possible farm beneficiaries in the two districts should therefore be about 7,000 farmers.

3. Impact

The indirect beneficiaries will be those who will transport, pick and pack new agricultural products as well as those who will supply credit, agricultural inputs, farm equipment and management for new farm enterprises. Many of these will likely be low-paying jobs which will be filled mostly by women and immigrants. There are, in general, no sociocultural obstacles to the adoption of new crops and farm technologies in Belize. Mestizo, Creole, and Maya farmers have proven themselves very adaptive and willing to try new techniques and methods.

The project design team has taken into account a number of factors which may affect specific aspects of the project. These factors include formal and informal farmer organizations, land tenure, credit, land settlement patterns, and the impact on women. As the development of the crops and the marketing system proceeds, currently organized and new farmer organizations will need to be strengthened and will be looked to as valuable assets in the new production systems. Land tenure and access to credit may be constraints to some farmers in the Cayo District, because so much of the land that has good road access is held by a few large holders. There is insufficient data to determine the significance of these problems. In the two other districts land is not a problem. However, holdings may be scattered and varied which may be a problem with crops that require more supervision than cane. In the Maya and hispanic cultures of the north women have major responsibilities for farming intensive home gardens and in the care of domestic livestock. The potential for the production of better quality feed for domestic animals and spice production may lead to the expansion and improvement of traditional areas of female economic activity. The Prime Contractor will be made aware of these factors in order to facilitate the implementation of project activities.

D. Administrative Analysis

It was pointed out in the project description that the design team was unable to identify an appropriate private sector producer's organization or association of agro-industrialists with the capacity to implement the project. Because of this fact and after consultations with both private sector interests and MNR staff, it was decided that a private company should be established. Since BABCO has only recently been created, an assessment of its administrative capacity is not possible.

The public sector component of this project will be implemented by the MNR. As has already been pointed out, the MNR is expected to take on new activities as the agricultural sector diversifies.

At present, MNR is patterned after the traditional Ministry of Agriculture with a central research station, School of Agriculture, and an extension service. In addition to research, the Central Farm is involved in livestock production. The professional staff of MNR are well trained, dedicated individuals who are open to change. The major limitation in staffing is simply that the numbers are small. Given the fact that staff increases are

not expected in the near future, MNR must assess its efficiency and its current deployment of personnel among activities. The project has been designed to provide assistance to MNR to facilitate such an undertaking.

In addition to the development and implementation of the action plan of MNR, the Permanent Secretary of MNR will serve as the Chairman of the Board of BABCO. As Chairman, the Permanent Secretary is expected to provide the linkage between the MNR, the Prime Contractor, and the private sector. The purpose of this linkage is to coordinate the activities of MNR in extension with the activities of the Prime Contractor. This linkage will be extremely important as non-traditional crops reach the point where widespread production is desired.

Given the scope of MNR in this project, it is the assessment of the project design team that adequate capacity currently exists. At the same time, one component of the project is specifically designed to strengthen MNR and to increase its capacity for the future.

E. Environmental Analysis

An Environmental Assessment (EA) was conducted during the preparation of the PP in order to evaluate the foreseeable impacts of the project on the human and natural environment and to suggest measures to reduce or eliminate any undesirable or negative effects. The following represents a summary of the major elements of that EA, attached as Annex 8. A budget for the recommended crop/environmental protection plan has been included in the PP and will be implemented during the LOP.

The direct environmental impacts of this project are likely to be minimal because of limited land intervention and scope of activities which are primarily of an investigatory nature. Pesticides, which represent the principle environmental concern, will be used during the project in the context of experiments and field trials involving a limited acreage and a small number of cooperating farmers, under the supervision of a Prime Contractor. However, there is the potential for more significant long-term and indirect effects on the environment and people of Belize if the project is successful. Crop production technologies developed, including crop protection methods, are intended eventually to be adopted by a large number of farmers in the Corozal, Orange Walk, and Cayo Districts. The major measures proposed to mitigate adverse impacts of pesticide use involve adoption of a crop protection package for each crop species tested during the project. Educational materials will be produced, which will then be available for dissemination to farmers and pesticide distributors involved with follow-on activity.

The design of this project is such that a number of key factors such as selection of sites for research and field trials, types of research to be conducted and crop protection methods to be used, cannot be determined at this time. In lieu of a comprehensive assessment of the environmental soundness of the project, which cannot be done in absence of this information, this EA

identifies as accurately as possible the potential environmental and public health concerns associated with the various stages of the project and identifies measures needed to reduce the hazards.

Clearing of forested lands will not be promoted under the proposed project. If preparation of such new lands for agricultural purposes is proposed during implementation, a new EA will be required.

Because no forested lands will be sought or utilized during the project, no adverse impacts on endangered species or their habitat are anticipated.

Some project activities could occur on gently sloping lands (less than 7° slope), especially in the Cayo District. If such activities are proposed, the following treatment-oriented scheme for intensive tillage and use will be followed:

- Deep (greater than 36 inches)
- Moderately deep (20 - 36 inches)
- Shallow (8 - 20 inches)

Cultivable land up to 7° slope requiring no or few intensive conservation measures such as contour cultivation, strip cropping, vegetative barriers, rock barriers, and in larger farms, broad base terraces; the shallower the soil, the greater probability of need for the above recommended practices.

- Very shallow (less than 8 inches)

Improved and managed pasture only, especially if slope above 5°.

Specific actions needed to place the project in conformity with 22 CFR Part 216 on environmental procedures are listed below. Because the research and development activities will be undertaken by contractors, with relatively little direct AID or GOB involvement, assurance that these actions will be taken must be made by building specific requirements for the provision of resources, equipment, technical assistance and supervision into contractual agreements and by providing for AID and GOB oversight of contractor's activities. An illustrative budget is included in the EA.

The following actions will be incorporated into the proposed project as the designated Environmental Protection Component.

- A. Only those pesticides so indicated in Table 2 of Annex 8 are authorized for on-farm programs within the project (See Section IV, H).
- B. Only those uses approved by the EPA and/or the WHO/FAO, as indicated in Table 3 of Annex 8 are authorized for on-farm programs within the project.
- C. Pesticides identified for use subsequent to the preparation of the PP and EA will require amendment of the EA and are subject to procedures dictated

according to the regulatory status of the compound. Actual procurement or use must be approved in writing by the Mission Director and the AID/LAC Bureau Environmental Officer.

D. The above actions do not apply where the pesticides are used for research or limited field evaluation purposes under supervision of project personnel (See Section IV, H). Requirements declared in Section 216 3(b) (2) iii must be observed. It is recommended that research at Central Farm, or research sites yet to be designated, be limited to pesticides already approved unless alternatives are identified which possess significantly greater selectivity, reduced mammalian toxicity or other environmental advantages.

E. Pesticides, particularly those shown in Table 2 of Annex 8 do present significant hazards to fish and other aquatic organisms, and should not be used in a manner which will lead to contamination of any of the many surface waters of Belize. Where there is risk of water contamination, an appropriate monitoring system should be set in place (See Section IV, E, G).

F. Technical assistance should be obtained for crop protection specialties (entomology, plant pathology, and weed control), for pesticide use and safety training, and, as needed, for monitoring human and environmental exposure to pesticides. It is suggested that crop protection specialists be engaged for a three month period in the first active growing season to assist with identifying research needs. Project personnel and cooperating farmers should receive training in safe pesticide use and principles of pest management before pesticides are disbursed to them. (See Section IV K of Annex 8 for details).

G. The project should be reviewed annually (by crop protection specialists) to evaluate pesticide practices within the project and to advise on any observed or potential hazards being promoted within the project. For the purposes of this review, pesticide use records should be maintained by project personnel.

H. Storage of pesticides used by project personnel and cooperating farmers must meet the following conditions:

1. Pesticides should be stored in a dry, secure area, protected from water and extreme heat.
2. The area must be separated from living quarters and stored food products.
3. A sign (in English and Spanish) indicating "Danger - Poison" should be posted outside the building.
4. Pesticides should be dated upon receipt and stored in non-corrodable containers.
5. Pesticides should be stored in their originally labelled containers. Repackaged, the container must contain a label including the compound name (local trade name), concentration, and proper caution words in English and Spanish. The label must be securely fastened on the container.

6. Disposal of pesticides and/or containers should conform to label instructions. Empty containers should be collected and destroyed to prevent re-use.

I. Handling and use of pesticides by project personnel and cooperating farmers must meet the following conditions:

1. All pesticides must be used with strict adherence to label directions, including crop-use registrations, field re-entry intervals, and pre-harvest intervals.
2. Appropriate, properly maintained equipment and protective clothing must be made available and its use ensured.
3. Precautions must be taken to prevent pesticide contamination of drinking water (See Sections IV, E, G of Annex 8).

J. The following materials should be used in the project only for research purposes, applied by trained personnel, and should not form the basis of any crop protection packages developed and/or recommended: Carbofuran, Monocrotophos, Fenaniphos, Methamidophos, Methomyl, Paraquat, Methyl-partathion, and 2,4-D.

K. Major elements of an Integrated Pest Management (IPM) Program should be developed and implemented during the first year of the project in conformity with general guidelines listed in Section IV, C of the EA (Annex 8).

VII B TABLE 1 COMPUTATION OF THE FINANCIAL INTERNAL RATE OF RETURN DISCOUNTED

YEAR	PROJECT COSTS COMPONENT		NET PROJECT REVENUE		NET BENEFIT FLOW	DISCOUNT FACTOR at 25%	NET DISCOUNTED BENEFIT FLOW
	I	II	WITHOUT	WITH			
(U.S. \$000)							
1	\$594	\$88	\$1,531	\$0	(\$2,213)	0.800	(\$1,770.35)
2	\$1,109	\$389	\$1,531	\$0	(\$3,029)	0.640	(\$1,938.52)
3	\$1,196	\$1,194	\$1,531	\$1,581	(\$2,340)	0.512	(\$1,198.15)
4	\$1,173	\$721	\$1,531	\$1,977	(\$1,448)	0.410	(\$593.77)
5	\$727	\$289	\$1,531	\$3,743	\$1,196	0.328	\$392.27
6	\$0	\$0	\$1,531	\$4,972	\$3,441	0.262	\$901.61
7	\$0	\$0	\$1,531	\$6,099	\$4,568	0.210	\$959.29
8	\$0	\$0	\$1,531	\$6,099	\$4,568	0.168	\$767.43
9	\$0	\$0	\$1,531	\$6,099	\$4,568	0.134	\$612.12
10	\$0	\$0	\$1,531	\$6,099	\$4,568	0.107	\$488.78
11	\$0	\$0	\$1,531	\$6,099	\$4,568	0.086	\$392.85
12	\$0	\$0	\$1,531	\$6,099	\$4,568	0.069	\$315.19
13	\$0	\$0	\$1,531	\$6,099	\$4,568	0.055	\$251.24
14	\$0	\$0	\$1,531	\$6,099	\$4,568	0.044	\$200.99
15	\$0	\$0	\$1,531	\$6,099	\$4,568	0.035	\$159.88
TOTAL	\$4,799	\$2,681	\$22,964	\$67,163	\$36,719		(\$59.13)

FINANCIAL INTERNAL RATE OF RETURN 24.7943%

VII B TABLE 2 COMPUTATION OF THE ECONOMIC INTERNAL RATE OF RETURN DISCOUNTED

YEAR	PROJECT COSTS COMPONENT		NET PROJECT REVENUE		NET BENEFIT FLOW	DISCOUNT FACTOR at 12%	NET DISCOUNTED BENEFIT FLOW
	I	II	WITHOUT	WITH			
(U.S. \$000)							
1	\$594	\$88	\$3,973	\$0	(\$4,655)	0.893	(\$4,156.94)
2	\$1,109	\$389	\$3,973	\$0	(\$5,471)	0.797	(\$4,360.41)
3	\$1,196	\$1,194	\$3,973	\$1,935	(\$4,428)	0.712	(\$3,152.52)
4	\$1,173	\$721	\$3,973	\$2,547	(\$3,320)	0.636	(\$2,111.43)
5	\$727	\$289	\$3,973	\$5,144	\$155	0.567	\$88.06
6	\$0	\$0	\$3,973	\$6,858	\$2,885	0.507	\$1,462.82
7	\$0	\$0	\$3,973	\$8,318	\$4,345	0.452	\$1,963.82
8	\$0	\$0	\$3,973	\$8,318	\$4,345	0.404	\$1,755.27
9	\$0	\$0	\$3,973	\$8,318	\$4,345	0.361	\$1,568.45
10	\$0	\$0	\$3,973	\$8,318	\$4,345	0.322	\$1,399.00
11	\$0	\$0	\$3,973	\$8,318	\$4,345	0.297	\$1,246.94
12	\$0	\$0	\$3,973	\$8,318	\$4,345	0.257	\$1,116.53
13	\$0	\$0	\$3,973	\$8,318	\$4,345	0.229	\$954.94
14	\$0	\$0	\$3,973	\$8,318	\$4,345	0.205	\$890.67
15	\$0	\$0	\$3,973	\$8,318	\$4,345	0.183	\$795.08
TOTAL	\$4,799	\$2,681	\$53,535	\$91,345	\$24,269		(\$500)

ECONOMIC INTERNAL RATE OF RETURN 11.4511%

VII B TABLE 3 SENSITIVITY ANALYSIS OF ECONOMIC INTERNAL RATE OF RETURN

(ASSUMES CUCUMBER AND MELON ACREAGE REACHES ONLY 2000 ACRES)

YEAR	PROJECT COSTS COMPONENT		NET PROJECT REVENUE		NET BENEFIT FLOW	DISCOUNT FACTOR at 12%	DISCOUNTED NET BENEFIT FLOW
	I	II	WITHOUT	WITH			
	(U.S. \$000)						
1	\$594	\$88	\$3,973	\$0	(\$4,655)	0.293	(\$4,156.94)
2	\$1,109	\$389	\$3,973	\$0	(\$5,471)	0.797	(\$4,360.41)
3	\$1,196	\$1,194	\$3,973	\$1,935	(\$4,429)	0.712	(\$3,152.52)
4	\$1,173	\$721	\$3,973	\$2,547	(\$3,320)	0.636	(\$2,111.43)
5	\$727	\$289	\$3,973	\$5,001	\$12	0.567	\$6.67
6	\$0	\$0	\$3,973	\$5,700	\$1,727	0.507	\$875.79
7	\$0	\$0	\$3,973	\$6,500	\$2,527	0.452	\$1,142.08
8	\$0	\$0	\$3,973	\$6,500	\$2,527	0.404	\$1,020.80
9	\$0	\$0	\$3,973	\$6,500	\$2,527	0.361	\$912.15
10	\$0	\$0	\$3,973	\$6,500	\$2,527	0.322	\$813.61
11	\$0	\$0	\$3,973	\$6,500	\$2,527	0.287	\$725.17
12	\$0	\$0	\$3,973	\$6,500	\$2,527	0.257	\$649.37
13	\$0	\$0	\$3,973	\$6,500	\$2,527	0.229	\$578.52
14	\$0	\$0	\$3,973	\$6,500	\$2,527	0.205	\$517.98
15	\$0	\$0	\$3,973	\$6,500	\$2,527	0.183	\$462.39
TOTAL	\$4,799	\$2,681	\$99,595	\$73,622	\$6,505		(\$6,077)

ECONOMIC INTERNAL RATE OF RETURN 3.9317%

VII B TABLE 4 SENSITIVITY ANALYSIS OF ECONOMIC INTERNAL RATE OF RETURN

(ASSUMES CUCUMBER AND MELON ACREAGE AT 2000 BUT MAXIMUM YIELD)

YEAR	PROJECT COSTS COMPONENT		NET PROJECT REVENUE		NET BENEFIT FLOW	DISCOUNT FACTOR at 12%	DISCOUNTED NET BENEFIT FLOW
	I	II	WITHOUT	WITH			
	(U.S. \$000)						
1	\$594	\$88	\$3,973	\$0	(\$4,655)	0.893	(\$4,156.94)
2	\$1,109	\$389	\$3,973	\$0	(\$5,471)	0.797	(\$4,360.41)
3	\$1,196	\$1,194	\$3,973	\$1,935	(\$4,429)	0.712	(\$3,152.52)
4	\$1,173	\$721	\$3,973	\$2,547	(\$3,320)	0.636	(\$2,111.43)
5	\$727	\$289	\$3,973	\$5,001	\$12	0.567	\$6.67
6	\$0	\$0	\$3,373	\$8,353	\$4,380	0.507	\$2,220.75
7	\$0	\$0	\$3,973	\$9,153	\$5,179	0.452	\$2,341.13
8	\$0	\$0	\$3,973	\$9,153	\$5,179	0.404	\$2,092.52
9	\$0	\$0	\$3,973	\$9,153	\$5,179	0.361	\$1,869.80
10	\$0	\$0	\$3,973	\$9,153	\$5,179	0.322	\$1,667.30
11	\$0	\$0	\$3,973	\$9,153	\$5,179	0.287	\$1,486.52
12	\$0	\$0	\$3,973	\$9,153	\$5,179	0.257	\$1,331.13
13	\$0	\$0	\$3,973	\$9,153	\$5,179	0.229	\$1,185.10
14	\$0	\$0	\$3,973	\$9,153	\$5,179	0.205	\$1,061.90
15	\$0	\$0	\$3,973	\$9,153	\$5,179	0.183	\$947.95
TOTAL	\$4,799	\$2,681	\$99,595	\$100,209	\$33,134		\$2,431

ECONOMIC INTERNAL RATE OF RETURN 14.4952%

VII B TABLE 5 SENSITIVITY ANALYSIS OF ECONOMIC INTERNAL RATE OF RETURN

(ASSUMES SUGARCANE YIELDS AVERAGE 15 TON/ACRE RATHER THAN 20 TONS)

YEAR	PROJECT COSTS COMPONENT		NET PROJECT REVENUE		NET BENEFIT FLOW	DISCOUNT FACTOR at 12%	DISCOUNTED NET BENEFIT FLOW
	I	II	WITHOUT	WITH			
(U.S. \$000)							
1	\$594	\$88	\$3,154	\$0	(\$3,836)	0.893	(\$3,425.17)
2	\$1,109	\$389	\$3,154	\$0	(\$4,652)	0.797	(\$3,707.31)
3	\$1,196	\$1,194	\$3,154	\$1,935	(\$3,608)	0.712	(\$2,569.07)
4	\$1,173	\$721	\$3,154	\$2,547	(\$2,500)	0.636	(\$1,590.26)
5	\$727	\$289	\$3,154	\$5,144	\$975	0.567	\$552.69
6	\$0	\$0	\$3,154	\$6,858	\$3,705	0.507	\$1,878.29
7	\$0	\$0	\$3,154	\$8,318	\$5,164	0.452	\$2,334.21
8	\$0	\$0	\$3,154	\$8,318	\$5,164	0.404	\$2,086.33
9	\$0	\$0	\$3,154	\$8,318	\$5,164	0.361	\$1,864.27
10	\$0	\$0	\$3,154	\$8,318	\$5,164	0.322	\$1,662.87
11	\$0	\$0	\$3,154	\$8,318	\$5,164	0.287	\$1,482.12
12	\$0	\$0	\$3,154	\$8,318	\$5,164	0.257	\$1,327.19
13	\$0	\$0	\$3,154	\$8,318	\$5,164	0.229	\$1,182.60
14	\$0	\$0	\$3,154	\$8,318	\$5,164	0.205	\$1,058.56
15	\$0	\$0	\$3,154	\$8,318	\$5,164	0.183	\$945.04
TOTAL	\$4,799	\$2,681	\$47,304	\$91,345	\$36,561		\$5,082

ECONOMIC INTERNAL RATE OF RETURN

17.9217%

VIII EVALUATION AND AUDIT ARRANGEMENTS

Evaluation Plan

1. Annual Reviews

The steps described below will be taken in addition to monitoring arrangements. The Mission will conduct annual reviews with BABCO (including the Prime Contractor and the Board of Directors) and with the MNR to assess progress in achieving the project's objectives, identify methods to improve performance, and consider possible modifications to project implementation and design, as appropriate. As the reviews will be held towards the end of each year, they will serve as the basis for the subsequent year's implementation plan and budget.

2. In-Depth Evaluations

In addition to the annual reviews, the project will have two in-depth evaluations funded by project resources. The mid-project evaluation will take place two and a half years after project initiation and will carefully examine the appropriateness of the design in relation to achievement of the project purpose. This evaluation will assess the extent to which project outputs have been achieved. Therefore, the following areas will be looked at: the operations of BABCO and its Board of Directors, the selection of exportable crops, amount of acreage in export crop production, extent of oilseed production, private/public sector linkages under the project, and extent to which the MNR has adapted to an agricultural diversification orientation.

The recommendations made in the mid-term evaluation will provide guidance to USAID, BABCO, and the MNR on whether the ongoing project activities should be continued, modified or terminated and whether or not new activities will need to be incorporated. It is important to note that given the tentative nature of selecting and marketing export crops, USAID will be evaluating progress on the contractual basis and will make appropriate changes where necessary.

The final evaluation, to take place near the end of the project will not only measure the extent to which objectives have been achieved, but will also examine the need for any follow-up assistance, given the long-term nature of the agricultural diversification and export development strategies.

3. Financial Audits

Sufficient funds are budgeted in the evaluation and audit line item to conduct annual financial audits of BABCO operations. For funds control purposes, this is important given the nature of BABCO - i.e., BABCO will be administered by a Prime Contractor assisted by subcontractors. The audits will examine and render audit opinions on financial reports, analyze and make recommendations on internal control and vulnerability.

IX CONDITIONS COVENANTS, WAIVERS, AND NEGOTIATING STATUS

Two separate agreements will be signed to obligate the project's funds. A Cooperative Agreement will be signed with the BABCO Board of Directors for obligating project funds for the private sector component. A Grant Agreement will be signed with the GOB for obligating project funds for the public sector component. The conditions and covenants to be included in each of the two obligating instruments follow below. The standard conditions precedent requiring legal opinions and naming of authorized and additional representatives will also be included.

A. Cooperative Agreement

1. Conditions Precedent to Disbursement

Except as AID may otherwise agree in writing:

a. Prior to any disbursement, the issuance of any commitment documents under the Agreement with BABCO, BAB shall furnish in form and substance satisfactory to AID:

(i) a statement by the Board of Directors of BABCO in which it names the person empowered in BABCO to receive the funds provided under the Cooperative Agreement and of any additional representatives, together with a specimen signature of each person so designated.

(ii) evidence that BABCO has established a separate bank account to control the receipt and disbursement of project funds.

b. Prior to any disbursement for subcontracted technical assistance for production or marketing, or to the issuance by AID of documentation pursuant to which disbursement will be made, BABCO will present to AID, the Prime Contractor's implementation plan and budget for the first year of the project's activities.

2. Covenants

a. BABCO shall covenant that in addition to the first implementation plan and budget, it will submit to AID for approval annual implementation plans for project financed activities.

b. BABCO shall covenant that AID will be able to brief and debrief subcontractors and consultants financed under the Cooperative Agreement and will be furnished copies of reports produced by such persons.

B. GOB Grant Agreement

1. Conditions Precedent to Disbursement

Except as AID may otherwise agree in writing: Prior to any disbursement of project funds, or to the issuance of any commitment document under the Grant Agreement, the Grantee shall furnish in form and substance satisfactory to AID, an implementation plan and budget for the first year of the public sector component activities, including the scope of work for long-term technical assistance.

2. Covenants

a. GOB shall covenant that in addition to the first implementation plan and budget, it will submit to AID for approval annual implementation plans for project financed activities.

b. GOB shall covenant that AID will be able to brief and debrief subcontractors and consultants financed under the Cooperative Agreement and will be furnished copies of reports produced by such persons.

C. Waivers

1. Competition in the procurement of goods is hereby waived and a single-source negotiated contract is hereby authorized in order to permit this procurement of approximately seven Ford vehicles and spare parts with a value of approximately U.S.\$107,000.

2. The requirement for shipping by U.S. flag vessels is hereby waived. The waiver will permit payment or shipment on vessels registered in AID Geographic Code 899 countries.

3. The requirement for technical assistance and training from U.S. sources is waived. AID Geographic code 941 countries are approved as sources for technical assistance and training.

4. The requirement for host country funding of AID-financed participant travel is waived.

here by
D. Negotiation Status

The project has been jointly developed with members of the BABCO Board of Directors and the Ministry of Natural Resources. The Mission expects that the Agreements will be signed expeditiously after project authorization.

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AID/LAC/DR: MJUNE: CMJ: 1131N
05/10/85 EXT: 632-0246
AID/LAC/DR: DBJOHNSON

AID/LAC/DR: EZALLMAN
AID/LAC/DR/RD: DSTEEEN
AID/PPC/PS: JWEBER

AID/LAC/DR: CPEASLEY
AID/LAC/DR: BSEVERN
AID/LAC/DR: JHESTER

PRIORITY BELIZE

AIDAC

E.O. 12356: N/A

TAGS:

SUBJECT: AGRICULTURAL DIVERSIFICATION PROJECT (505-3008)

REF: STATE 102315

1. A DAEC REVIEWED AND APPROVED THE SUBJECT PID ON JUNE 5. THE FOLLOWING GUIDANCE IS PROVIDED TO ASSIST THE MISSION IN THE DESIGN AND DEVELOPMENT OF THE PP.

2. PUBLIC AND PRIVATE SECTORS. THE RESPECTIVE ROLES OF THE MINISTRY OF NATURAL RESOURCES (MNR) IN RESEARCH AND EXTENSION AND PARTICIPATING PRIVATE ORGANIZATIONS IN PRODUCTION AND MARKETING SHOULD BE CLEARLY DELINEATED. THE FINAL PROJECT DESIGN SHOULD ESTABLISH THEIR RESPECTIVE ACTIVITIES AS DISCRETE AND DIVISIBLE COMPONENTS TO BE EXECUTED UNDER SEPARATE AID AGREEMENTS WITH THE GOB AND PRIVATE SECTOR. CONTRACTING AND GRANT (OPG) ARRANGEMENTS FOR PRIVATE SECTOR ACTIVITIES SHOULD BE DESCRIBED IN DETAIL. SPECIAL ATTENTION SHOULD ALSO BE GIVEN TO ARRANGEMENTS FOR OVERALL PROJECT IMPLEMENTATION AND ADMINISTRATION OF THE TWO COMPONENTS.

3. POLICY DIALOGUE. CONCERN WAS EXPRESSED OVER THE NEGATIVE EFFECT THAT VARIOUS GOB IMPORT REGULATIONS,

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DBJ

MJ *u*

EZ *u*

CP *u*

DS *u*

BS *u*

JW *u*

JH *u*

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INCLUDING LICENSING AND CEILINGS ON DOMESTIC MARKETING MATTERS, WOULD HAVE ON PRODUCTION ACTIVITIES. IN DEVELOPING AND NEGOTIATING THE PUBLIC SECTOR COMPONENT OF THE PROJECT WITH THE GOB, USAID SHOULD APPLY WHATEVER LEVERAGE PROPOSED AID ASSISTANCE WILL OFFER TO OBTAIN COMMITMENTS FOR APPROPRIATE POLICY REFORMS IN THESE AREAS. THE PP SHOULD IDENTIFY MAJOR POLICY CONSTRAINTS THAT CURRENTLY ACT AS DISENCEMENTIVES TO AGRICULTURAL DIVERSIFICATION AND PRESENT A STRATEGY, INCLUDING CONDITIONALITY, FOR DEALING WITH THEM.

THE PP SHOULD ALSO ADDRESS THE PROBLEMS INVOLVED IN EXPANDING THE SCOPE OF CENTRAL FARM RESEARCH ACTIVITIES, WHICH NOW FOCUS ON LIVESTOCK, TO INCLUDE ADAPTIVE RESEARCH IN CROP VARIETIES. THE MISSION SHOULD EXAMINE THE NEED FOR CONDITIONS (E.G. REQUIREMENT FOR ADEQUATE LEVELS OF BUDGET SUPPORT, REDUCTIONS IN CENTRAL FARM PERSONNEL, PROVISION OF THE MINIMUM ACREAGE NECESSARY TO CARRY OUT CROP RESEARCH) TO ENSURE THAT THESE INSTITUTIONAL CHANGES OCCUR. IN DETERMINING THE LEVEL OF MNR INVOLVEMENT APPROPRIATE IN THIS ACTIVITY, THE PP TEAM SHOULD WEIGH THE ADVANTAGES OF A GOVERNMENT INVESTMENT IN STATION-BASED RESEARCH VERSUS THAT OF CARRYING CARDI RESEARCH RESULTS TO THE ON-FARM LEVEL. WHATEVER ROLE IS IDENTIFIED FOR THE MNR, THE PP SHOULD CLEARLY DEMONSTRATE GOB CAPACITY AND COMMITMENT TO SUSTAIN THESE RESEARCH/EXTENSION ACTIVITIES BEYOND THE LIFE OF THE PROJECT.

4. PRODUCT MIX. THE PP SHOULD CLEARLY ESTABLISH THE CRITERIA BY WHICH THE TECHNICAL ASSISTANCE TEAM WILL SELECT THE CROPS THAT WILL BE TESTED UNDER THE PROJECT. THE CRITERIA SHOULD REFLECT ECONOMIC ANALYSES THAT COMPARE THE PROFITABILITY/FEASIBILITY OF THESE CROPS WITH OTHER ALTERNATIVES, INCLUDING LIVESTOCK. THE RATIONALE FOR THE PRODUCT MIX SELECTED SHOULD BE FULLY DESCRIBED, INCLUDING THE ECONOMIC CONSIDERATIONS REFLECTED IN PARAGRAPHS 8 AND 9 OF REPTL.

5. PRODUCTION AND MARKETING SUPPORT SYSTEM. THE PP SHOULD ANALYZE THE EXISTENCE OF THE FINANCIAL, HUMAN AND PHYSICAL INFRASTRUCTURE NECESSARY TO SUPPORT FARMERS WHO WOULD DIVERSIFY INTO NEW CROP PRODUCTION. TO THE EXTENT THESE ARE LACKING (E.G. PHYSICAL FACILITIES FOR STORAGE AND PROCESSING, CREDIT, MARKETING INFORMATION, TECHNICAL ASSISTANCE IN EXPORT PROMOTION AND INVESTMENT, TRAINING, ETC.), THE PP SHOULD DESCRIBE WHAT RESOURCES WILL BE PROVIDED WHEN AND BY WHOM TO FILL ANY GAPS IN THE PRODUCTION-PROCESSING-MARKETING SYSTEM FOR EACH NEW CROP

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SELECTED. LINKAGES WITH THE PROJECT DEVELOPMENT ASSISTANCE PROGRAM (PDAP) SHOULD BE DESCRIBED, AND WHAT SUPPORT IN TERMS OF STIMULATING AGRIBUSINESS THIS PROGRAM MIGHT PROVIDE. THE PP SHOULD PARTICULARLY DISCUSS THE RELATION OF THE SUBJECT PROJECT TO THE FY 86 EXPORT AND INVESTMENT PROMOTION AND THE FY 87 AGRICULTURAL CREDIT AND MARKETING PROJECTS. THE DISCUSSION SHOULD ADDRESS THE EXTENT TO WHICH THE RESOURCES AND SERVICES PROVIDED IN THESE PROJECTS IS NECESSARY TO SUPPORT ACTIVITIES IN THE IMMEDIATE PROJECT, AND THE TIMELINESS OF PROVIDING THEM ONE TO TWO YEARS LATER.

IN DESIGNING THE PRIVATE SECTOR COMPONENT, THE MISSION SHOULD RE-EXAMINE CAREFULLY THE NEED FOR FOUR PERSON YEARS OF MARKETING EXPERTISE IN THE U.S., AND ONLY ONE FULL TIME CROP SPECIALIST IN THE TWO SUGAR CANE DISTRICTS.

6. EXTENSION ACTIVITY. THE PROPOSED EXTENSION ACTIVITIES SHOULD BE ELABORATED AND ADDRESS: (A) HOW MUCH OF THEIR TIME WILL THE NINE IDENTIFIED EXTENSION AGENTS BE ABLE TO DEVOTE TO PROJECT ACTIVITIES, (B) AS SPECIALISTS IN LIVESTOCK, HOW WILL THEY BE PREPARED TO PROVIDE TECHNICAL ASSISTANCE IN CROP PRODUCTION, AND (C) IN VIEW OF THEIR POTENTIALLY CONFLICTING RESPONSIBILITIES WITH THE CONTRACTOR, WHO WILL THEY BE RESPONSIBLE TO REGARD TO PROJECT ACTIVITIES? IN EXAMINING THESE ISSUES, THE MISSION MAY WANT TO CONSIDER THE ALTERNATIVE OF A CONTRACTOR HIRING TA LOCALLY, USING CANDIDATES WITH APPROPRIATE CROP EXPERIENCE TO CARRY OUT EXTENSION ACTIVITIES.

7. HOST COUNTRY CONTRIBUTION. THE PP SHOULD IDENTIFY THE SOURCE, KIND AND AMOUNT OF CONTRIBUTION THAT WILL BE PROVIDED TO CONSTITUTE 25 PERCENT OF PROJECT COSTS. THIS SHOULD BE BROKEN DOWN BY PUBLIC AND PRIVATE SECTOR ORGANIZATIONS. UNDER THE ASSUMPTION THAT SEPARATE AGREEMENTS WILL BE SIGNED WITH PRIVATE SECTOR ORGANIZATIONS, MISSION SHOULD REVIEW POLICY ON PVO COUNTERPART REQUIREMENT IN HDBK 3, CHAPTER 4.

8. ENVIRONMENTAL ASSESSMENT. SEE PARAGRAPH 10 REFTEL.

9. AS MISSION IS AWARE, THE AGENCY DEADLINE FOR OBLIGATION OF ALL NEW PROJECT FUNDS IS AUGUST 31. IN ORDER TO MEET THIS DEADLINE, THE PP SHOULD BE SUBMITTED TO AID/W NO LATER THAN JULY 31. PLEASE ADVISE BY JULY 15 IF THERE ARE DIFFICULTIES IN MEETING THIS SUBMISSION DATE. 44

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LOG FRAME

<u>NARRATIVE SUMMARY</u>	<u>OBJECTIVELY VERIFIABLE INDICATOR</u>	<u>MEANS OF VERIFICATION</u>	<u>ASSUMPTIONS</u>
<u>Private Sector Portion of Project</u>			
<u>Goal</u>			
To generate increased employment, income, and foreign exchange.	<ol style="list-style-type: none"> 1. Increased production of alternative products for export and import substitution. 2. Increased employment in agriculture production and processing sectors. 	<ol style="list-style-type: none"> 1. GOB data and statistics. 2. Presence of processing facilities. 	<ol style="list-style-type: none"> 1. GOB and specifically MNR continues support of project. 2. Political, economic, and social situation in Belize remains stable.
<u>Purpose</u>			
To expand the base of economic activity in Belize by developing alternative agricultural products for export and for import substitution.	<ol style="list-style-type: none"> 1. Alternative agricultural products are produced and exported. 2. Production and processing of import substitutes. 3. Increased production of traditional crops. 	<ol style="list-style-type: none"> 1. Export statistics. 2. Import statistics. 3. Yield and quality data from project research. 	<ol style="list-style-type: none"> 1. GOB continues to support export and investment promotion.
<u>Outputs</u>			
<u>A. Private Sector Component</u>			
<u>1. Creation of the Belize Agri-Business Company (BABCO)</u>			
	<ol style="list-style-type: none"> 1. Cooperation and joint participation between private & public sectors represented on BABCO's Board of Directors. 	<ol style="list-style-type: none"> 1. Joint efforts by Board to meet objectives of BABCO. 2. Desire by private sector groups to be associated with BABCO. 	<ol style="list-style-type: none"> 1. Qualified individuals will be on BABCO Board. 2. Members of Board will be active participants in operation of BABCO.

2. Addition of producers' groups and other private sector components to Board of BABCO.
3. Successful implementation of cooperative agreement and meaningful input by BABCO Board.

2. Production/Marketing of Non-Traditional Export Crops

- | | | |
|--|--|---|
| <ol style="list-style-type: none"> 1. Correct selection of at least two exportable crops. 2. 3,000 acres in production of export crops. 3. Involvement of Belize entrepreneurs in packing, shipping, and sales of products. | <ol style="list-style-type: none"> 1. Project evaluations. 2. Project records, GOB data, and statistics. | <ol style="list-style-type: none"> 1. Crops will be grown in quantities sufficient for export. 2. Foreign markets will be available. 3. Production and marketing costs are competitive on world markets. |
|--|--|---|

3. Production/Processing/Marketing of Import Substitution Crops

- | | | |
|--|--|--|
| <ol style="list-style-type: none"> 1. Field testing of crops for oil and animal feed use. 2. Completion of feasibility assessment of oil extraction and refinement, oil meal production and processing for direct feeding to animals. 3. When determined feasible startup of process by local entrepreneurs (with aid of BABCO) | <ol style="list-style-type: none"> 1. Test results verifying potential production. 2. Project records. 3. GOB data and statistics. 4. GOB data on imports. | <ol style="list-style-type: none"> 1. Assistance from MNR for field trials. 2. Production in quantities sufficient for economic production. 3. Active role by BABCO in obtaining entrepreneurs and financing. |
|--|--|--|

4. Production of 4,000 acres of Sesame and 6,000 acres of soybeans.
5. Reduction of edible oil imports by 50% and lard imports by 30%.

B. Public Sector Component

1. Participation in BABCO

1. Leadership from MNR in BABCO.
2. Linkages between public and private sectors of BABCO Board.

1. Feedback from Prime Contractor.
2. Private sector response to project initiative..

1. Public and private sector will work together.

2. Development of an Action Plan

1. Completion of an Action Plan to enhance ability to bring about agricultural diversification.
2. Assessment completion on schedule, plan completed and actions implemented in agricultural sector of MNR as scheduled.
3. Equipment purchased and specialized training completed.

1. Periodic evaluations.
2. Consultant reports.
3. Contractor records.

1. The assessment phase will show needs for plan.
2. System is flexible enough to allow change to occur.

Inputs

Life of Project

Private Sector Component

A. AID

- | | | | |
|--------------|----------------------|----------------|--|
| 1. AID grant | 1. U.S.\$4.8 million | 1. AID records | 1. Sufficient availability of funds by AID throughout life of project. |
|--------------|----------------------|----------------|--|

Public Sector Component

A. AID

- | | | | |
|---------------------|----------------------|---|---|
| 1. AID grant | 1. U.S.\$2.0 million | 1. AID records | 1. As above. |
| 2. GOB contribution | 1. U.S.\$680,000 | 1. MNR records and project records of contribution of appropriate resources both actual currency and in-kind contributions. | 1. Financial situation of MNR permits counterpart contribution. |

5C(2) PROJECT CHECKLIST

Listed below are statutory criteria applicable to projects. This section is divided into two parts. Part A. includes criteria applicable to all projects. Part B. applies to projects funded from specific sources only: B.1. applies to all projects funded with Development Assistance Funds, B.2. applies to projects funded with Development Assistance loans, and B.3. applies to projects funded from ESF.

CROSS REFERENCES: IS COUNTRY CHECKLIST UP TO DATE? HAS STANDARD ITEM CHECKLIST BEEN REVIEWED FOR THIS PROJECT?

A. GENERAL CRITERIA FOR PROJECT

1. BY 1982 Appropriation Act Sec. 523; FAA Sec. 634A; Sec. 653(b).

(a) Describe how authorizing and appropriations committees of Senate and House have been or will be notified concerning the project;
 (b) Is assistance within (Operational Year Budget) country or international organization allocation reported to Congress (or not more than \$1 million over that amount)?

A Congressional notification has been issued and the waiting period has expired.

Yes.

2. FAA Sec. 611(a)(1). Prior to obligation in excess of \$100,00, will there be

N/A.

(a) engineering, financial or other plans necessary to carry out the assistance and (b) a reasonably firm estimate of the cost to the U.S. of the assistance?

3. FIA Sec. 611(a)(2). Is any legislative action is required within recipient country, what is basis for reasonable expectation that such action will be completed in time to permit orderly accomplishment of purpose of the assistance? N/A.

4. FIA Sec. 611(b); FY 1982 Association Act Sec. 501. Is for water or water-related land resource construction, has project met the standards and criteria as set forth in the Principles and Standards for Planning Water and Related Land Resources, dated October 25, 1973? (See AID Handbook 3 for new guidelines.) N/A.

5. FIA Sec. 611(e). Is project is capital assistance (e.g., construction), and all U.S. assistance for it will exceed \$1 million, has Mission Director certified and Regional Assistant Administrator taken into consideration the country's capability effectively to maintain and utilize the project? N/A.

6. FAA Sec. 209. Is project susceptible to execution as part of regional or multilateral project? If so, why is project not so executed? Information and conclusion whether assistance will encourage regional development programs.

No.

This project will use the resources of the regional research institution, but will have little effect on regional development programs.

7. FAA Sec. 601(a). Information and conclusions whether project will encourage efforts of the country to: (a) increase the flow of international trade; (b) foster private initiative and competition; and (c) encourage development and use of cooperatives, and credit unions, and savings and loan associations; (d) discourage monopolistic practices; (e) improve technical efficiency of industry, agriculture and commerce; and (f) strengthen free labor unions.

- a) Yes, by increasing exports of non-traditional crops for the U.S. winter market.
- b) Yes, by supporting private farmer organizations and encouraging entrepreneurship in both the U.S. and Belize.
- c) Yes, see b above.
- d) Yes, by working with BABCO to discourage monocropping which leads to market control of prices.
- e) Yes, by training in improved production techniques.
- f) No effect is anticipated.

8. FAA Sec. 601(b). Information and conclusions on how project will encourage U.S. private trade and investment abroad and encourage private U.S. participation in foreign assistance programs (including use of private trade channels and the services of U.S. private enterprise).

A private sector Prime Contractor with U.S. market contacts will encourage participation of U.S. firms in the project.

9. FAA Sec. 612(b), 636(h);
FY 1982 Appropriation
Act Sec. 507. Describe
steps taken to assure
that, to the maximum
extent possible, the
country is contributing
local currencies to meet
the cost of contractual
and other services, and
foreign currencies owned
by the U.S. are utilized
in lieu of dollars. Local currency cost
will be financed by host
country contribution
and ESF.
10. FAA Sec. 612(d). Does
the U.S. own excess
foreign currency of the
country and, if so, what
arrangements have been
made for its release? No.
11. FAA Sec. 601(e). Will
the project utilize
competitive selection
procedures for the
awarding of contracts,
except where applicable
procurement rules allow
otherwise? Yes.
12. FY 1982 Appropriation Act
Sec. 521. If assistance
is for the production of
any commodity for export,
is the commodity likely
to be in surplus on world
markets at the time the
resulting productive
capacity becomes
operative, and is such
assistance likely to
cause substantial injury
to U.S. producers of the
same, similar or
competing commodity? No.
13. FAA 113(c) and (d).
Does the project comply
with the environmental
procedures set forth in
AID Regulation 16? Does Yes.

the project or program take into consideration the problem of the destruction of tropical forests?

Yes.

14. FAA 121(d). If a Sahel project, has a determination been made that the host government has an adequate system for accounting for and controlling receipt and expenditure of project funds (dollars or local currency generated therefrom)?

N/A.

B. FUNDING CRITERIA FOR PROJECT

1. Development Assistance Project Criteria

a. FAA Sec. 102(b), 111, 113, 281(a). Extent to which activity will (a) effectively involve the poor in development, by extending access to economy at local level, increasing labor-intensive production and the use of appropriate technology, spreading investment out from cities to small towns and rural areas, and insuring wide participation of the poor in the benefits of development on a sustained basis, using the appropriate U.S. institutions; (b) help develop cooperatives, especially by technical assistance, to assist rural and urban poor to help themselves toward better life, and

a) Yes, in all production related activities small- and medium farmers in rural Belize will have the opportunity to participate fully in the project and receive technical assistance for the production of new crops.

b Yes, grower organization will be formed dependent on which crops are found to be viable, and will be assisted by sub-contractors who have markets for the crops.

otherwise encourage democratic private and local governmental institutions; (c) support the self-help efforts of developing countries; (d) promote the participation of women in the national economies of developing countries and the improvement of women's status; and (e) utilize and encourage regional cooperation by developing countries?

b. FAA Sec. 103, 103A, 104, 105, 106. Does the project fit the criteria for the type of funds (functional account) being used?

c. FAA Sec. 107. Is emphasis on use of appropriate technology (relatively smaller, cost-saving, labor-using technologies that are generally most appropriate for the small farms, small businesses, and small incomes of the poor)?

d. FAA Sec. 110(a). Will the recipient country provide at least 25% of the costs of the program, project, or activity with respect to which the assistance is to be furnished (or is the latter cost-sharing requirement being waived for a "relatively least developed" country)?

(c) Yes, this program is in alignment with the primary GOB objective of broadening the economic base with agricultural diversification being a key area of concentration.

d) Yes, the project's Prime Contractor will be responsible for the continued involvement of women in vegetable production. Also, the production of feed for domestic animals will increase women's income

e) This project will use the resources of the regional research institute.

Yes.

Yes.

Yes, the GOB will provide 25% of the cost of the public sector component.

e. FAA Sec. 110(b).
 Will grant capital assistance be disbursed for project over more than 3 years? If so, has justification satisfactory to Congress been made, and efforts for other financing, or is the recipient country "relatively least developed"? (U.O. 122.1 defines a capital project as "the construction, expansion, equipping or alteration of a physical facility or facilities financed by USD dollar assistance of not less than \$100,000, including related advisory, managerial and training services, and not undertaken as part of a project of a predominantly technical assistance character.

N/A.

f. FAA Sec. 122(b). Does the activity give reasonable promise of contributing to the development of economic resources, or to the increase of productive capacities and self-sustaining economic growth?

Yes.

g. FAA Sec. 231(b).
 Describe extent to which program recognizes the particular needs, desires, and capacities of the people of the country; utilizes the country's intellectual resources to encourage

The project is based on the need for an expanded agricultural base that will assist small Belizean farmers and Belize as a whole increase their economic standing through:
 --their strategy of agricultural diversification;
 --strengthened Agricultural Department of the Ministry of Natural Resources.

institutional development;
and supports civil
education and training in
skills required for
effective participation in
governmental processes
essential to self-government.

2. Development Assistance Project
Criteria (Loans Only)

- a. FAA Sec. 122(b). Information and conclusion on capacity of the country to repay the loan, at a reasonable rate of interest. N/A.
- b. FAA Sec. 620(d). If assistance is for any productive enterprise which will compete with U.S. enterprises, is there an agreement by the recipient country to prevent export to the U.S. of more than 20% of the enterprise's annual production during the life of the loan? N/A.
- c. ISACA of 1961, Sec. 724 (c) and (d). If for Nicaragua, does the loan agreement require that the funds be used to the maximum extent possible for the private sector? Does the project provide for monitoring under FAA Sec. 624(g)? N/A.

3. Economic Support Fund
Project Criteria

- a. FAA Sec. 531(a). Will this assistance promote economic or political Yes.

stability? To the extent possible, does it reflect the policy directions of FAA Section 102?

b. FAA Sec. 531(c). Will assistance under this chapter be used for military, or paramilitary activities? No.

c. FAA Sec. 534. Will ESF funds be used to finance the construction of the operation or maintenance of, or the supplying of fuel for, a nuclear facility? If so, has the President certified that such use of funds is indispensable to nonproliferation objectives? No.

d. FAA Sec. 609. If commodities are to be granted so that sale proceeds will accrue to the recipient country, have Special Account (counterpart) arrangements been made? N/A.



BELIZE
Please Quote
No.

*Ministry of Natural Resources
Belmopan*

13th August, 1985

Mr. Neboysa Brashich
A.I.D. Representative
USAID Mission to Belize
American Embassy
BELIZE

Dear Mr. Brashich,

On behalf of the Belize Agribusiness Company, I hereby request the Agency for International Development (A.I.D.) to provide a grant of four million eight hundred thousand United States dollars for the establishment of a service for Belizean farmers and business community in a Cooperative Agreement with A.I.D. which will:-

- a. facilitate the development and commercialization of Belize agricultural products for export, as well as import substitution;
- b. provide facilities, services, technical and business assistance to developing business devoted to the commercialization of Belize agricultural products, and
- c. facilitate the promotion of Belize agricultural products for both the domestic and international markets.

This grant will be used to address the constraints confronting the agricultural sector of Belize, stimulate production and marketing efficiencies that will result in foreign exchange savings through import substitution activities, and increase employment through new production and processing activities.

The project's private sector component, implemented by BAECO, will be closely coordinated with the public sector component implemented by the Ministry of Natural Resources.

We hope our request will be received positively and we look forward to working through a Cooperative Agreement with A.I.D.

Sincerely,

R. E. Neal
for (RODNEY E. NEAL)
Chairman of the Board
Belize Agri-Business Company (BAECO)

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ANNEX 4

BELIZE
Please Quote
No.

Ministry of Natural Resources
Belmopan

13th August, 1985

Mr. Neboysha R. Erashich
A.I.D. Representative
USAID Mission to Belize
American Embassy
BELIZE

Dear Mr. Erashich,

On behalf of the Government of Belize, I hereby request the Agency for International Development to provide a grant of two million United States dollars to the Ministry of Natural Resources (MNR).

This grant will be used to strengthen the Ministry of Natural Resources in the area of agricultural diversification as farmers in Belize look for alternative crop potentials in light of the decline of the sugar industry in Belize. We understand that the MNR will take an active role in the Belize Agri-Business Company (BABCO) by being represented on BABCO's Board of Directors and by coordinating MNR activities with BABCO activities.

My Government welcomes this assistance from A.I.D., and we look forward to an early negotiation of an agreement covering this requested assistance.

Sincerely,

(DEAN R. LINDO)
Minister of Natural Resources

TECHNICAL ANALYSESI. OVERVIEWA. Background

In the final report of 'An Assessment of Belize's Agricultural Sector' it is pointed out that of a total land area of 5.7 million acres, some 2.2 million acres are suitable for agriculture. Of the 2.2 million acres suitable for agriculture approximately 354,700 acres are reported under cultivation.

Table 1 categorizes the different agricultural usages to which the 'cultivated' land is put.

Table 1: Cultivated Land Usage

<u>Type of Usage</u>	<u>Acreage</u>	<u>% of Total</u>
Export Crops	73,600	20
Domestic Crops	40,100	12
Pasture	<u>241,000</u>	<u>68</u>
TOTAL	354,700	100

Usage can also be broken down by commodity as presented in Table 2.

Table 2: Land usage (cultivated excluding pasture), production, and farmers/farm establishments by commodity.

<u>Commodity</u>	<u>Acreage</u>	<u>Production</u>	<u>Number of Farmers or Farm Establishments</u>
Sugarcane	60,000	1,059,000 long tons	4,400
Citrus	12,000	1,770,000 boxes	360
Bananas	1,600	525,000 boxes	8
Corn	28,000	47,000,000 lbs.	9,000
Beans	6,200	3,900,000 lbs.	NA
Rice (Paddy)	5,900	17,500,000 lbs.	NA

The citrus industry is located primarily in the Stann Creek District where the processing plants are. Bananas are grown country wide but the industry is centered in South Stann Creek and produce exported through facilities at Big Creek. Corozal and Orange Walk have the sugar industry and commercial rice operations are found in Belize District, South Stann Creek, and the Toledo Districts. Other main crops - corn, beans, sorghum, and peanuts, are grown both commercially and as subsistence crops. Commercial mechanized operations are done primarily by the Mennonite communities in Cayo and some in Orange Walk while subsistence farming is done by 'milpa' farmers and is found throughout the country.

Expanded production of the major export crops, sugarcane, citrus, and bananas, is limited by market constraints. Record low world prices for sugar has put stress on the Belizean sugar industry, and the protected markets in the U.S. and U.K. are limited. Banana production faces a similar situation. Most of the current production goes to the U.K., tied to the importers and shippers by a heavy debt incurred by the nature of input supply to the banana producers. Citrus is more likely a prospect for expansion given currently strong world demand, and the damage to the Florida and Texas industry in recent years. However, Belize will face strong competition from Brazil and other CBI countries for increased shares of that market.

As sugar is the major foreign exchange earner and represents 20% of the GDP, the country has been affected by the decline in the sugar industry, but Corozal and Orange Walk Districts most of all. In 1980 over half the households in Corozal had farms, and 75% of these depended on sugarcane as the main crop. Similarly, 60% of the farms in Orange Walk District depended on cane as the main crop in 1980, while another 27% depended on corn.

Given the small size of the domestic market, expansion of production easily leads to oversupply and a sharp drop in prices. The Belize Marketing Board (BMB) was established to help control swings in supply and price levels for certain products (corn, beans, and rice), but has not done so successfully. Export potential for these crops is limited, due to Belize's relatively higher costs of production.

As a result of these factors, agricultural production has remained concentrated in a narrow range of products. During the period of high commodity prices, through the late 1970s, this product mix offered substantial rewards to Belize. However, in the past several years, agriculture has shown no real growth, due primarily to the decline in sugar. At present few products in the sector can compensate for a continuing decline in the sugar industry. While the non-sugar sector has shown some real growth since 1978, it did not keep pace with even the modest growth of the economy as a whole.

Efforts to diversify agriculture in Belize have been small and scattered. While farmers have attempted various crops for export or import substitution, many have failed primarily because of the lack of any initial, adaptive research. Some adaptive research has been done by the Caribbean Agricultural Research and Development Institute (CARDI) in Belize. Their work has focused on import substitution items, such as cabbage, onions, and soybeans. There is however, a need to provide linkages with international research institutions. More field testing and on-farm trials are required to determine what crops may be suited for export production in Belize, and how such crops might best be fitted in with farming systems. Possibilities for local production and processing of soybeans and sesame for vegetable oil and protein meal for livestock, poultry, and shrimp mariculture merit further examination. Without the research and adaptation to commercial production, the limited range of productive activity in agriculture will continue to be a drain on the sector's growth and capacity to contribute to employment and income.

lab

B. Geographic Setting of the Project

The project focuses on diversification in the districts of Corozal, Orange Walk, and Cayo. While project benefits are expected to flow to farmers in all sections of the country over the long-term, it is important to clarify why these three particular districts are the focus of project activity.

Corozal and Orange Walk Districts receive emphasis due to the precarious economic position of the sugar industry which is located in these areas and is the mainstay of their economy. To assist in solving the potential problems which will arise with the imminent decline in the sugar industry the project will give special emphasis in developing alternative agricultural enterprises to supplant sugar as a cash crop. Emphasis will be placed on crops with export potential while work will also be done on traditional crops and import substitution activities.

Farmers in the district of Cayo are the main producers of domestic food supplies for the country. The land and climatic attributes of the district afford potential flexibility for the development of alternative crops, which can offset the current level of dependence on imported foods. Additionally, the principal sources of research and development within the country for agriculture are located in this district. These consist of Central Farm, the research arm of ICR, and CARDI -- a regional research and development activity supported jointly by Belize and international donors. The project will use this established research and development capacity as the starting point for diversification initiatives which focus primarily on the development of import substitution enterprises. Particular emphasis will be given to the development and exploitation of oilseed and feed crops. As an ancillary activity in this district, the project will also help develop more efficient production regimes for traditional Belizean crops by providing additional alternatives for cropping systems being used.

Table 3.

Pertinent Data for Three Districts in Belize

<u>District</u>	<u>Segment</u>	<u>Population</u>	<u>Percent of Country Total</u>	<u>Economic Activities</u>
Cayo	Urban	8,551	5.9	Corn, beans, cattle, poultry, eggs, and lumber.
	Rural	<u>14,286</u>	<u>9.8</u>	
	Total	22,837	15.7	
Orange Walk	Urban	8,439	5.8	Sugarcane, corn, beans, and cattle.
	Rural	<u>14,431</u>	<u>9.9</u>	
	Total	22,870	15.7	

Corozal	Urban	6,899	4.7	Sugarcane and subsistence crops
	Rural	<u>16,003</u>	<u>11.0</u>	
	Total	22,902	15.7	
All Three Districts	Urban	23,889	16.4	
	Rural	<u>44,720</u>	<u>30.8</u>	
	Total	68,609	47.2	
National	Urban	72,717	50.0	
	Rural	<u>72,636</u>	<u>50.0</u>	
	Total	145,353	100.00	

Source: Belize Agricultural Assessment. 1985. Page A-87

II. PRODUCTION POTENTIAL/CONSTRAINTS

A. Agronomic Description of Target Areas

1. Soils

In 1959, Wright et al. prepared a comprehensive study describing the general distribution of soils, land use potential, and vegetation cover for the whole country. The main soil features of each major landform unit were described. The principal landform which is found in the Corozal, Orange Walk, and Cayo Districts is described as Calcareous Soils usually found at elevations close to sea level. Materials accumulated on this shelf include coral rubble and calcareous sand mixed with clays and forming beds of marl. Alluvial deposition has filled slight depressions and further differentiation has occurred. Heterogeneous sediments permit the differentiation of nine subunits. This area comprises some 1.8 million acres which can be further identified as:

- a. Soils from coral rubble, coralline limestone, beach sand, and gravels. Area - 99,300 acres.
- b. Soils similar to A. but containing some volcanic ash minerals. Area - 125,500 acres.
- c. Soils from hard Miocene limestone; cemented conglomerate. Area - 548,800 acres.
- d. Soils similar to C. but with volcanic ash minerals. Area - 63,000 acres.
- e. Soils from soft siliceous limestone. Area - 101,000 acres.
- f. Soils from calcareous marl and gravel. Area - 386,800 acres.
- g. Soils from hard siliceous limestone with flints. Area - 110,400 acres.

- h. Soils from hard cretaceous and shattered limestone. Area -- 140,300 acres.
- i. Soils from alluvium and colluvium over marl or hard limestone. Area - 260,800 acres.

A variety of soil types are found in the three target districts. However, the only detailed soil maps and classifications available is for the Belize River Valley, located partly in the Cayo District, as reported in the study entitled 'Resource Development in Belize'. This study suggests that 'Redzinas' soils show the greatest agricultural potential.

Wright, et al. 1959, stated that the best distributed soil in Corozal District was 'Louisville Clay' and this soil is a 'gumbo' black clay, very sticky and plastic during the wet months and crisp and granular in the dry months. This soil is underlain by hard and soft limestone which causes difficulties in developing good soil aeration.

An important soil found in Orange Walk District is the 'Lazaro Sandy Clay' which is usually 18 inches deep underlined with soft limestone parent material which weathers quickly. This soil retains its Redzina characteristics. The sand content is not enough to appreciably affect the internal drainage. Mayas would call this soil 'Yaxhon' which means that the soil is slow to dry after a rain, making it difficult to get into the fields to spray fungicides.

In Cayo District, farmers at Spanish Lookout describe two types of soils; they differentiate between 'black soils' and 'red river soils'. Similar soils are also found at Central Farm. The 'black soil' is a shallow clay soil underlain by weathered limestone. The 'red river soil' is an alluvial, reddish-brown, loamy clay soil located near the Belize River. Similar black clay soils can be found around Belmopan. The soil at the CARDI Experiment Station is a shallow black clay underlined by soft limestone.

2. Soil Chemistry and Fertility

Little information is available on the chemistry and fertility of soils in Belize. The pH of soils in Cayo, Orange Walk, and Corozal Districts would be expected to fall between 7.0 and 8.0. In general, soil pH would be closer to 8.0 in Corozal District and closer to a neutral 7.0 in Cayo District. A lower soil pH would be expected where average annual precipitation was greater. It would also be predicted that potassium levels would be adequate or high. Alkaline soil pH's would suggest the possibility of existing or potential minor element deficiencies; in this area, of particular concern would be iron, manganese, and zinc fertilization, which could be added in foliar sprays. Present fertilization practices would indicate that phosphorus fertilization is necessary. The 'black' soils found in Belize would be expected to have high organic matter content. This condition and its effect upon soil nutrient availability should be considered when designing fertilizer programs.

The Prime Contractor will obtain more information on the levels of soil salinity. Low lying areas should be examined for the presence of detrimental salt levels before planting.

3. Topography

The topography in Orange Walk and Corozal Districts and in the northern portion of Cayo District would be described as 'flat undulating and rolling land' and few slopes would exceed 5%. Furrow irrigation is possible on contour farmed land with slopes of up to 2-3%. In the western portion of Cayo District and south of the Belize River the topography is 'hilly' with 15-20% slopes. The foothills of the Mayan Mountain Range are found in the western portion of Cayo District and altitudes of 500 meters above sea level are not uncommon. This type of topography is common in at least two-thirds of Cayo District.

4. Climate and Precipitation

In Belize, precipitation appears to be the most important climatological variable related to agricultural production. Annual average precipitation in Belize ranges from 56 inches in north Corozal to 151 inches in south Punta Gorda. There are 'wet' and 'dry' seasons throughout the country. Precipitation data would indicate that the 'dry' season lasts from January through May (March and April are the 'driest' months in the 'dry' season); the 'wet' season lasts the rest of the year. In Orange Walk and Corozal Districts there is significant average precipitation, more than 2.5 inches per month, in all months except January, February, March, and April. In Cayo District only the months of March and April do not have significant average precipitation. (See Table 4).

Most crops could be satisfactorily produced if average precipitation occurs. Care would have to be taken to consider potential precipitation deficiencies which might occur during 'predictable' periods of the year. Also, one important factor must be considered when planning rain-fed farming systems. Rainfall data for Belize indicates that the range of precipitation is great. 'Surprise' rain in the dry season could damage fruit, flowers, or vegetables. Certain statistical analyses could be performed on Belize precipitation data to be able to more accurately predict potential precipitation at different locations although the trends are well established. (See Table 5).

The months of the year which have the greatest opportunity for possible fresh vegetable exports for the U.S. winter market are October through April. Although the specific 'market windows' for individual commodities can vary slightly from the above mentioned period it is that time when most fresh fruits and vegetables are imported into the U.S. Excess precipitation can be a major deterrent to the successful development of a fresh produce export operation. Precipitation and even high humidity can lead to environmental conditions where economic control of fungal diseases cannot be achieved. Precipitation in equal amounts on different soil types could have completely different outcomes. A little rain on heavy textured clay soils could be much

Table 4 Average monthly and annual precipitation (in inches) for different locations in Belize.*

	Corozal		Orange Walk	Belmopan	Cayo		Belize
	S. Cruz B.S.I.	Consejo	San Pablo		Cent. Farm	San Ignacio	Int'l Airport
Years	12	6	10	9	18	17	25
Month							
Jan	1.69	2.31	1.80	4.70	4.27	4.00	4.64
Feb	1.30	1.62	2.39	3.90	3.10	2.88	2.56
Mar	1.02	1.15	1.56	1.33	1.75	1.71	2.20
Apr	1.45	1.89	1.82	1.93	1.14	1.25	2.17
May	2.92	2.26	2.25	4.09	2.62	3.18	3.62
Jun	10.85	10.34	9.91	15.11	8.46	7.55	10.44
Jul	7.11	7.16	7.20	12.01	8.52	7.44	9.54
Aug	6.04	6.29	5.78	9.33	5.96	5.52	7.79
Sep	9.67	10.55	8.66	11.08	7.88	6.96	10.84
Oct	7.82	7.91	6.88	9.27	8.16	7.71	10.77
Nov	2.26	3.74	1.73	6.81	7.32	6.74	7.08
Dec	3.46	3.01	2.50	9.92	6.27	6.01	6.94
Total	55.59	58.23	52.48	89.48	65.45	60.95	78.69

*From: The Chief Meteorologist. Meteorological Department.
Belize International Airport, Belize. C.A. DAB:06/30/95

Table 5. Low, high, and average monthly and annual rainfall
(in inches) at different locations in Belize.*

Month	Years	Location	BSI	Int'l	Toledo	Central
		Corozal	Corozal	Airport	Agstation	Farm
		12	12	25	20	18
January	Low	0.1	0.1	0.7	1.4	0.3
	High	3.3	3.3	10.1	15.7	7.8
	Average	1.7	1.7	4.6	6.6	4.3
February	Low	0.1	0.1	0.2	1.0	0.6
	High	2.5	2.5	7.9	8.3	5.3
	Average	1.3	1.3	2.7	4.2	1.8
March	Low	0.1	0.1	0.3	0.2	0.0
	High	2.2	2.2	9.6	8.1	5.1
	Average	1.0	1.0	2.2	3.4	1.8
April	Low	0.0	0.0	0.1	0.2	0.0
	High	6.2	6.2	8.2	6.0	4.3
	Average	1.5	1.5	2.2	2.5	1.1
May	Low	0.0	0.0	0.4	0.0	0.0
	High	5.3	5.3	9.2	13.2	7.0
	Average	2.9	2.9	3.6	6.4	2.6
June	Low	1.0	1.0	0.5	12.0	1.8
	High	21.1	21.1	26.2	41.0	17.6
	Average	10.9	10.9	10.4	23.8	8.5
July	Low	0.3	0.3	0.5	15.3	2.2
	High	11.8	11.8	25.2	50.0	25.5
	Average	7.1	7.1	9.5	29.4	8.5
August	Low	1.8	1.8	4.7	16.1	1.3
	High	11.7	11.7	13.8	48.6	11.4
	Average	6.0	6.0	7.8	27.4	6.0
September	Low	3.5	3.5	5.7	8.8	3.2
	High	18.6	18.6	16.4	30.9	16.0
	Average	9.7	9.7	10.8	20.2	7.9
October	Low	2.6	2.6	2.7	2.9	3.5
	High	13.2	13.2	22.0	17.9	15.0
	Average	7.8	7.8	10.8	11.5	7.7
November	Low	0.0	0.0	1.3	2.6	0.6
	High	5.7	5.7	15.4	15.5	13.0
	Average	2.3	2.3	7.1	8.5	6.7
December	Low	0.4	0.4	0.4	1.4	0.2
	High	7.4	7.4	16.3	13.2	12.3
	Average	3.5	3.5	6.9	7.3	6.0
Year	Low	36.3	36.3	52.9	105.9	44.7
	High	70.8	70.8	105.4	205.3	107.3
	Average	55.6	55.6	85.9	151.0	60.0

*From: Chief Meteorologist, Meteorological Department, Belize
International Airport, Belize, C.A. DAB:07/02:85

worse than a heavy rain on light textured soils, thus requiring a high level of management by the producer. Rainfall variation trends are shown in Table 6.

Feedgrains and oilseeds are not so sensitive to precipitation; in fact, best yields are secured during the rainy season. They could possibly be grown in Cayo from May to December and Corozal and Orange Walk from June to October without irrigation if other agronomic requirements can be met.

Water requirements for local market vegetables vary. Dry onions must 'finish off' in the dry season, whereas tomatoes need good soil moisture through harvest. Cabbage grows best in the cooler months.

Variations in average monthly rainfall at any specific location are significant. Although June is normally rainy, this year, 1985, the rains were delayed to July and the first corn plantings were lost. Heavy rain has been known to occur in March and would cause serious loss to export produce harvested at that time.

5. Groundwater

Groundwater resources in Belize have divided into seven groundwater provinces. Each province has one or more potential aquifers but the extent to which they might be developed and utilized must await further data on well productivity and water quality. Corozal and Orange Walk Districts and portions of Cayo District are found in the Coastal Plain and Shelf Groundwater Province. Groundwater in this province is tapped from limestone chinks and marls and almost without exception are characterized by uncertainty of water supply and/or questionable quality. Portions of Cayo District are located within the Campur Groundwater Province and good quality groundwater should be available from water-bearing zones in weathered limestone found less than 150 meters deep.

In Orange Walk District the presence of shallow (25-60 feet), hand-dug wells are common. It is not clear whether water is readily available from these wells at all times of the year or during periods of drought; surveys are needed to determine this.

In Cayo District, the availability of groundwater is another case. Perforations in search of water have been made at the CARDI Experiment station in Belmopan without success. The Mennonite community at Spanish Lookout have not been successful in encountering water in perforations that have reached depths of 300 feet. At Spanish Lookout all water is obtained from rain collection or trucked from the Belize River in times of drought.

The chemical quality of groundwater for irrigation has not been intensively studied in Belize. Some references to the quality of groundwater with respect to human consumption is available. Apparently, the quality of some water in the three districts was as follows:

Table 6 Low, high, and average precipitation (in inches) during specific months in different regions of Belize.*

Location:		BSI Corozal	Consejo Corozal	San Pablo O. Walk	C. Farm Cayo	Belmopan Cayo	Airport Belize
Month	Years	12	6	10	18	9	25
January	Low	0.1	0.2	0.6	0.3	0.3	0.7
	High	3.3	6.3	4.8	7.6	6.7	15.7
	Average	1.7	2.3	1.8	4.3	4.7	4.6
February	Low	0.1	0.4	0.0	0.6	1.3	1.0
	High	2.5	3.2	9.0	5.3	7.3	8.3
	Average	1.3	1.6	2.4	1.8	3.9	2.7
March	Low	0.1	0.1	0.2	0.0	0.2	0.2
	High	2.2	2.5	2.9	5.1	3.0	8.1
	Average	1.0	1.2	1.6	1.8	1.3	2.2
April	Low	0.0	0.0	0.0	0.0	0.0	0.1
	High	6.2	4.6	5.3	7.1	5.9	8.2
	Average	1.5	1.9	1.3	1.1	1.9	2.2
October	Low	2.6	5.7	2.4	3.5	2.8	2.7
	High	13.2	12.0	11.7	15.0	15.8	22.0
	Average	7.8	7.9	6.9	7.7	9.3	10.8
November	Low	0.0	0.1	0.2	0.6	1.2	1.3
	High	5.7	5.5	3.7	13.0	15.3	15.4
	Average	2.3	3.7	1.7	6.7	6.8	7.1
December	Low	0.4	0.3	0.2	0.2	4.6	0.4
	High	7.4	4.6	5.2	18.3	17.8	16.3
	Average	3.5	3.0	2.5	6.0	9.9	6.9
Total of Averages		19.1	21.6	15.7	29.4	37.8	36.5
Total for Year	Low	36.3	-	-	44.7	69.1	52.9
	High	70.8	-	-	107.3	103.0	105.4
	Average	55.6	58.2	52.5	60.9	69.5	65.9

* From: The Chief Meteorologist, Meteorological Department.
Belize International Airport, Belize C.A. DAB:07/02/95

Table 7.

Drinking Water Quality Characteristics - February 1984*

District:	Cayo	Orange Walk	Corozal
Location:	Belmopan	Orange Walk	Calcutta
Source	River	Well	Well
pH	7.6	7.4	7.2
Conductivity (u-mhos/cm)	140	400	700
Hardness	190	500	800

*From: Belize - Country Environmental Profile. 1984.

6. Irrigation

In Belize, irrigation is not common. There are a few situations where irrigation is used with the production of some fruits and vegetables. In general, this system is rudimentary and might consist of 55 gallon drums mounted on a small tractor. The topography of Corozal, Orange Walk, and Cayo Districts is such that the presence of large flat areas where furrow irrigation could be established are rare. Also, the prevalence of shallow soils would eliminate the possibility of leveling tracts of land for furrow irrigation installation. Other considerations that have to be studied are the availability and quality of groundwater, and the economics of using these waters for irrigation.

Ideally, climates where irrigation is required are generally preferred for vegetable production in the tropics. This is due to the desire to better control possible disease problems and to be able to irrigate when needed and under control. Topography and the absence of existing irrigation systems in Belize, and potential problems of irrigation water availability, cost and quality, suggest considering the use of drip irrigation systems, although more costly to install.

Drainage, both internal and surface, is an important consideration when establishing farming operations. This factor is critical in situations where heavy rains can be predicted. Generally, surface drainage systems can be designed to remove large quantities of surface water with minimal detrimental effects to plants and limited erosion.

7. Pests and Diseases

Pests and diseases in Belize are not expected to be greatly different from similar environments in neighboring countries such as Guatemala and Mexico. Pest and disease pressure, prevalence, and controls in the tropics are expected to be different from those in the temperate zones. Recent reports

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and conversations have enumerated particular problems such as Fusarium, Nematodes, virus infestations, bacterial wilts, aphid and worm attacks, and fruit rots.

8. Weeds

The presence Cyperus rotundus (Purple Nutsedge) has been observed in some production fields. The presence of this weed in fields will affect production costs if it is to be controlled. Control is recommended for some crops at specific physiological stages. Costs for control could be considerable, even with soil fumigation using the newer systemic herbicides. Efforts should be taken to reduce the spread of this noxious weed to fields where it is not present.

B. Export

1. Fresh Fruit and Vegetable Potential

In the U.S., the per capita and total consumption of fresh produce has been increasing in recent years. Large volumes of fresh produce and vegetables are imported into the U.S. from foreign countries to partially fill this demand for fresh produce. The Fruit and Vegetable Division of the Agricultural Marketing Service of the U.S. Department of Agriculture (USDA/AMS/F&Veg Div) is a readily available source of information on imported fresh produce. This report draws heavily from this source.

In 1984, fresh fruit and vegetables were imported into the U.S. from thirty two countries, from as close as Mexico and Canada and as distant as Australia. The number of commodities imported per country ranged from one to more than fifty one. Fresh produce imports were greatest from the following countries:

Table 5.

U.S. Fresh Fruit and Vegetable Imports - 1984*

1,000 CWT

<u>Country</u>	<u>All Imports</u>	<u>Excluding Banana</u>
Mexico	29,091	28,404
Costa Rica	13,027	129
Honduras	12,411	571
Ecuador	11,042	27
Colombia	10,338	

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A.S.

Canada	5,461	5,461
Chile	4,683	4,683
Guatemala	4,284	257
Panama	3,918	15
Nicaragua	1,499	0
New Zealand	482	482
South Africa	405	405
TOTAL	96,641	

*From: USDA/AMS/F&V Div.

The fresh imports from these 12 countries represent, by weight, 98% of the total fresh produce imported into the U.S. in 1984. These countries, except for Mexico, Canada, Chile, New Zealand, and South Africa are principally exporters of bananas. Banana imports represented approximately 57%, by weight, of the total fresh produce imports in 1984. The principal exporter of fresh produce to the U.S. is Mexico. It's production, volumes, and variety must be considered if one is to compete in this market. (See Table 9).

Countries in the Caribbean and in Central America have increased their interest in the development, expansion, and promotion of agricultural exports, especially non-traditional exports. Historically, and at present, the U.S. continues to be the market of choice for fresh produce exports from almost all Central American and Western Caribbean countries due to its proximity, existing shipping and transportation patterns, and the size and diversity of the U.S. marketplace.

The regions and countries that would be in competition for the U.S. fresh fruit and vegetable market would be as follows:

<u>Region</u>	<u>Country</u>
Bahamas	Bahamas
Central America	Belize Costa Rica El Salvador Guatemala Honduras Nicaragua Panama
Mexico	Mexico

TABLE 9 US FRESH FRUIT AND VEGETABLE IMPORTS BY COUNTRY AND YEAR.*

COUNTRY	1,000 CWT					% AVE
	1980	1981	1982	1983	1984	YEARLY INCREASE
ARGENTINA	2	12	11	77	50	600.0%
AUSTRALIA	99	139	48	98	73	-6.6%
BAHAMAS	135	192	170	187	123	-2.2%
BELGIUM	15	14	22	33	42	45.0%
BELIZE	-	-	-	15	8	-46.7%
BRAZIL	0	2	55	139	12	27.8%
CANADA	5,408	6,901	7,931	7,291	5,461	0.2%
CHILE	1,252	1,596	2,299	3,398	4,633	68.5%
COLOMBIA	4,652	6,774	8,604	8,282	10,338	30.6%
COSTA RICA	-	-	-	12,901	13,027	1.0%
DOMINICAN REP.	-	-	-	432	675	56.3%
ECUADOR	11,564	11,677	13,250	9,851	11,042	-1.1%
EL SALVADOR	-	-	-	21	47	123.8%
FRANCE	66	81	86	191	198	50.0%
GREECE	0	0	1	2	0	0.0%
GUATEMALA	-	-	-	4,835	4,284	-11.4%
HAITI	-	-	-	142	154	8.5%
HONDURAS	-	-	-	11,750	12,411	5.6%
ISRAEL	6	14	40	49	139	554.2%
INDIA	0	0	0	2	0	0.0%
ITALY	5	3	13	20	25	100.0%
IVORY COAST	0	3	0	0	0	0.0%
JAMAICA	-	-	-	22	42	90.9%
JAPAN	25	21	26	39	29	4.0%
MEXICO	23,134	18,795	22,583	25,448	29,091	6.4%
MOFOCCO	1	4	4	15	40	975.0%
NETHERLANDS	84	3	84	35	250	3.4%
NEW ZEALAND	299	332	279	398	482	15.3%
NICARAGUA	-	-	-	1,366	1,499	9.7%
PANAMA	-	-	-	4,877	3,918	-19.7%
PERU	11	4	3	1	0	-25.0%
SENEGAL	0	0	0	0	2	0.0%
SOUTH AFRICA	210	189	318	269	405	23.2%
SPAIN	21	26	217	60	194	206.0%
TAIWAN	0	12	24	0	0	0.0%
VENEZUELA	8	4	18	32	59	159.4%
WEST GERMANY	0	0	0	0	5	0.0%
CENTRAL AMERICA	35,750	35,939	35,504	35,765	35,194	-0.4%
WEST INDIES	436	602	548	596	871	24.9%
TOTAL	83,183	83,339	92,138	92,268	99,908	

*FROM: USDA/AMS/F&V

DAB:07/06/85 (FILE: CP652)

TABLE 10 US FRESH FRUIT & VEGETABLE IMPORTS FROM DIFFERENT REGIONS- 1984.*

1,000 CWT								
1984							PERCENT	
COMMODITY	BAHAMAS	CENTRAL AMERICA	MEXICO	WEST INDIES	PUERTO RICO	ALL OTHERS	TOTAL	OF TOTAL
ASPARAGUS	0	0	118	0	0	10	128	0.1%
AVOCADO	0	0	0	25	0	0	25	.0%
BANANA	0	34,167	687	21	0	21,381	56,256	56.3%
BEAN	0	0	228	16	0	14	258	0.3%
BROCCOLI	0	0	45	0	0	1	46	.0%
BRUS. SPFGUTE	0	0	124	0	0	0	124	0.1%
CABBAGE	0	12	979	17	0	393	1,399	1.4%
CANTALOUPE	0	44	2,213	219	2	3	2,478	2.5%
CARROT	0	0	102	0	0	787	839	0.8%
CAULIFLOWER	0	0	32	0	0	95	127	0.1%
CUCUMBER	19	16	2,989	8	11	9	3,052	3.1%
EGGPLANT	0	0	385	18	0	0	403	0.4%
GARLIC	0	0	282	0	0	89	370	0.4%
GRAPEFRUIT	8	0	39	0	0	0	47	.0%
GRAPES, TABLE	0	0	248	0	0	3,151	3,399	3.4%
HONEYDEW	0	0	406	0	103	0	509	0.5%
LETTUCE/ENDIVE	0	0	164	4	0	215	383	0.4%
LIME	73	12	396	2	2	0	483	0.5%
MANGO	0	8	698	155	0	8	869	0.9%
MELON, MIXED	1	277	25	26	0	231	560	0.6%
OKRA	0	20	416	1	0	1	438	0.4%
ONION, DRY	0	0	1,326	0	0	512	1,841	1.8%
ONION, GREEN	0	0	686	0	0	0	686	0.7%
ORANGE	0	0	161	78	0	190	429	0.4%
PAPAYA	17	0	33	0	0	0	50	0.1%
PEAS, GREEN	0	0	97	0	0	0	97	0.1%
PEAS, OTHER	0	45	67	28	0	0	140	0.1%
PEPPER, BELL	1	0	1,580	98	0	49	1,728	1.7%
PEPPER, OTHER	0	0	595	0	17	0	612	0.6%
PINEAPPLE	0	565	334	69	2	8	998	1.0%
RADISH	0	0	128	6	0	9	143	0.1%
SPINACH	0	0	12	0	0	0	12	.0%
SQUASH	0	0	1,440	44	0	4	1,488	1.5%
STRAWBERRY	0	0	62	0	0	21	83	0.1%
TANGERINE	0	0	137	0	0	23	160	0.2%
TOMATO	2	1	7,540	30	22	37	7,632	7.6%
TOMATO, CHERRY	0	0	915	0	0	0	915	0.9%
WATERMELON	0	6	2,876	4	2	0	2,888	2.9%
LEGS. OTHERS	0	0	263	0	0	0	263	0.3%
MISC TROP F&V	0	0	115	0	0	0	115	0.1%
ALL OTHERS	2	1	148	1	0	7,345	7,497	7.5%
TOTAL	123	35,194	29,091	871	161	34,529	99,959	100.0%
PERCENT	0.1%	35.2%	29.1%	0.9%	0.2%	34.5%	100.0%	

*From: USDA/AMS/F&V DIU.

DAB:07/06/95 (FILE: FFIMPS42)

U.S. Territories	Puerto Rico
West Indies	Dominican Republic
	Jamaica
	Haiti

The amounts of fresh produce exported to the U.S. from Central America, the Western Caribbean, Mexico, Puerto Rico, and all other countries are increasing and the greatest volume of imports are from Mexico. (See Table 10).

Although there were more than 38 different fresh fruits and vegetables imported into the U.S. from these regions in 1984, the commodities with the largest volumes were as follows:

Table 11.

U.S. Fresh Fruit and Vegetable Imports
from Defined Regions - 1984*

No.	Commodity	Volume (1,000 CWT)	Percent of Total
1.	Banana	56.256	56.3
2.	Tomato	7,632	7.6
3.	Grape, Table	3,399	3.4
4.	Cucumber	3,052	3.1
5.	Watermelon	2,888	2.9
6.	Cantaloupe	1,398	2.5
7.	Onion, Dry	1,841	1.8
8.	Pepper, Bell	1,728	1.7
9.	Squash	1,488	1.5
10.	Cabbage	1,398	1.4
11.	Pineapple	998	1.0
12.	Tomato, Cherry	915	0.9
13.	Mango	869	0.9
14.	Carrot	839	0.8
15.	Onion, Green	686	0.6
16.	Pepper, Other	612	0.6
17.	Melon, Mixed	560	0.6
18.	Honeydew	509	0.5
19.	Lime	483	0.5
20.	Okra	438	0.4

This list of commodities should be considered the 'primary list' in the selection of commodities to be considered for export crop experimentation in Belize. This list represents the commodities which have the largest U.S. import volumes. Further examination of these types of data would indicate import trends for these commodities.

The 1984 U.S. imports from countries in the West Indies and Central America and the variety of imports from these countries were as follows:

Table 12.

Number of Different U.S. Imported Commodities - 1984

<u>Central America</u>		<u>West Indies</u>	
Belize	1	Dominican Republic	18
El Salvador	4	Jamaica	2
Costa Rica	5	Haiti	3
Guatemala	8		
Honduras	8		
Nicaragua	1		
Panama	5		

The variety of fresh produce imported from West Indies countries is greater than from Central American countries. (See Table 13). One reason for this difference is due to fresh produce import restrictions established by the Plant/Pest Quarantine Division, Animal/Plant Health Inspection Service of the USDA (USDA/APHIS/PPQ). To be able to import fresh produce from Belize into the U.S., a permit is required from this organization. The present APHIS/PPQ list of allowable imports from Belize includes most of the commodities considered in the 'preliminary list', except mango, citrus (orange and grapefruit), and possibly grapes. (See Table 14).

2. U.S. Winter Market for Fresh Produce

Due to the reduced capability of producing many vegetables during the winter months in the U.S., lucrative markets exist in the U.S. for many fresh fruits and vegetables from December through May. Each commodity will have a unique production period due to the available supplies from the different vegetable production regions in the U.S. U.S. imports from Mexico, by month, illustrates the period when produce is imported and this indicates when the market exists for Mexican producers. Care and knowledge is needed to fully interpret these data to be able to decide when produce can be imported to be able to best compete with these known markets. Also, we have to be able to produce these identified commodities for these specific periods in Belize. (See Table 15).

3. Average Wholesale Price

Due to high export, distribution, and marketing costs for off-shore produce, it is generally necessary to identify those commodities which have the highest value so that these high costs can be covered. The average wholesale price of imported fresh fruit and vegetables indicate the relative value of the different commodities. (See Table 16).

TABLE 13 US FRESH FRUIT & VEGETABLE IMPORTS FROM VARIOUS COUNTRIES.

1984	1,000 CWT											
	CENTRAL AMERICA							WEST INDIES				
	BEL.	E.S.	C.R.	GUA.	HON.	NIC.	PAN.	TOTAL	D.R.	HAI.	JAM.	TOTAL
ASPARAGUS	0	0	0	0	0	0	0	0	0	0	0	0
AVOCADO	0	0	0	0	0	0	0	0	25	0	0	25
BANANA	0	0	12898	4027	11840	1499	3903	34167	21	0	0	21
BEAN	0	0	0	0	0	0	0	0	16	0	0	16
BROCCOLI	0	0	0	0	0	0	0	0	0	0	0	0
BRUS. SPROUTS	0	0	0	0	0	0	0	0	0	0	0	0
CABBAGE	0	0	5	5	1	0	0	12	17	0	0	17
CANTALOUPE	0	1	0	5	35	0	1	44	218	0	1	219
CARROT	0	0	0	0	0	0	0	0	0	0	0	0
CAULIFLOWER	0	0	0	0	0	0	0	0	0	0	0	0
CUCUMBER	0	0	0	3	-13	0	0	16	5	0	3	8
EGGPLANT	0	0	0	0	0	0	0	0	13	0	0	13
GARLIC	0	0	0	0	0	0	0	0	0	0	0	0
GRAPEFRUIT	0	0	0	0	0	0	0	0	0	0	0	0
GRAPES, TABLE	0	0	0	0	0	0	0	0	0	0	0	0
HONEYDEW	0	0	0	0	0	0	0	0	0	0	0	0
LETTUCE/ENDIVE	0	0	0	0	0	0	0	0	4	0	0	4
LIME	0	1	1	0	10	0	0	12	0	2	0	2
MANGO	8	0	0	0	0	0	0	8	4	151	0	155
MELON, MIXED	0	43	12	180	34	0	8	277	20	0	5	26
OKRA	0	2	0	15	0	0	3	20	0	1	0	1
ONION, DRY	0	0	0	0	0	0	0	0	1	0	0	1
ONION, GREEN	0	0	0	0	0	0	0	0	0	0	0	0
ORANGE	0	0	0	0	0	0	0	0	63	0	10	73
PAPAYA	0	0	0	0	0	0	0	0	0	0	0	0
PEAS, GREEN	0	0	0	0	0	0	0	0	0	0	0	0
PEAS, OTHER	0	0	0	45	0	0	0	45	28	0	0	28
PEPPER, BELL	0	0	0	0	0	0	0	0	90	0	8	98
PEPPER, OTHER	0	0	0	0	0	0	0	0	0	0	0	0
PINEAPPLE	0	0	111	0	474	0	0	585	63	0	0	69
RADISH	0	0	0	0	0	0	0	0	5	0	0	5
SPINACH	0	0	0	0	0	0	0	0	0	0	0	0
SQUASH	0	0	0	0	0	0	0	0	40	0	4	44
STRAWBERRY	0	0	0	0	0	0	0	0	0	0	0	0
TANGERINE	0	0	0	0	0	0	0	0	0	0	0	0
TOMATO	0	0	0	1	0	0	0	1	24	0	5	30
TOMATO, CHERRY	0	0	0	0	0	0	0	0	0	0	0	0
WATERMELON	0	0	0	0	3	0	3	6	0	0	4	4
VEGS. OTHERS	0	0	0	0	0	0	0	0	0	0	0	0
MISC TROP F&V	0	0	0	0	0	0	0	0	0	0	0	0
ALL OTHERS	0	0	0	1	0	0	0	1	1	0	0	1
TOTAL	8	47	13027	4294	12411	1499	3913	35194	675	154	42	871

•From: USDA/AMS/F&V CIV.

TABLE 14 ALLOWABLE US IMPORTS (USDA/APHIS/PPQ).*

US PORT	PRODUCE	C. DOM. EL											
		BAH.	BAR.	BEL.	CA	DOM.	EL	REP.	SAL.	GUA.	HAI.	HON.	JAM.
ALL	ALLIUM	+	+	+	+	+	+	+	+	+	+	+	+
	ASPARAGUS	+	+	+	+	+	+	+	+	+	+	+	+
	BEAN	+								+			
	BEET	+		+	+	+	+	+	+	+	+	+	+
	BRASSICA	+	+	+	+	+	+	+	+	+	+	+	+
	CARROT	+		+	+	+	+	+	+	+	+	+	+
	CELERY	+		+	+	+	+	+	+	+	+	+	+
	CUCURBIT	+		+	+	+	+	+	+	+	+	+	+
	EGGPLANT	+	+	+		+					+		+
	LETTUCE	+	+	+	+	+	+	+	+	+	+	+	+
	MANGO										T		
	OKRA				+	+			+	+		+	
	PAPAYA	+	+	+			+				+		+
	PARSLEY	+	+	+			+			+	+		+
	PEA				+	+			+	+		+	
	PEPPER	+	+	+			+				+		+
	RADISH	+		+	+	+	+			+	+		+
	RUTABAGA	+		+	+	+	+	+	+	+	+	+	+
	SPINACH	+	+	+	+	+	+	+	+	+	+	+	+
	STRAWBERRY	+	+	+	+	+	+	+	+	+	+	+	+
S. CHARD	+		+	+	+	+	+	+	+	+	+	+	
TOMATO	+	+	+	+	+					+		+	
NA	ARTICHOKE	+		+	+	+	+	+	+	+	+	+	+
	AVOCADO	+	+				+				+		+
	BEAN		+	+	+					+			
	CARROT		+										
	CITRUS	+	+	T	T	+	T	T	+	T	+	T	T
	CUCURBIT		+		+			+	+		+		+
	MANGO	T	T	T	T	T	T	T			T	T	T
	OKRA		+			+				+		+	
	PAPAYA				T		T	T			T		T
	PEA	+				+				+		+	
	RADISH		+										
	TOMATO				+			+	+		+		+
SAG	ARTICHOKE	+		+	+	+	+	+	+	+	+	+	+
	AVOCADO	+				+				+		+	
	CHAYOTE				+		+	+		+		+	
	CITRUS	+				+				+		+	
	CUCUMBER		+										
	MELON		+										
	OKRA	T	T				T			T		T	
	PEA	+					+			+		+	

*EFFECTIVE JAN. 1984; SUBJECT TO REVISION AND CHANGE. PORTS OF ENTRY: ALL, NA (ATLANTIC-NORTH OF BALTIMORE), AND SAG (SOUTH ATLANTIC & GULF). T = TREATMENT REQUIRED. DAB:07/07/85 (FILE: APH:SL2)

TABLE 15 US FRESH FRUIT & VEGETABLE IMPORTS FROM MEXICO BY MONTH IN 1984.*

1984 COMMODITY	1,000 CWT												TOTAL	% OF TOTAL
	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC		
ASPARAGUS	10	24	39	8	0	0	0	12	13	10	2	0	118	0.4
BANANA	50	43	52	59	66	68	57	57	57	65	58	55	637	2.4
BEAN	72	47	34	23	3	2	1	0	0	0	3	43	228	0.8
BROCCOLI	7	12	9	3	0	0	3	1	2	3	2	3	45	0.2
BRUS. SPROUT	11	19	44	33	14	0	1	0	0	0	0	2	124	0.1
CABBAGE	258	265	344	107	5	0	0	0	0	0	0	0	979	3.4
CANTALOUPE	33	175	394	819	657	91	7	0	0	9	18	10	2213	7.5
CARROT	12	4	8	9	4	1	0	3	7	9	29	16	102	0.4
CAULIFLOWER	15	9	2	0	0	0	0	0	0	1	0	5	32	0.1
CUCUMBER	643	521	565	230	35	4	0	1	0	11	366	563	2989	10.3
EGGPLANT	86	83	78	39	16	2	0	0	0	1	36	44	385	1.3
GARLIC	0	3	22	44	51	105	33	14	7	2	1	0	282	1.0
GRAPEFRUIT	8	1	0	0	0	0	0	0	0	18	6	6	39	0.1
GRAPES	0	0	0	0	39	171	38	0	0	0	0	0	248	0.9
HONEYDEW	44	45	78	101	119	9	0	0	0	0	4	6	406	1.4
LETTUCE/END	47	31	22	0	0	0	0	0	0	1	6	57	164	0.5
LIME	47	22	27	22	16	24	27	30	48	45	39	49	396	1.4
MANGO	0	3	7	16	119	222	201	100	30	0	0	0	698	2.4
MELON, MIXED	3	2	2	3	7	4	1	0	0	0	0	3	25	0.1
OKRA	19	18	23	13	25	104	141	59	8	1	2	3	416	1.4
ONION, DRY	157	117	543	365	70	41	2	4	1	1	1	24	1326	4.6
ONION, GREEN	75	96	114	93	54	25	17	12	6	16	80	88	686	2.4
ORANGE	42	27	14	6	10	4	0	0	0	13	11	34	161	0.6
PAPAYA	1	2	5	5	6	3	4	2	1	1	1	2	33	0.1
PEAS, GREEN	27	27	20	4	1	0	0	0	0	1	1	16	97	0.3
PEAS, OTHER	0	1	3	3	3	2	0	0	1	17	33	4	67	0.2
PEPPER, BELL	385	378	395	120	34	10	16	9	8	9	23	193	1560	5.4
PEPPER, OTRO	57	59	69	62	54	52	38	64	34	30	28	48	595	2.0
PINEAPPLE	37	38	57	59	49	18	7	6	10	8	19	26	334	1.1
RADISH	26	22	24	12	2	0	0	0	0	2	19	21	128	0.4
SPINACH	6	3	0	0	0	0	0	0	0	0	0	3	12	.0
SQUASH	321	330	236	114	61	20	8	5	6	23	94	222	1440	4.9
STRAWBERRY	17	4	1	0	0	0	0	0	0	1	17	22	62	0.2
TANGERINE	18	0	0	0	0	0	0	0	0	9	63	47	137	0.5
TOMATO	1001	1706	1741	1009	469	287	150	219	266	319	191	182	7540	25.9
TOMATO, CHR	136	154	138	117	82	43	11	8	19	33	57	118	315	3.1
WATERMELON	114	229	573	684	999	159	24	3	0	0	18	73	2376	9.9
VEG. OTHERS	35	36	29	28	24	18	15	11	12	15	17	23	263	0.9
MIS TROP F&V	10	11	9	10	10	9	10	9	10	12	8	7	115	0.4
ALL OTHERS	38	22	27	11	6	0	0	4	1	2	5	32	148	0.5
TOTAL	3868	4589	5748	4281	3120	1498	812	633	546	608	1258	2050	29091	100.0
% of TOTAL	13	16	20	15	11	5	3	2	2	2	4	7	100	

*From: USDA/AMS/F&V DIV.

DAB:07/06/85 (FILE: FFMEX64)

TABLE 16 AVERAGE NEW YORK WHOLESALE PRICES PER POUND FOR FRESH
FRUIT AND VEGETABLES IN 1982 AND 1983.*

COMMODITY	ORIGIN	PACKAGE		AVERAGE PRICE PER POUND		
		TYPE	LBS	1982	1983	AVERAGE
ASPARAGUS	MEXICO	1/2 CARTON	14	\$1.81	\$2.02	\$1.92
BANANA	ECUADOR	CARTON	40	\$0.25	\$0.29	\$0.27
BROCCOLI	CALF	14-16 CARTONS	23	\$0.47	\$0.51	\$0.49
BRUS. SPROUTS	MEXICO	10 OZ CUPS	0.63	\$1.14	\$1.29	\$1.22
CABBAGE	NEW JER	CARTON	50	\$0.09	\$0.12	\$0.11
CANTALOUPE	MEXICO	1/2 CRATES	40	\$0.38	\$0.56	\$0.47
CARROT	TX & FLA	SACKS	50	\$0.17	\$0.16	\$0.17
CAULIFLOWER	FLA	CARTON- 12'S	22	\$0.61	\$0.54	\$0.58
CUCUMBER	MEXICO	1&1/9	55	\$0.34	\$0.34	\$0.34
EGGPLANT	MEXICO	1&1/9	33	\$0.28	\$0.31	\$0.30
HONEYDEW	PR & MEX	CARTON	30	\$0.33	\$0.47	\$0.40
LIME	MEXICO	36-72 CARTON	10	\$0.79	\$0.48	\$0.64
MANGO	MEXICO	CARTON 8-14	10	\$0.69	\$0.66	\$0.68
MELON, MIXED	MEXICO	CARTON	30	\$0.72	\$0.65	\$0.69
OKRA	MEXICO	1/2 BU CRATE	15	\$0.74	\$0.84	\$0.73
ONION, DRY	MEXICO	BOILER/RED	25	\$0.52	\$0.54	\$0.53
ONION, GREEN	MEXICO	CARTON- 48'S	13	\$0.67	\$0.56	\$0.62
PAPAYA	HAWAII	9-12 CARTONS	10	\$1.06	\$1.05	\$1.06
PEAS, GREEN	MEXICO	1&1/9 BU	30	\$0.63	\$0.60	\$0.62
PEAS, OTHER	GUAT.	(CHINA TYPE)	1	-	\$2.10	\$2.10
PEPPER, BELL	MEXICO	1&1/9 BU	28	\$0.54	\$0.58	\$0.56
PINEAPPLE	HON	TWO-LAYER	40	\$0.29	\$0.30	\$0.30
RADISH	FLA	BUNCH- 24'S	15	\$0.40	\$0.44	\$0.42
SPINACH	TX & FLA	BUSHEL	25	\$0.37	\$0.37	\$0.37
SQUASH- ZUCC	MEXICO	LUGS	26	\$0.34	\$0.56	\$0.45
SQUASH- YSNECK	MEXICO	LUGS	26	\$0.30	\$0.63	\$0.62
TOMATO	MEXICO	2- LYR FLAT	20	\$0.53	\$0.53	\$0.53
TOMATO, CHERRY	MEXICO	12 PT TRAY	15	\$0.73	\$0.56	\$0.65
WATERMELON- CG	MEXICO	3-4 CARTONS	1	\$0.24	\$0.31	\$0.28
WATERMELON- J'	MEXICO	3-4 CARTONS	1	\$0.23	\$0.31	\$0.27
AVERAGE PRICE PER LB				\$0.55	\$0.62	\$0.61

* From: USDA/AMS/F&V DIV./MARKET NEWS BRANCH.
DAB:07/07/85 (FILE: FFIMP836)

4. Determining Criteria for Export Crops

Price is an important factor in selecting crops for export production as well as production and marketing factors to include quantity capable of being produced, cost of production, allowable exports; ease of production, perishability, availability of transportation, and cost of developing processing and transportation networks both in and out of Belize. An initial rank of potential export crops was determined using most of these criteria. (See Table 17). The ranking provides useful study alternatives for early phases of the project. From the table the deletion of fry onion, cabbage, carrot, and green onion seems warranted as these produce items are being grown more competitively, under more favorable climates, in Mexico. Cherry tomato, ranked fourth might be reversed with large tomato (sixth) under the assumption that large tomato can be shipped mature-green, holding somewhat longer in transit.

Three suggested products, bell peppers, pineapple, and squash hold for approximately three weeks from harvest and therefore could not be shipped under present ocean freight services from Belize. The low value of these products cannot justify air freight rates and remain competitive. The possible solution may be a new ocean service, or shipment by Mexican reefer IN BOND to Texas.

Using the rankings from Table 17, some research and development interest in the following products is warranted.

- a. Honeydew and mixed melons: They ship well, lasting up to five weeks under refrigeration. Although sensitive to mildew they are rather easy to grow. They will have strong competition from three other Latin countries. Current prices require production costs of U.S.\$1.75 per 28 lb. case.
- b. Other peppers: Hungarian wax, Cayenne, Jalapeno, and other varieties sell for high prices. They tend to be resistant to many diseases and are easier to grow than bell peppers. Market is thin but price is high enough for air shipment. Competition from Central America is negligible because of the Med-fly quarantine.
- c. Cucumbers, watermelon, okra, and squash: All cucurbits have similar vine culture and are capable of holding for upto three weeks after picking. Okra grows easily but transport must be by air.
- d. Cherry tomato: A substantial labor input is needed but yields are good and there is no competition from Central America because of the Med-fly quarantine. Its relatively high value sometimes allows for air shipments.
- e. Pineapple: The culture is well known and growth can be controlled with hormones. They tolerate drought, and their demand is improving. Pineapples have been grown successfully in Corozal.

TABLE 17 RATING SYSTEM FOR EXPORT FRESH FRUIT & VEGETABLES FROM BELIZE.

		RATING SYSTEM									
LARGEST VOLUME US FRESH PRODUCE IMPORTS		CAN NOT GROW IN AREA	USDA APHIS PPQ BAN	1982-83 AVERAGE WHOLESALE VALUE \$/LB	5 = EASY, LOW 10 = MEDIUM 15 = HARD, HIGH	EASE TO GROW	EASE TO HANDLE	EASE TO SHIP	COST TO SHIP	TOTAL	RANK
NO.	COMMODITY										
1	BANANA	X									
2	TOMATO			0.53	10	15	10	15	10	60	6TH
3	GRAPE	?									
4	CUCUMBER			0.34	10	10	5	10	10	45	3RD
5	WATERMELON			0.29	15	5	5	10	10	45	3RD
6	CANTALOUPE			0.47	10	15	10	15	10	60	6TH
7	ONION, DRY	(?)		0.53	10	5	5	5	10	35	1(?)
8	PEPPER, BELL			0.55	10	10	10	10	10	50	4TH
9	SQUASH			0.53	10	5	10	10	10	45	3RD
10	CABBAGE	(?)		0.11	15	5	5	5	5	35	1(?)
11	PINEAPPLE			0.33	15	10	10	10	10	55	5TH
12	TOMATO, CHERRY			0.65	5	10	10	15	10	50	4TH
13	MANGO		X								
14	CARROT	(?)		0.17	15	5	5	5	5	35	1(?)
15	ONION, GREEN			0.62	5	5	5	15	15	45	3RD
16	PEPPER, OTHER			?	10	5	5	10	10	40	2ND
17	MELON, MIXED			0.40	10	5	5	5	10	35	1ST
18	HONEYDEW			0.40	10	5	5	5	10	35	1ST
19	LIME	?									
20	OKRA			0.78	5	5	5	15	15	45	3RD
TOTAL					165	120	110	160	160	555	

DAB:07/08/85 (File: FFRANK1)

4. Tomato and cantaloupe: Both are high-volume items and are always in demand. The culture is well known and a good selection of varieties exist.

5. Export Potential for Other Crops

Because the project emphasizes annual crops that can demonstrate a fast cash payback, tropical tree fruits have been excluded. The following suggested crops have been grown before in a small scale in Belize. Except for ginger, they require a high level of specialized production expertise and contractual market access that would be possible only through long-term commitment by foreign buyers.

These crops can be divided into two categories, and within each category first, second, and third choices are listed.

a. Very Intensive Crops require approximately 50 acres to reach commercial volumes. For so few acres needed, appropriate sites can be found and developed. Manpower is the critical factor. These are practically 'greenhouse' operations with high labor and managerial inputs. Investment per acre is also high. Because planting stock is often expensive, a reproductive phase of two or three years is necessary to establish commercial production.

1. Ornamental Foliage: A farm in Belize District has been shipping for several years. Florida growers of houseplants already rely on CBI sources for cutting stock. Most cuttings must be shipped by air; but unlike vegetables or flowers, harvest times can be coordinated with available cargo space. Some varieties (yucca, dracaena, ficus) can be grown extensively and shipped by sea.

2. Cut Tropical Flowers: Anthurium, bird-of-paradise, and similar species are gaining popularity and would grow in Cayo. A brief study on the feasibility of domesticating 'xate' foliage might be worthwhile. Florists presently receive wild stock gathered in Guatemala and south Mexico, but with increasing demand cultivation under natural shade might become competitive.

3. Vanilla: A high priced spice with limited market. Because world supply is cartelized, a few major spice packers are seeking new sources. The vines must be grown under shade, hand-pollinated, and the beans carefully fermented.

b. Extensive crops need perhaps 1,000 acres minimum for potential export interest. Labor and capital investments are low, compared to the very intensive crops just mentioned. Critical factor is getting high yields at the lowest cost per pound. Therefore, finding enough suitable acreage may be difficult. Because they are preserved (dried or frozen), all can be shipped by sea.

1. Certified Seed: Although the wonders of biotech might accelerate genetic research, the seeds still must be multiplied to meet high volume demand. Seed companies can put a new variety onto the market a year earlier by contracting winter production in Mexico, Central America, or the Bahamas.

2. Frozen Vegetables: Items like okra, peas, zucchini, or sweetcorn are too perishable to ship by sea. However, acreage can be developed for an IQF (individual quick freeze) plant. Well known case histories include Hanover Brands in Guatemala, Quality Foods of El Salvador, and Southland in Nicaragua and the D.R.

3. Dry Ginger: Demand is steady, but exports have decreased from traditional producers. Ginger needs heavy rainfall and fertilization with manure cover. This might be a possible 'milpero' crop for southern Cayo District. Presumably, the best technology and rootstock can be found in Jamaica or in India. Ginger can also be pickled for Japan or distilled into oil for England.

C. DOMESTIC

1. Domestic Market Limitations

a. The Prospects of Domestic Market Oversupply

Belize is a very small national market. Even though dependence on imported food supplies exacerbates the foreign exchange problem, relatively small amounts of crops produced for import substitution would turn the situation around. Given that a viable enterprise is developed, it appears that availability of land resources for production would not be a constraint.

Farmers are notorious for their capacity to respond to profitable enterprise options over the long-term. There is little to suggest that Belizean farmers are an exception. When a new enterprise becomes demonstrably feasible, it will probably gain momentum rapidly. This poses the dilemma that success in the development of new import substitution enterprises may ultimately lead to over response by farmers, causing oversupply and depressed prices. These problems may become more difficult if policy concessions have been made to producers in order to shield the enterprise from foreign competition. Once farmers enter production under these circumstances, retraction of the protection becomes difficult from both an economic and political standpoint. The current plight of the cane farmers after a protracted period of profitable production because of protected markets vividly illustrates this scenario.

Not all of these consequences are negative. Consumers might benefit as product prices fall toward competitive international levels, lowering food costs. Stress on an enterprise would also impart vigor to efforts designed to improve product quality in order to stimulate consumption. The foreign exchange drain problem, that a particular enterprise was designed to alleviate, would be fully met with consequent improvement in the national economy.

The potential long-term problem deserves attention and consideration in the execution of the project because the national market is small and thus highly sensitive to changes in supply, and in view of the abundance of land resources in the country, this may not be a significant constraint on production.

b. Imperfect Domestic Competition

As mentioned earlier, Belize constitutes a small market for food and feed crops, and modest levels of production of crops to substitute for imported products would be sufficient to meet domestic demand. The restricted size of the Belize market is likely to also create problems in supporting marketing and processing firms. While production may be broad based and competitive at the farm level, the processing and marketing system into which products move may have few if any competitive characteristics.

Inventive price discovery methods and transaction modes are required to achieve producer-marketing firm equity in such situations. For this reason, moderately high tariffs rather than import bans would be a better way to give the local industry sufficient opportunity to become competitive. Competition in the form of imports is always present.

2. Domestic Potential

The project has the potential to significantly decrease the imports of some food and feedstuffs. (See Table 18).

Table 18.

Selected Imports to Belize, 1983

Animal feed	4,000,000
lard	3,500,000
edible oil	1,500,000
onion	1,300,000
prepared food	3,000,000
cabbage	200,000
minor vegetable	100,000
 Total imports	 BZ\$13,600,000

According to estimates by CARDI, a dollar of imported inputs, e.g. fertilizer, plastic, fuel, ag.chem, is needed to substitute U.S.\$3.60 of imported lard, oils, and feedstuffs. Extending this premise the NET potential foreign exchange savings could approximate U.S.\$4.9 million.

a. Feedstuffs

Over 5,000 tons of concentrates and speciality feeds are imported from the USA and Guatemala. After three years of varietal testing, CARDI has identified AGS-29 from AVRDC (Taiwan) as capable of yielding 35 bushels/acre under conditions at Belmopan and Cayo District. At 30 bu/acre 6,000 acres would be needed to satisfy total feed concentrate consumption. The beans could be extruded through a low-cost cooker (LEC). The result would be full-fat soy with 40% protein possibly equal in cost and better in quality than imports.

Indirectly, the substitution of imported animal products will be promoted by developing better crop systems for corn and sorghum. Reducing feedgrain cost to animal producers will stimulate an increase in animal products for reasonable prices to the consumers.

b. Lard and Oils

On average, Belize imports 2,000 tons/year of lard, 500 tons/year of vegetable oils, and 400 tons/year of margarine. It is possible that a large portion of this can be replaced by the development of an oilseed industry. CARDI has grown Yuamar, a sesame variety from Panama, at their research site in Belmopan; and without irrigation or disease and pest problems have obtained yields of 1,200 lbs./acre. Yuamar also has the potential of being accepted on the world spice market as well as being a good source of oil. CARDI has also tested several other varieties of sesame but none were as promising as Yuamar.

Other potential oilseeds such as rape, mustard, sunflower, and safflower have also been tested by CARDI but none matched sesame's oil yield and ease of cultivation. Sesame is among the easiest of oilseeds to refine. A focus may thus be placed on sesame oil to relieve imports of oils and lard.

c. Onion

Belize imports approximately 1.9 million lbs. of onion per year at an average CIF cost of BZ\$72/cwt. Seasonal prices can drop as low as BZ\$40/cwt. At this minimum level, sales of BZ\$4,000/acre are possible with yields of 10,000 lbs./acre. CARDI and the Cayo Vegetable Growers' Association have tested several varieties, but much work remains. While 200 acres would be enough to satisfy existing onion demand, lower retail prices might increase Belizean per capita consumption.

d. Prepared Foods

Small market size and a history of trading have prevented Belize from developing a food processing industry. Nevertheless, certain items can be produced on a kitchen-scale basis to compete with imports successfully. These include catsup, mustard, snacks, fruit juice, sauces, pickles, and cheese. Kitchens have recently started to market peanut butter, fruit jams, and hot sauce. Probably, the market will not sustain more than one processor in each item, but assisting such operations will offer options to consumers, who now must buy costly imports, and farmers who must now dump fresh produce during market 'gluts' that can be as short as one week.

e. Cabbage and Minor Vegetables

Development work on vegetables with potential for import substitution will be coordinated with the development work of export oriented vegetables. For a few winter months each year, some reject or surplus export produce can be fed to the local market. Potato and carrot, although a significant portion of imported vegetables, will be sidelined, because they are not likely candidates for economic production without major R&D inputs and high tariff protection.

Efforts by CARDI and the MNR have promoted local production to the point where imports of cabbage, tomato, and pepper are under temporary ban. Current demand for cabbage is 10,400 cwt/year, which can be met with 40 acres. Yields of 300 cwt/acre marketable heads are possible at present.

f. Project Flexibility

The project has sufficient flexibility to take advantage of opportunities as they arise. Although soybean is programmed for extruder processing, the 20% oil content can be extracted with an expeller that might be included in a large mariculture project under development. Sesame is programmed for oil, but the seedcake from the first 4,500 acres will provide 1,350 short tons of animal feed concentrate. Vegetable field trials for export might be applicable for domestic market. Food processing R&D geared to the local demand could uncover export options later.

III. MARKETING/DISTRIBUTION PROBLEMS

A. Domestic

The Belize Household Expenditure Survey, 1980, indicates that Belizeans spend approximately 4% of their income on produce or U.S.\$38 per capita. The produce distribution system is deficient, resulting in limited selection, poor quality, and higher retail prices than necessary.

Trucking is not a major constraint. Distances are short to market and roads are fairly good. However, truckers tend to be growers or friends from the same village rather than professional intermediaries. There is no coordination in shipping produce from various farms, thus volumes transported are too small to be economically viable.

The produce usually arrives at urban markets having been exposed several days to ambient temperatures of 70-90° F. The wholesalers don't have adequate cold storage, and are reluctant to buy unless they are sure that the offered produce can move immediately. Produce must be delivered to each retail outlet by the wholesaler, or by the grower if he markets himself. Most outlets are small and do not merit delivery more frequently than once per week. Moreover, the retailer rarely has refrigerated space. As a result, spoilage and retail margins are high. Quality is dismal as very few produce items can remain in good condition after being exposed to a week at tropical temperatures.

Five large wholesalers also import Mexican produce and their purchase decisions are made a week in advance. Geared in the past to imports, the wholesaler feels no commitment to advise farmers in advance of market conditions. Belizean farmers who truck in produce to these wholesalers are sometimes turned away regardless of low price or better quality. The MNR presently does not offer any market news programs by radio; extension agents do not collect timely planting data that could be used to warn farmers of over-supply situations in advance.

B. Export

Transportation to export markets for dry foods such as sesame seeds or pulses is adequate. The CAROL Consortium of HAPAG/CGM/HARRISON/NEDLOYD sails to Europe via Caribbean ports every ten days. Containers, including speciality types, e.g. tanker, ventilated, open-top, conair are available on request. Rates are set by the WITASS Agreement. Sailings every two weeks to Tampa or Miami are offered by Hyde and Nexos lines.

Although refrigerated containers (reefers) are available, the schedules offered by these shipping lines are not conducive to fresh produce shipments. Only vegetables with a fairly long shelf life can move through existing shipping schedules. A typical scenario may be as follows:

Using Hyde to Miami a produce shipper must expect an average seven day wait before sailing. Actual sailing time to Miami is eight days northbound (only two days southbound), because Hyde stops at French Harbor, Honduras before proceeding north. Inspection staffs of USDA/PIQ and U.S. Customs are under-manned at Miami, considering the fast rising volume of produce through that port of entry. A shipper should budget 48 hours before his container is released. The produce is then unloaded into one of a dozen good cold storage transfer facilities in south Florida and enters the U.S. distribution system. A broker often breaks down the consignment for mixing into full trailerloads for the two day transit to major northeastern markets. Alternatively, the produce could be stuffed into LD-7 pallets for air shipment to Canada or Europe. If a weekend intervenes, then another day is lost, because loaders are rarely available and terminals are closed after noon Saturday in most locales. At destination, the fresh produce will be inspected by the buyer at his cold storage, and will spend another day or so there before delivery to a supermarket shelf. Total elapsed time from the Belize field to the U.S. consumer may average 22 days -- a long time for most produce.

In contrast other CBI produce exporters (e.g. the D.R., Guatemala, Honduras) enjoy weekly service with three day northbound transits. Served by two or three lines -- CCT, Seaboard, Comcorde -- these competing nations often get a sailing every three to five days. Effectively, they are a week closer to the USA market than Belize.

Trucking through Mexico is feasible, but reefers are not often available during the winter season when Mexico itself is heavily shipping to the USA. Assistance at both borders would be essential to facilitate quick passage and Mexican trucks must be used. Transit to McAllen, Texas is three days if border formalities are arranged correctly. Receivers at McAllen then break down the load for mixing with other Mexican crossings and reshipment by U.S. reefers to northern cities.

Air service is available daily to Miami and New Orleans via TACA and TAN/Sahsa, but cargo space is severely limited. Reserved space is impossible, because passenger baggage has priority. TACA has considered renewing its

weekly all-cargo flight. Challenge Air just started daily flights to Miami. CAME (a charter line) has weekly service to Los Angeles and New York. The Belizean government has maintained an 'open skies' policy. These hopeful developments may increase available cargo space. Almost all Belizean produce exports to date have left by air. An airport cooler owned by the present mango shipper could be available during the winter, when mango is out-of-season. Transit time is only a few hours. The Miami and Los Angeles airports have excellent infrastructure for trans-shipping perishables.

Freight is usually the major cost in shipping produce. Rates offered ex-Belize are fair and not likely to drop, unless heavy pre-scheduled volume is contracted. Hyde charges U.S.\$180/ton regardless of commodity (except for beef at U.S.\$120/ton). Because 40-foot reefers rarely hold more than 30,000 lbs. of produce, the Hyde rate equals U.S.\$2,700 per container. Considering that inland transfer charges (at both Belize and Miami) are extra, this cost is about a penny per pound above reefer rates from other Central American ports. Reefer trucks through Mexico to McAllen will charge about U.S.\$3,500. Air rates are negotiable, depending on volume shipped and type of aircraft used. For scheduled service the lowest rate will be about U.S.\$0.20/lb. Charter rates vary wildly but are often more expensive, unless southbound backhaul cargo is arranged. Both Hyde and the airlines might offer concessionary rates to promote fresh volume initially, but such offers cannot be projected for the long-term if they are not sustainable.

All packaging material must be imported. Good wire-bound wood crates and woven (jute, burlap, poly) bags are available in Honduras. Most fresh and frozen produce require printed cardboard cartons of 275-test or stronger. Each class of fresh produce needs a different box design (a detailed discussion of corrugated containers is beyond the scope of this report). As a 'rule of thumb', however, planners should expect CIF box costs of U.S.\$0.70 - 0.85/cu. ft., depending on wall thickness and finish. Delivery time is five weeks from Alton at Jacksonville, Florida or International Paper at Georgetown, South Carolina via Nexos Line from Tampa. These firms provide USA growers with boxes and are familiar with exact requirements. Fiber boxes from Central American sources are of poor quality.

Processing, packing, and storage facilities at present are all inadequate for the export crops that this project would promote. Therefore, pilot facilities must be provided for initial shipments to foreign markets. Belize has had no reason to erect infrastructure for seed-cleaning, produce packing, vegetable freezing, drying, or cold storage. Existing exporters of fresh mango, banana, and frozen citrus juice and beef all have their own packing and storage, but these are not situated in the three target districts.

Belize has favored access to all potential export markets. As a member of the CEE, CARICOM, the Commonwealth, and EEC 'ACP' group, Belize can ship its produce to the USA, the Caribbean, and Europe with minimal restrictions and usually no customs duty. At present, export market information is scarce and

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scattered among several commercial libraries. For example, an exporter cannot access such data as tomato prices in new York or the address of a Dutch spice importer of phytosanitary regulations for Trinidad. Therefore, he cannot pinpoint export opportunities.

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SOCIAL SOUNDNESS

I. BACKGROUND AND SUMMARY

Belize is a multi-ethnic country of approximately 160,000 people in 1984. Population density is very low, divided evenly between urban and rural areas, with more than a quarter of the population living in Belize City. While the city is predominately English speaking Creole (Afro-American), the rest of the country is diverse, and a majority of the rural population speaks Spanish as a first language. Nationally, the largest group are Creoles (39.7% of total population in 1980), followed by Mestizos of mostly Maya ancestry (33.1%), Garifuna (Afro-Indians, 7.6%), Yucatec and Mopan Maya (6.8%), Mennonite (3.3%), Kekchi Maya (2.7%), and East Indians (2.1%). A substantial number (estimated between 5,000 and 10,000) of refugees from El Salvador and Guatemala have entered the country in the last five years, scattering in rural areas and the cities, and forming several villages of their own. In addition, many Guatemalans and Mexicans enter Belize on a seasonal basis to find farm work.

This complex mix does not break down easily into groups by class, wealth, or economic role, and mixed communities are common. The only single-ethnic communities are the Mennonite settlements, the Amerindian villages of the south, and some Mestizo villages in the west and north. Belize has one of the highest fertility rates in the world, yet the country's population is growing slowly. Legal and illegal emigration (mostly to the U.S.) seems to balance immigration from neighboring countries and natural increase. Because most immigrants are ethnically Mestizo, and because so many emigrants are Creole, the ethnic balance of the country is changing, though government is still largely dominated by Creoles. Belize City is the main stage for emigration to other countries, and this has led to a rare situation among LDCs, in that the rural population is growing at a faster rate than the urban. All these trends tend to increase the cultural differences between Belize City and the rest of the country.

Major socioeconomic divisions within the country are along rural/urban lines and among the various ethnic groups, though there is a good deal of intermarriage and a slowly emerging national Belizean identity which cuts across ethnic divisions. Class has never emerged as a major division, as Belizeans generally value equity and equal access to resources very highly.

II. SOCIOCULTURAL CONTEXT

A. Historical Summary

Historically, Belize has never had an economic or cultural base in agriculture. The large landowners who dominated the colony from the early 19th century made their fortunes in the export of logwood and mahogany, and the import of foods to feed what was essentially a captive workforce. Small

holder agriculture was systematically suppressed as a threat to control of that labor force, mainly by limiting access to land. The sugar industry was first established in the 1850s by Maya immigrants from Mexico, but larger estates under British and Mestizo control grew very slowly due to labor shortages. As the logging industry began an uneven decline at the end of the 19th century, small holders (mainly Mestizos, immigrant Mayas and rural Creoles) began to settle small villages in the countryside where they pursued subsistence agriculture. Most such settlements used public lands or squatted on private land; agricultural land remained overwhelmingly in the hands of a very few foreign landholders. As late as 1973, over 90% of the private land in the country was held by foreigners, few of whom lived in the country. Small Belizean farmers are concentrated in areas which were once public land, and on a few private holdings that were expropriated by the government in the 1970s for distribution to farmers.

There have been many attempts, beginning in the late 19th century, to establish commercial export agriculture in Belize. Sugar was one of the first such cash crops, and has been the most enduring, though the industry has been progressively concentrated in fewer, larger enterprises since its inception. Other crops, such as bananas, ramie, cocoa, coconuts, and rubber have come and gone with fluctuations in world markets. A major barrier to all labor-intensive export crop production over the years is the relative scarcity of farm labor. Because most of the rural population is involved in subsistence farming, they are only available for farm labor on a seasonal basis, and the high cost of living in Belize in general means that labor is quite expensive compared with neighboring countries.

B. The Present

Today the farm population is extremely diverse, scattered widely in small settlements. Average settlement size varies from district to district from about 300 up to 500 persons. The largest rural communities are found in the north, where villages also have the best access to social service, electricity, and potable water.

Most farmers use some variant of slash-and-burn farming (milpa) to produce basic subsistence foods (corn, rice, vegetables, and root crops). The common rural life history includes many short periods of full- or part-time local work on farms or in town, seasonal farm labor, and short-term urban migration, interspersed with periods of residence and work on a family subsistence farm. Most farmers also produce some quantity of a cash crop, but are hindered by very thin local markets for produce that are easily saturated, and by the lack of any adequate system of rural bulking or wholesale markets. There are very few middleman-entrepreneurs who buy at the farm and sell in town. Rural producers must therefore transport and sell the crop themselves, which is prohibitively expensive and time-consuming for those who are distant from towns.

The cash crop varies widely according to the area of the country and the ethnicity of the producer. In the Cayo and Belize Districts, milpas are often

turned into rough pasture for cattle after the corn crop, and vegetables and fruits are often grown on a more permanent basis on small mechanized plots, while in the north sugarcane is dominant.

III. PROJECT BENEFICIARIES

In the broadest sense, the entire Belizean economy stands to benefit from this project if it is successful. Indirect beneficiaries include those who will transport, pick, and pack new agricultural products, as well as those who will supply credit, agricultural inputs, farm equipment and management for new farm enterprises. Direct beneficiaries will be the farmers and their families who are directly involved in crop production.

A. Direct Beneficiaries

Based on the 1980 census, there are approximately 11,500 rural households in Belize directly involved in farming, with perhaps another 1,000 living in urban areas but which own or manage a farm. The 1984 labor force survey (Ministry of Economic Development) lists a total population of 12,210 adults employed in farming, which includes 1,146 women and an unspecified number of farm laborers. This latter figure probably under-represents women who contribute labor to a family farm, and does not include children under 18 who also make a major contribution throughout the country.

Although of questionable reliability, total farm employment for the three districts targeted by this project can be derived from the 1980 census:

District	Males Employed in Farming	Females Employed in Farming
Cayo	1872	102
Orange Walk	3162	49
Corozal	3502	28
Total	8536	179

This figure under-represents those involved in farming on a part-time basis (as many milpa farmers work as laborers during the off-season, and many farmers have other businesses), but it does give some idea of the target groups in the three districts.

1. Cayo District

Cayo is probably the most diverse district in the country in terms of farming systems. Included in the area are Mennonite farmers practicing low-technology mixed farming and livestock production; Maya milpa farmers, many of whom have begun mechanized farming of corn and peanuts as cash crops; large Creole, Mestizo and expatriate landholders who have hundreds of acres of prime farmland under pasture and who often have other sources of income than farming; Creole and Mestizo tenant-farmers who feed themselves and a few

cattle on their land but work in citrus, cane, logging or chicle for much of the year; and a scattering of American and European expatriate farmers producing anything from ornamental plants to yoghurt. What they all have in common are the problems of a limited market for their produce. When asked what their problems are in farming, almost all farmers will say "a lack of market for my crops". Other problems of land, technical inputs, credit, and knowledge will only surface once a market is available.

With such a diverse group of farmers having technical and financial resources ranging from nothing to very substantial, it is difficult to predict who exactly will respond to and benefit from the present project. There are a substantial number, perhaps as many as 1,000 farmers, who have land, access to mechanized equipment, and sufficient family labor to participate. The largest and best capitalized farmers are likely to be able to move fastest in taking advantage of the crops developed under this project. Many of these are Mennonite farmers. Most of the least wealthy and poorest educated farmers are of Maya and Mestizo ethnicity, for whom social and cultural factors will be important in the adoption and success of new technologies and crops. Particular attention should be paid to communication channels in presenting the results of the project to them. Nevertheless, there are no specific cultural or social obstacles to innovation in crops or farming systems among these farmers.

2. Corozal and Orange Walk Districts

These two districts are culturally homogeneous, being settled mostly by Maya/Mestizo descendants of refugees from the Caste War in Yucatan in the mid-19th century. They combine subsistence farming with cash producing enterprises like fishing, hog-rearing, working on sugar estates, logging, and chicle gathering. The major change in the economy of the area has been the rapid increase in production of sugarcane, from 4,503 tons in 1955 to 13,400 tons in 1966 to 114,278 tons in 1983.

Up until 1972, the vast majority of cane was grown on the large plantation of the Belize Sugar Industry (BSI). At that time GOB and BSI agreed to transfer production to small farmers, and 220 farmers were sold established canefields with eight years to pay. A system of quotas for delivery of cane to the factory was established, and over the next years many new quotas were issued, to a total of 4,955 licensed quota holders in 1984.

The advent of cane farming as a source of cash caused drastic changes in the culture and social structure of the north, with the changes beginning first in Corozal District where the first modern factory was established. A number of studies of the area found some decrease in nutritional standards, less economic autonomy for women, an increase in social and economic inequality, and much strain in the fabric of community and village life. Political opportunism and village factionalism made community action very problematic. On the other hand, the family network proved very durable, and cane production became increasingly a family business as groups of related farmers pooled their labor in farming, and their capital in order to invest in equipment and

new technologies for crop production. Another major effect of the rise of cane was a rapid rise in disposable income and living standards, a rapid decline in food production in the area, and a rise in the price and value of land.

Since the time of the first distribution of quotas (licenses) for cane delivery, a number of changes have taken place in the system which makes it extremely difficult to tell the exact number and nature of the present cane farming population. While quotas are legally non-divisible and non-transferable, the sale of quotas has been common. Those who have quotas often buy cane from those who do not, but who nevertheless produce cane. Quotas are effectively inheritable property, and many women have acquired quotas as dowry or through inheritance (presently it is estimated that 23% or about 610 license holders are women). In addition, many small quotas of 40 to 100 tons were distributed by the government as political favors during the 1970s, often to shopkeepers, factory workers, and other non-farmers. People who lived in villages and farmed then moved to the towns, but kept their quotas.

The rules state that if a quota is not filled completely for three years it will be reduced, and if it is not filled at all for the same period it will lapse completely. This has meant that non-license holders had a ready market for their cane among the non-farming license holders, who needed to buy and sell in order to keep their quota.

The net result of this system today is that there is no longer a close relationship between the statistics available from the Cane Farmer's Association (CFA) on the number of license holders, and the actual number of cane farmers, or the actual acreage or distribution of cane plantings. The official statistics are presented in Table 1.

The leadership of the CFA estimates that more than 20% of the license holders are not farmers at all. In addition, many of the largest license holders are used to buying much of their cane from non-license holders. Finally, there are many cases in which two or more quotas are held by the same farm household, as when a man, his wife, and his mother all deliver on different licenses from the same canefields. It is nevertheless clear that in terms of size the people who profit from delivery (license-holders) are well distributed as to the size of their operation, with a tendency towards more small license holders over time.

This picture, however, fails to consider the many farmers who grow cane but have no license, and thus must sell their cane at a lower price. This number is completely unknown, but could be estimated at 500 - 1,000. Most such producers have very small operations, and cane provides their major source of income. The total number of cane farmers at present, subtracting the 20% of quota holders who have no farm, and another 5% for families with more than one quota, and adding 500 - 1,000 who have no quota, would yield a range of between 4,250 and 4,750 active cane farmers. This is not the total number of

possible beneficiaries for the present project in the two districts, however. Because of the high price of haulage per ton of cane, and the historical growth of the industry from centers around the two factories, there are a number of villages in the two districts that have never participated fully in the cane boom, though their members may have worked in the fields of other villages. Working from the 1980 census, which lists a total adult male population for the rural areas of the two districts of about 8,400, and allowing for about 10% of rural population not involved in farming, this leaves about 3,100 rural adult male farm population who are not cane farmers. Many of these are undoubtedly day laborers, but many others are subsistence farmers, Mennonites, and other marginal members of the farm population who will be interested in participating in new cash crop opportunities. The net of possible farm beneficiaries in the two districts should therefore be about 7,000 farmers.

It is clear that of this group, some farmers will be able to respond much faster to new technologies and markets than others, though farmers in the north have proven themselves capable of rapid innovation in the past. Studies of innovation in similar situations suggest that it is the "upper middle" range of farmers (in income and holdings) who will tend to respond most quickly. The richest farmers tend to be more conservative because they feel less pressure, while the poorer farmers lack the resources to innovate with and are more risk averse. These generalizations only apply for scale-neutral innovations and situations where credit constraints do not give preference to the largest farmers.

The drastic decline in cane prices in the last year has had a number of effects on the system described above, and has set the stage for the present project. Many farmers claim that with lower cane prices they are "going back to old time", that is, returning to a subsistence-production mode where they can at least feed their families. But now they have a higher standard of living to maintain and higher expectations, and are searching hard for new cash crops. The younger farmers who grew up in the cane business seem the most aggressive in this search, regardless of the size of their operations.

Few have given up on cane, however. They have seen the price fluctuate widely in the past, and are hedging their bets against the possibility that prices may go up again. For this reason, most farmers are trying to meet their quotas, even when they have to buy cane (which they sell almost at cost) to do it, so they will not lose their quotas. In 1985, only 231 farmers out of 2,729 in Orange Walk did not deliver cane, though 1,291 out of 2,729 did not fill their quotas. It seems that the urban dwellers with small quotas and no farms were the least likely to deliver cane this year.

Farmers tried to maintain their profit margins by reducing their costs, cutting out weeding, fertilizer and pesticide, and by evading their obligation to pay off loans. Because loan payments are deducted from the cane price at delivery to the factory (and the size of the payment in this marginal year would lead to losses of 3252-8/ton for many), payments can be evaded by selling cane in the field to others, who deliver it under their unencumbered quota.

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The other major impact of the decline in cane prices has been a complete change in the labor flow in the two districts. During the boom years hundreds of Guatemalan and Mexican immigrants flooded the area to work in cane, while Belizeans who had no cane or small quotas found steady employment as cutters, loaders and drivers. Some of the immigrants stayed and settled and joined either the rural or urban workforce, however, few were able to buy or lease land. Today this has all changed. Now, thousands of young and old Belizean men and women leave the north after the cane harvest in June, and enter Mexico legally or illegally to seek work in the tourist resorts of eastern Yucatan and Quintana Roo, or in the Mexican agribusinesses (including, ironically, a major sugar producing region near Obregon).

A final impact of the decline in sugar prices has been the closing of the Libertad sugar factory, which put over 1,000 people out of work. Many of the workers at the factory held quotas and were part-time farmers, and many are also from families that are small to medium scale cane producers. These people will now have to be re-absorbed into the farm workforce, for there are few employment opportunities in the urban areas. Inevitably, many will end up emigrating to Mexico or the USA.

B. Indirect Effects

At the present stage of project planning it is difficult to predict what effects will be felt elsewhere in the country. In broad outline three classes of indirect effects will be felt.

1. Spread Effects

It is likely that whatever new crops or technologies are introduced, and whatever new market channels are opened up, other farmers in the three non-targeted districts of the country will take advantage of them. Mennonites will likely be the first, as they have capital, equipment, land and a market orientation. Small vegetable farmers and mixed farmers in Belize and Cayo Districts, who presently produce large quantities for the local markets, will probably adapt quickly in order to maintain some competitiveness. If prices are stable, inputs are available, and existing extension channels remain open, it is expected that most farmers in the country who have access to the requisite resources will end up producing crops with cropping systems developed in the course of this project. It is usually the larger farmers who can be expected to lead in this development.

2. Employment Generation

New employment opportunities can be expected in harvesting, processing, packing, and transporting both new and traditional crops. These will likely be low-paying jobs which will be filled mostly by women and immigrants. The degree to which employers will be able to offer more than a few weeks of work, and be willing to provide basic housing is unknown, but is likely to be very limited in the case of small farms. It is difficult to gauge what the net benefit will be to Belize and Belizeans from these jobs.

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An unresolved issue at this point is the degree to which new farm labor demands will compete with the existing demand for harvesting labor in the citrus and cane industries. Competition could drive the price of labor up, but this depends on the seasonality of the labor required. It should be noted, however, that the December-February season is already a peak time for citrus and cane industries, and labor shortages may be a hindrance to expansion of new enterprises at that time of year unless immigrants are used. If the Coca-Cola citrus plantation project goes ahead, labor is likely to be crucially short in the north during the citrus picking and processing season.

3. Competition

One of the most important indirect effects of this project will be to provide competition for farmers engaged in low-technology cultivation of crops. If vegetables are cultivated for export on any scale, the rejects from export packing will also provide competition for those producers presently selling vegetables for domestic consumption. In the long run, both forms of competition will force other farmers to increase their own efficiency, accept lower incomes, or get out of cash production of those crops.

In the short run, however, low-technology milpa cultivators have proved themselves able to compete with mechanized producers of the same crop in Belize, as in the present rice industry in Toledo. Milpa farmers are not dependent on high-cost imported chemicals, equipment and fuels, and subsidize the cost of their labor by producing their own foodstuffs and accepting very low real wages. By improving the efficiency of mechanized producers elsewhere in the country, these farmers will be even harder-pressed to make an acceptable wage from selling their surplus over subsistence. These farmers may therefore seek wage labor on established mechanized farms as a solution to their cash needs, providing part of the labor needed in the north.

IV. FEASIBILITY AND IMPACTS

There are in general no sociocultural obstacles to the adoption of new crops and farm technologies in Belize. Mestizo, Creole, and Maya farmers in Belize have proven themselves very adaptable and willing to try new techniques and methods, even when quite drastic social and cultural changes are required. In fact, farmers have sometimes gone overboard and become highly dependent on a new crop, only to suffer later when the market is saturated and prices decline, or the world prices drop.

There are, however, a number of constraints and factors which will have effects on specific aspects of project design and which need to be taken into account. In the following sections these will be briefly discussed, and project impacts on various aspects of the social system will be anticipated.

A. Farmer Organizations

1. Formal Groups

It is necessary here to discuss some of the problems that farmer organizations of all kinds have had in Belize in the recent past because this project must depend on farmer organizations for extension and organization of production and marketing. The general record has been dismal, with numerous crop associations, cooperatives, marketing groups, and farmer interest groups formed and dissolved over the last 20 years. Many have been aided directly by PVOs with funds and personnel, and at times the government, through the Department of Cooperatives, has taken a direct hand in organizing and aiding the groups. Peace Corps and CARE have worked directly with such groups on many projects, and at times PCVs have managed cooperatives and associations. In almost every single case, as soon as the external support was withdrawn, the association collapsed.

The causes have been many. Village factionalism seems rampant in all parts of the country, and kinship-based groups often involve the association or cooperative in local struggles for power and prestige. A constant complaint is that managers or leaders inevitably use the association to their own political and economic ends, and accusations of embezzlement or fraud are common. In some cases the GOB itself has meddled in the affairs of rural associations when they appear to be acquiring some political role. A persistent lack of managerial, marketing, and book keeping skill underlies many of these problems, but there are also serious organizational problems that seem to be exploited by individuals and factions.

Those associations that have survived (among them the Cane Farmer's Association, and the Honey Cooperatives) have several things in common, though they have fallen prey to many of the abovementioned ills. They have largely stayed out of production, concentrating on marketing, and have developed professional, non-elective management that is responsive to the membership. They generally have a clearly defined monopoly position in the final processing or marketing of what their members produce. Based on this record, it is not recommended that any cooperatives or associations concerned directly with coordinating production, owning land or sharing equipment be fomented by this project. Instead, a role in marketing, grading or packing is much more likely to be an effective niche for an association that will last.

2. Informal Groups

Most farmers in Belize, but cane farmers in particular, form small kin-based groups that pool labor, equipment and sometimes capital in order to achieve economies of scale and efficiency. The groups are usually formed around a senior male who owns equipment, and includes his children, in-laws, and sometimes other relatives or close friends. In Cayo these groups function in the planting of grains as well as in harvesting and marketing of crops.

In the cane areas of the north "reaping groups" or "grupos" have become crucially important in the organization of the cane industry. During most of the year these function like the groups in Cayo, as small family firms that share labor and resources, though each member has their own land, cane, and quota. During the harvest season, however, the grupo becomes more like an agro-business corporation. The leader of the grupo invites a number of farmers in the village to come to a meeting, and there he schedules everyone's harvesting. The leader arranges all labor hiring, and provides all the equipment (often drawing on his family's labor and resources), and harvests each member's fields for a set fee per ton. A person who lives in town can contract with the grupo to harvest his or her field, and never even visit the area, paying the grupo's fee in cane rather than in cash. The cost is higher for those who do not belong to the 'core' group of friends and family. In this way, the high cost of equipment can be paid off relatively quickly.

Two informants estimated that between 80 and 90% of cane farmers are involved in a reaping group for harvest, while smaller numbers would form the family cores of the groups. It seems that grupos are not prey to the kinds of difficulties that cooperatives and associations have, partially because they have a defined authority structure and a heterogeneous membership bound together by non-voluntary ties. Individual grupos include members with a wide diversity of resources, and while leaders may have hundreds of acres of land, other members may have as few as ten. It is strongly recommended that extension and organization of production be pursued with grupos as the main target group as part of this project, as they seem the only viable existing organization which is socially cohesive enough to function in the context of new productive systems.

B. Land Tenure

Land is a constraint to farming in Cayo more than in any other district, because so much of the land that has good road access is held by a few large holders, while small farmers must work distant plots, often in difficult terrain, far from roads. Figures on average farm size are skewed by the small number of very large holdings, and by the large number of milpa farmers who may have no legal claim to the land they work, or who may have year-to-year tenancy. Nevertheless, for eight villages where data is available (raw data from Ministry of Natural Resources), the percentage of total land held in parcels of less than 75 acres ranged between 18.3% and 87.5%. The average for the district was about 58% of the land being held in parcels of less than 75 acres.

Tenant farmers are unlikely to be able to take advantage of the new crops developed under this project because they lack access to credit (having no security) and because they generally are the poorest and least educated group in general. The growth of custom-mechanized services in the private sector would make it feasible for some to mechanize, but there is always the possibility that a successful introduction of new crops will lead landlords to eject their tenants and farm the land themselves. These are clearly the most vulnerable group, and they include many refugees and immigrants. It is likely

that many in this group will end up being farm laborers, pickers and packers, and it is possible that their standards of living may actually decline in the long run. It is impossible, at present, to estimate the total number of farmers in this group, though the range is estimated as somewhere between 500 and 1,000.

The Corozal District tends to have many more very small holdings of less than one acre and a smaller average holding size (18.7 acres versus 62.1 in Orange Walk). This may be the result of having many small surveyed village plots where people live and have large gardens which have been shown to produce a substantial portion of the family's food. There are also many more large cattle ranching operations in the Orange Walk District. Both districts have a small number of extremely large private holdings in their more remote areas (greater than 20,000 acres, and up to 700,000 acres), that limit the ability of new farmers and immigrants to find new land.

While the person/land ratio is quite low (with an estimated 105,000 acres total under cultivation in the two northern districts), land values are comparatively high (BZ\$300-500/acre in cane areas for cleared land), and it is hard for small farmers to acquire new land except in very remote areas. From the point of view of this project the most important point about land tenure patterns in the north is that each farmer's holdings tend to be scattered and varied. It is common for a farmer to have land in five or six different areas, often separated by 25 miles, with some land under cane, some still in forest, and other land in food crops. This is an acceptable pattern for cane farmers, but a switch to crops that require closer supervision and more work will require change. Farmers will have to select the plots that have the highest potential (and they will need some assistance in this) and may have to change their residence to be closer to that field. Social dislocation and changes in village composition will result. Farmers who have moved into the larger towns will definitely have to move back to villages, or even to their farms.

C. Settlement Patterns

The hispanicized Maya of the north have always been a village-dwelling population. From very early times they have lived in small communities and have had their fields at some distance. If fields are too far from the village for a convenient walk each day, it was the custom to go and camp in the field for several weeks at the time of peak agricultural labor. In other words, it has never been the Maya custom to live on the farm, though it is very common for the family to have an intensive and highly productive garden in the village.

The coming of cane has really not altered this pattern very much, for cane does not require constant attention. There has been some tendency for population to concentrate in larger villages, with a number of small hamlets being abandoned in the last 15 years. Much of the cause of concentration is that government services (health, water, electricity, sanitation, education) tend to be present or of higher quality in larger settlements. Only the

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richer farmers have the resources to provide their own water, transportation and electricity for isolated farmsteads. Today only cattle ranchers tend to actually live on their farm plots in the north.

The introduction of high-value crops that require more constant care will put some pressure on the rural settlement system. Many farmers recognize that crop theft is rampant and will be a major problem with new crops, but they state that it will be difficult to move out of the village. Several who were interviewed expressed the feeling that it was unsafe to live in an isolated farmstead, given the high level of drug-related violence in the area. For this reason, opportunities to take advantage of new crops and technologies will initially be limited to those farmers who have land close to their existing residences in villages (which may be a substantial number), or those who are wealthy enough to build their own farmsteads.

In Iajo District the situation is more complex, as there is a much larger number of farmers who already live dispersed on their farms. Maya people and poorer Mestizos tend to live in villages, but the better-off cattle and vegetable farmers already live on their farms, or live in town and have resident managers on the farm. The level of crop theft is very high, but there does not seem to be the same sense of danger from violence.

On the other hand, in Cayo the availability of land means that any small farmers who want to get involved in new crops will have trouble finding land they can use which is close to their present village residence. Right now many are making milpas as much as 20 miles from their homes, and the expense of moving to live on the farm will be too much for many small farmers to bear.

D. Credit

Rural credit and crop loans in Cayo are generally limited in availability to the larger cattle producers. Small producers are reluctant to take out loans with their small holdings as the only assets to pledge as collateral. There are no functioning credit circles or credit unions that provide credit to small farmers. For many, the butchers and meat processors, who offer small cash advances against the delivery of an animal, are the main source of emergency credit.

The cane farmers, in contrast, are almost uniformly in debt to the Cane Farmer's Association, the DFC or the commercial banks. In the past the CFA has often given loans as political favors rather than as investments, and the repayment record is not very good. The commercial banks have been somewhat exploitative in their relationship to cane farmers, requiring very high collateral and charging very high interest rates. Today many farmers are carrying over debts from previous years. Indebtedness seems to be fairly evenly distributed across all size farming operations, with the exception of a few of the very largest. Ironically, the only group of farmers in the north who are free of debt, and will therefore be able to move more freely into new crops and technologies, are those who have never been major producers of sugarcane.

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E. Impacts on Women

Cane farming seems to have eroded the economic independence and well-being of women in the northern districts, and it is a possibility that agricultural diversification could progressively lower the level of economic control and responsibility women now hold in the farm economy.

The proposed project will provide women with some wage labor in packing and processing and hopefully some women could be identified for entrepreneurship in such roles. Women will continue to have some control over money from cane sold under the licenses in their names, but the amount of income they derive is likely to decline along with the general fortunes of the sugar industry.

In the Maya and hispanic cultures of the north women have major responsibilities for farming intensive home gardens and in care of domestic livestock. Attention to expanding on traditional areas of female economic activity, such as production of spices or other speciality crops and enabling women to share in other than traditional roles of food gathering could be a positive pursuit of this project.

DISTRIBUTION OF CANE FARMERS' LICENSES 1969 - 1976 - 1980 - 1984

GROUP	LICENCE RANGE LONG TONS	NUMBER OF FARMERS IN EACH LICENSE RANGE				PERCENTAGE TOTAL DELIVERIES IN 1980
		1969	1976	1980	1984	PERCENTAGE TOTAL
I	1-100	989	1744	1781	1931	10.2
II	101-200	848	614	358	1091	18.2
III	201-300	132	1081	848	979	20.6
IV	301-400	76	234	684	457	16.2
V	401-500	45	84	156	207	9.1
VI	501-1000	38	155	179	219	14.2
VII	Over 1001	25	91	77	71	11.5
Totals		2153	4003	4083	4955	100.0

NOTE:- BSI's research department continued to deliver cane as a registered farmer during 1984, delivering cane as follows in that year against a license of 25,000 tons although this is not included in the above table.

	<u>TONS</u>
Corozal Factory	19,833
Tower Hill Factory	<u>5,842</u>
	25,735

ENVIRONMENTAL ASSESSMENT

ENVIRONMENTAL ASSESSMENT AND ANALYSIS OF PESTICIDE USE
COMMERCIALIZATION OF ALTERNATIVE CROPS PROJECT - 505-0008

Prepared for: USAID/Belize

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July 1985

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LIST OF ACRONYMS AND ABBREVIATIONS

AID/W	Agency for International Development/Washington, D.C.
AID/LAC	AID Bureau for Latin America and the Caribbean
BABCO	Belize Agri-Business Company
BSI	Belize Sugar Industries
CARDI	Caribbean Agricultural Research and Development Institute
COP	Chief of Party
EA	Environmental Assessment
EPA	Environmental Protection Agency
GOB	Government of Belize
ICP	Integrated Crop Protection
IPM	Integrated Pest Management
LOP	Life of Project
MNR	Ministry of Natural Resources
PID	Project Identification Paper
RPAR	Rebuttable Presumption Against Reregistration
WHO/FAO	World Health Organization/Food and Agricultural Organization

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I. SUMMARY AND RECOMMENDATIONS

The direct environmental impacts of this project are likely to be minimal because of limited land intervention and scope of activities which are primarily of an investigatory nature. Pesticides, which represent the principal environmental concern, will be used during the project in the context of experiments and field trials involving a limited acreage and a small number of cooperating farmers under the supervision of a Prime Contractor. However, there is the potential for more significant long-term and indirect effects on the environment and people of Belize if the project is successful. Crop production technologies developed, including crop protection methods, are intended eventually to be adopted by a large number of farmers primarily in the Corozal, Orange Walk and Cayo districts. The major measures proposed to mitigate adverse impacts of pesticide use involve adoption of a crop protection package for each crop species tested during the project. Educational materials will be produced, which will then be available for dissemination to farmers and pesticide distributors involved with follow-on activities.

The design of this project is such that a number of key factors such as selection of sites for research and field trials, types of research to be conducted and crop protection methods to be used, cannot be determined at this time. In lieu of a comprehensive assessment of the environmental soundness of the project, which cannot be done in absence of this information, this EA identifies as accurately as possible the potential environmental and public health concerns associated with the various stages of the project and identifies measures needed to reduce the hazards.

Clearing of forested lands will not be promoted under the proposed project. If preparation of such new lands for agricultural purposes is proposed during implementation, a new EA will be required.

Because no forested lands will be sought or utilized during the project, no adverse impacts on endangered species or their habitat are anticipated.

Some project activities could occur on gently sloping lands (less than 7° slope), especially in the Cayo district. If such activities are proposed, the following treatment-oriented scheme for intensive tillage and use will be followed:

Soil Depth

- Deep (greater than 36 inches)
- Moderately deep (20-36 inches)
- Shallow (8-20 inches)

Scheme

Cultivable land up to 7° slope requiring no or few intensive conservation measures such as contour cultivation, strip cropping, vegetative barriers, rock barriers and, in larger farms, broad base terraces; the shallower the soil, the greater probability of need for the above recommended practices.

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Soil Depth

Scheme

-- Very Shallow (less than 8 inches) Improved and managed pasture only, especially if slope above 5°.

The EA begins with an overview of the project purpose and goals, a description of the environment and population affected, and the relationship of the project to other AID activities in Belize. Because the proposed use and promotion of pesticides was the principal factor leading to the preparation of this EA, a detailed Pesticide Use Assessment is provided, in accordance with AID regulations (Section 216.3(b)1(i)). Aspects which are covered include the pesticides approved for use in the project, their EPA registration status and their effectiveness for the proposed use; the availability of alternative crop protection methods, the relationship of the project plan to an integrated pest management approach; anticipated application methods and conditions of use; acute and long-term toxicological hazards and need for monitoring human and environmental exposure to pesticides; effects on non-target organisms; requirements for equipment and protective clothing; training needs for users and applicators; measures for controlling distribution, handling, storage and disposal; provisions for monitoring pesticide use and effectiveness; and the regulatory capabilities of the Government of Belize (GOB).

Specific actions needed to place the project in conformity with 22 CFR Part 216 on environmental procedures are listed below. Because the research and development activities will be undertaken by contractors, with relatively little direct AID or GOB involvement, assurance that these actions will be taken must be made by including a crop protection specialist on the project staff, by building specific requirements for the provision of resources, equipment, technical assistance and supervision into contractual agreements and by providing for AID and GOB oversight of contractors' activities. An illustrative budget is included in the EA.

The following actions will be incorporated into the proposed project as the designated Environmental Protection Component.

- A. Only those pesticides so indicated in Table 2 are authorized for on-farm programs within the project (see Section IV, H.).
- B. Only those uses approved by the EPA and/or the WHO/FAO, as indicated in Table 3 are authorized for on-farm programs within the project.
- C. Pesticides identified for use subsequent to the preparation of the PP and EA will require amendment of the EA and are subject to procedures dictated according to the regulatory status of the compound. Actual procurement or use must be approved in writing by the Mission Director and the AID/LAC Bureau Environmental Officer.
- D. The above actions do not apply where the pesticides are used for research or limited field evaluation purposes under supervision of project personnel (see Section IV, H). Requirements declared in Section 216.3(b)2(iii) must be observed. It is recommended that research at

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sites yet to be designated, be limited to pesticides already approved unless alternatives are identified which possess significantly greater selectivity, reduced mammalian toxicity or other environmental advantages.

- E. Pesticides, particularly those labeled as highly toxic to fish in Table 4 do present significant hazards to fish and other aquatic organisms, and should not be used in a manner which will lead to contamination of any of the many surface waters of Belize. Where there is risk of water contamination, an appropriate monitoring system should be set in place (see Section IV, E and G).
- F. Technical assistance should be obtained for crop protection specialties (entomology, plant pathology and weed control), for pesticide use and safety training and, as needed, for monitoring human and environmental exposure to pesticides. It is suggested that crop protection specialists be engaged for a three-month period in the first active growing season to assist with identifying research needs. Project personnel and cooperating farmers should receive training in safe pesticide use and principles of pest management before pesticides are disbursed to them. (See Section IV, K for details.)
- G. Provisions should be made for needed analysis of pesticide residues on crops, as described in Section IV, E and J.
- H. The project should be reviewed annually (by crop protection specialists) to evaluate pesticide practices within the project and to advise on any observed or potential hazards being promoted within the project. For the purposes of this review, pesticide use records should be maintained by project personnel.
- I. Storage of pesticides used by project personnel and cooperating farmers must meet the following conditions:
 - 1. Pesticides should be stored in a dry, secure area, protected from water and extreme heat.
 - 2. The area must be separated from living quarters and stored food products.
 - 3. A sign (in English and Spanish) indicating "Danger - Poison" should be posted outside the building.
 - 4. Pesticides should be dated upon receipt and stored in non-corrodable containers.
 - 5. Pesticides should be stored in their originally labelled containers. If repackaged, the container must carry a label including the product name (local trade name), names and concentrations of active ingredients, directions and precaution for use (including crop uses and reentry and preharvest intervals) and appropriate warning words in English and Spanish. The label must be securely fastened on the container.

6. Disposal of pesticides and/or containers should conform to label instructions. Empty containers should be collected and destroyed to prevent reuse.
- J. Handling and use of pesticides by project personnel and cooperating farmers must meet the following conditions:
1. All pesticides must be used with strict adherence to label directions, including crop-use registrations, field re-entry intervals and pre-harvest intervals.
 2. Appropriate, properly maintained equipment and protective clothing must be made available and its use ensured.
 3. Precautions must be taken to prevent pesticide contamination of drinking water. (See Section IV, E and G.)
- K. The following materials should be used in the project only for research purposes, applied by trained personnel, and should not form the basis of any crop protection packages developed and/or recommended: Monocrotophos, Fenamiphos, Methamidophos, Methomyl, Paraquat, and Methyl-parathion.
- L. Major elements of an Integrated Pest Management (IPM) Program should be developed and implemented during the first year of the project in conformity with general guidelines listed in Section IV, C of the EA.

II. PROJECT DESCRIPTION

A. Purpose and Goals

The purpose of the Commercialization of Alternative Crops Project is to expand the base of economic activity in Belize by developing alternative agricultural products for export and for import substitution. It will provide Belizean farmers with improved production technology and marketing support in alternative crops to reduce dependence on sugarcane. In addition, the project will identify agronomically feasible crops and conduct applied research and on-farm trials to extend the results. The project is designed to provide for Belizean continuance after funding ceases, thus moving the economy onto a path of sustained growth. Efforts will focus on three development areas: (1) crops which may be competitive on the world market, e.g., vegetables, fruit, spices, foliage plants and tropical flowers; (2) import substitution crops; e.g., soybean, sesame, sunflowers, cabbage and onion; and (3) enhancement of traditional crops, e.g., rice, maize, and red kidney beans. These goals are to be accomplished in an economically, as well as environmentally sound manner.

B. Affected Environment

Located south of the Yucatan Peninsula, Belize includes 22,963 Km² (8,866 square miles) of land area. It is bordered on the south and southwest

by Guatemala, and on the east by the Caribbean. At 15-19° N. latitude, it is in the subtropics, with typical temperature regimes. Rainfall ranges from about 1,500 mm/yr in the north to over 4,000 mm/yr in southern Toledo District. The country has a history of devastating encounters with tropical hurricanes. The country is divided into six districts. Coastal districts from south to north are Toledo, Stann Creek, Belize and Corozal. West of Belize District lies Cayo to the south and Orange Walk to the north. (Figure 1)

Mangroves represent most of Belize's coastline and can be found inland where there is salt water influence. Coastal lagoons provide feeding grounds for many near-shore fish species and habitat for wildlife such as the manatee and crocodile. Mariculture is a new undertaking with industries located in southern Stann Creek and southern Belize District.

Belize geology is based largely on limestone. The Mayan Mountains in Toledo and Cayo Districts represent an exception, consisting of large upfaulted and sedimentary rocks. The oldest rocks are at Victoria Peak, 1120m above sea level.

Major cities utilize surface water for their domestic needs, while smaller villages are located near creeks and water is dipped. Pollution is not yet considered to be a serious problem, although contamination poses a real risk. In addition to surface water, Belize has artesian water-table aquifers and artesian aquifers. Shallow water-table aquifers are utilized throughout the country. If artesian aquifer water is of suitable quality, an important source of groundwater remains to be exploited.

Belize encompasses a considerable area of undisturbed or little disturbed wilderness. It has good to excellent populations of many wildlife species that are endangered in neighboring countries. Included are jaguar, puma, ocelot, jaguarundi, margay, Bairds tapir. Rare birds include Ocellated Turkey, American Sungrebe, and Boat-billed Heron. Solitary Eagle, Orange-breasted Falcons, and Agami Heron still live in Belize's wilder areas. Pest species include "Riceys", which are rice feeding finches, and brown rats. Invertebrate pests are, of course, serious problems in agriculture, while biting flies and malaria transmitting mosquitoes plague the populace.

It is estimated that 19% of Belize's land is suited to mechanized agriculture without large financial and technological investments. Only about 2% of Belizean land is currently used for agriculture. Major crops include sugarcane, citrus, rice, maize, banana, and beans. With about 10,000 hives, the country exports honey valued at nearly U.S.\$200,000. Figure 2 depicts major land uses. Major soil types, their location with respect to the three proposed districts of project intervention, and selected soil constraints are shown in Figure 3 and Table 1.

It is possible that the entire country could potentially become involved in or affected by the Project. Specific areas of concentration during the project duration have not yet been identified. However, it is expected that the domestic development will center in the Cayo District, while export vegetable development will center in Orange Walk and Corozal Districts. Thus, while the environment affected by the project via

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Mangroves represent most of Belize's coastline and can be found inland where there is salt water influence. Coastal lagoons provide feeding grounds for many near-shore fish species and habitat for wildlife such as the manatee and crocodile. Mariculture is a new undertaking with industries located in southern Stann Creek and southern Belize District.

Belize geology is based largely on limestone. The Mayan Mountains in Toledo and Cayo Districts represent an exception, consisting of large upfaulted and sedimentary rocks. The oldest rocks are at Victoria Peak, 1120m above sea level.

Major cities utilize surface water for their domestic needs, while smaller villages are located near creeks and water is dipped. Pollution is not yet considered to be a serious problem, although contamination poses a real risk. In addition to surface water, Belize has artesian water-table aquifers and artesian aquifers. Shallow water-table aquifers are utilized throughout the country. If artesian aquifer water is of suitable quality, an important source of groundwater remains to be exploited.

Belize encompasses a considerable area of undisturbed or little disturbed wilderness. It has good to excellent populations of many wildlife species that are endangered in neighboring countries. Included are jaguar, puma, ocelot, jaguarundi, margay, Bairds tapir. Rare birds include Ocellated Turkey, American Sungrebe, and Boat-billed Heron. Solitary Eagle, Orange-breasted Falcons, and Agami Heron still live in Belize's wilder areas. Pest species include "Riceys", which are rice feeding finches, and brown rats. Invertebrate pests are, of course, serious problems in agriculture, while biting flies and malaria transmitting mosquitoes plague the populace.

It is estimated that 19% of Belize's land is suited to mechanized agriculture without large financial and technological investments. Only about 2% of Belizean land is currently used for agriculture. Major crops include sugarcane, citrus, rice, maize, banana, and beans. With about 10,000 lives, the country exports honey valued at nearly U.S.\$200,000. Figure 2 depicts major land uses. Major soil types, their location with respect to the three proposed districts of project intervention, and selected soil constraints are shown in Figure 3 and Table 1.

It is possible that the entire country could potentially become involved in or affected by the Project. Specific areas of concentration during the project duration have not yet been identified. However, it is expected that the domestic development will center in the Cayo District, while export vegetable development will center in Orange Walk and Corozal Districts. Thus, while the environment affected by the project via

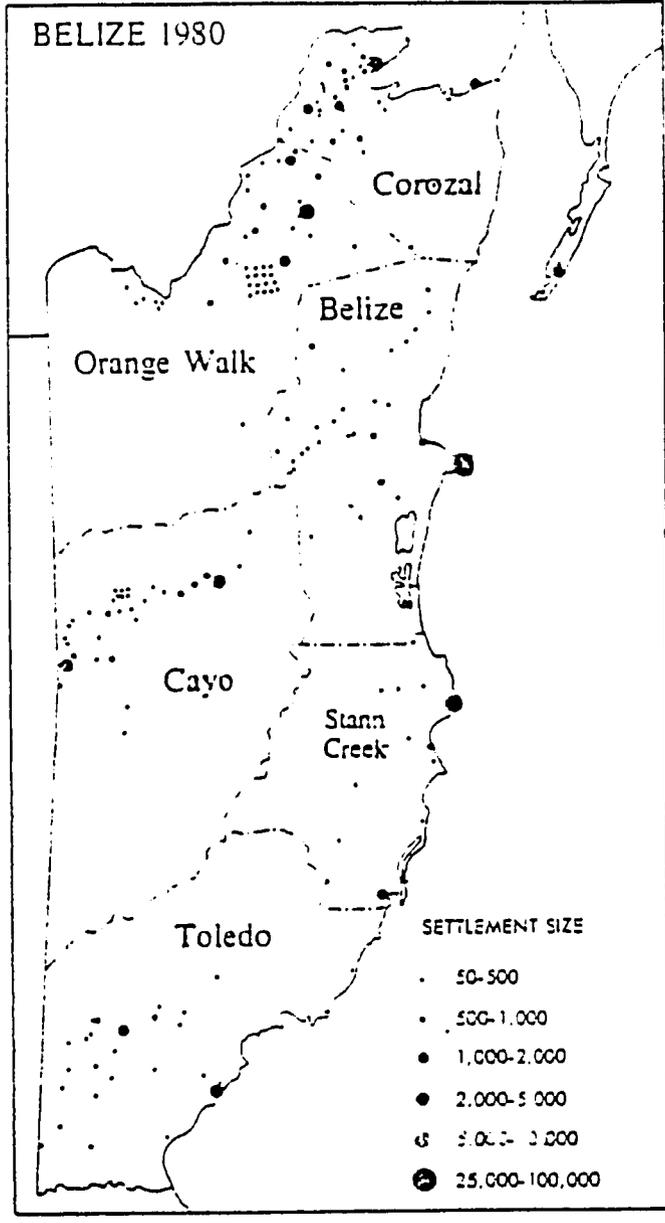


FIGURE 1. Geopolitical map of Belize showing major settlements and Districts. The proposed project will be implemented in Corozal, Orange Walk, and Cayo Districts (Source: Belize Country Environmental Profile, 1984).

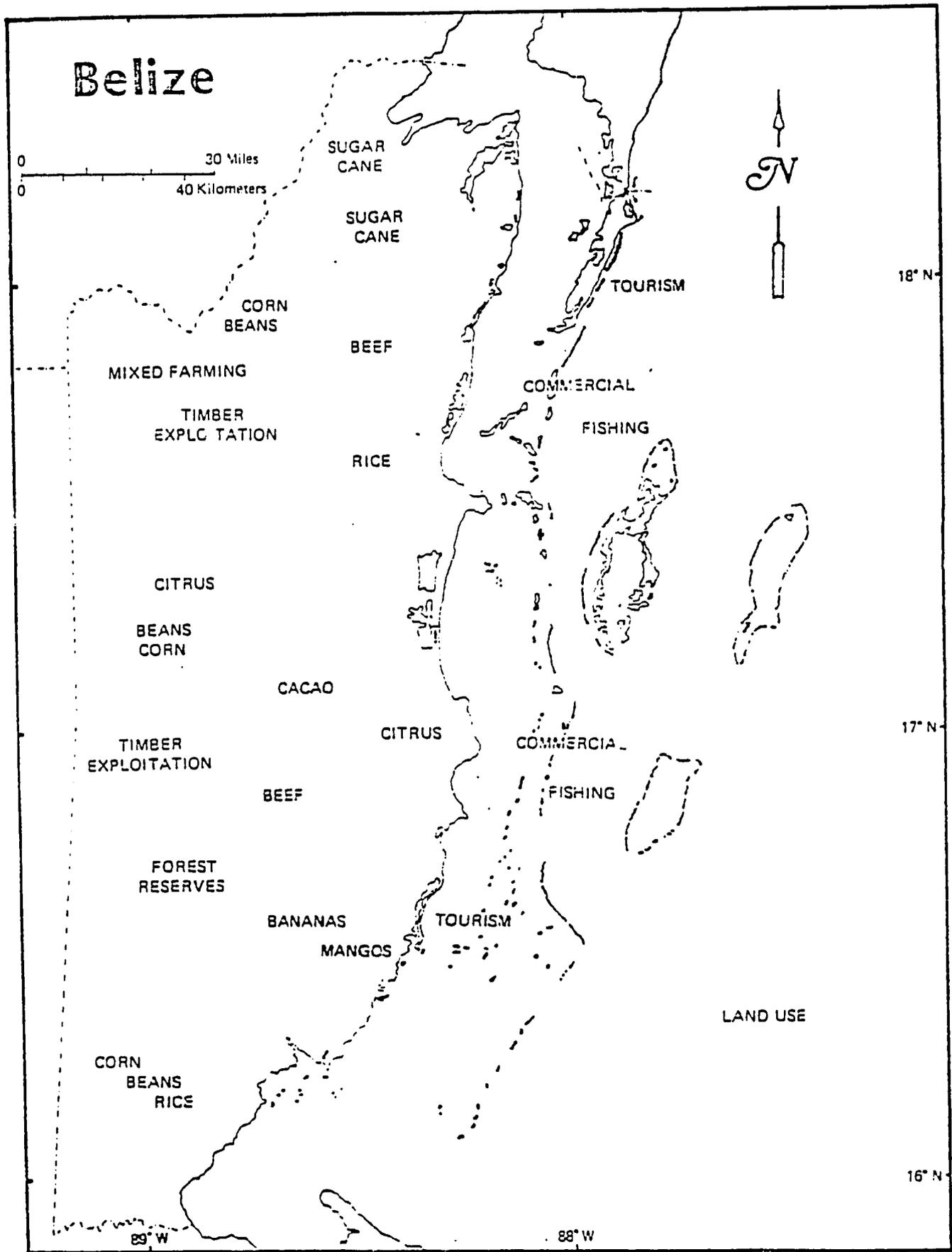


FIGURE 2. Major land use in Belize (Source: Belize Country Environmental Profile, 1984).

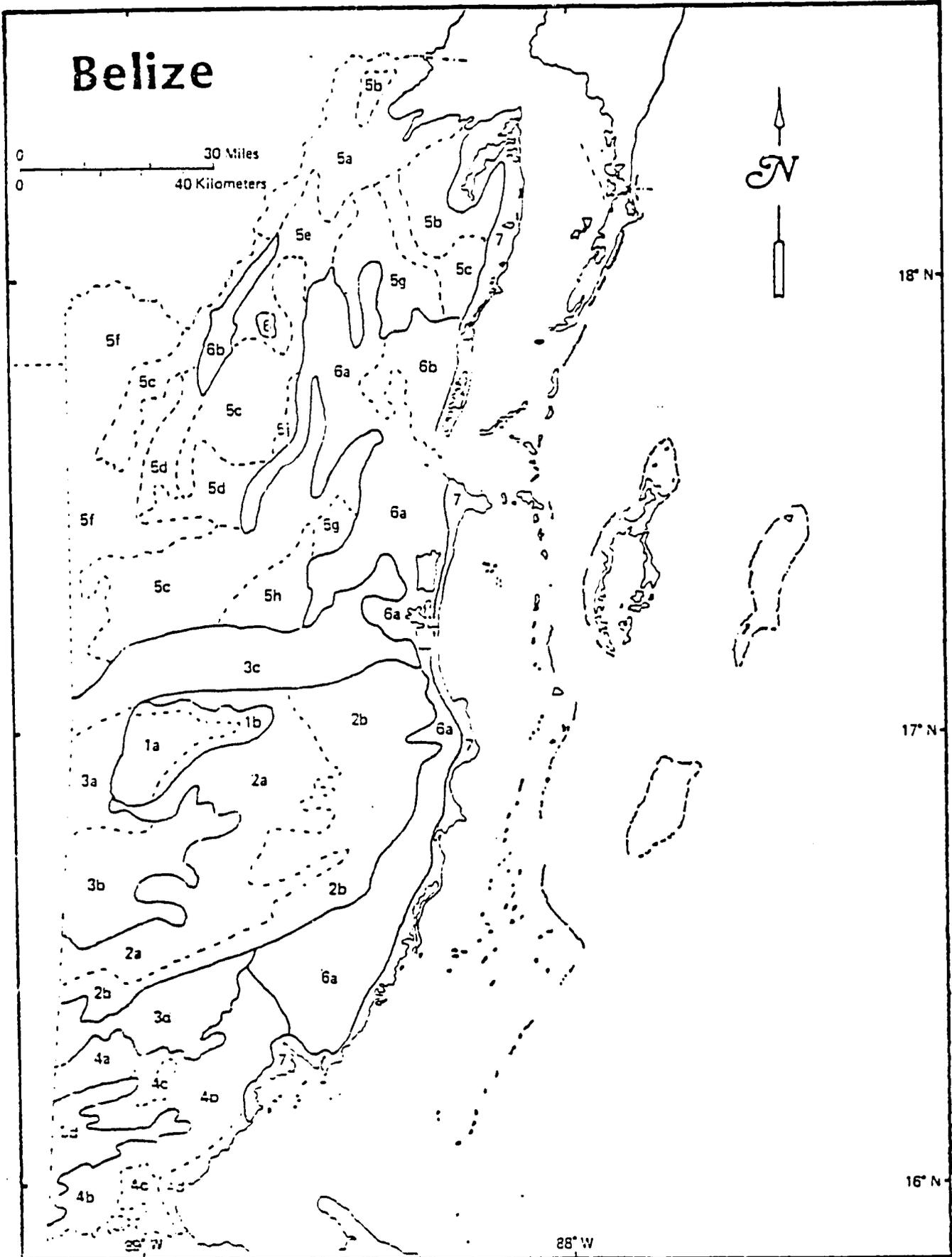


FIGURE 3. Principal landforms of Belize based on major soil features. Accompanying Table 1 provides major features of these soils, particularly major soil limitations (Source: Belize Country Environmental Profile, 1984).

projected pesticide use will initially be limited in area and to use in adaptive research, the long-term impact could have serious repercussions throughout the country. It is vital to the overall health and well-being of Belize that the long-term effects of the project remain a focus throughout the decision making procedures.

C. Population

The population of Belize approximates 160,000. The population density averages 6.3 people per Km² (16.4/mi²) characterizing Belize as a "sparsely" populated country. However, the distribution pattern gives a more meaningful figure. Over 90% of the population congregates in places of over 50 people, and 51% live in towns larger than 2,000 (Figure 1). Such clustering gives a density of less than one person per Km² (2.6/mi²).

About one-third of the workforce is agricultural. Milpa or slash-burn subsistence farmers do not readily accept technologies based on fertilizers or pesticides. Small farmers use permanent fields with holdings of 2.20 Ha. Farms in the 20-200 Ha range are owned and operated mostly by Mennonites who pool resources for the purchase and use of machinery and production inputs including pesticides. Large landholdings are mostly corporate-owned and include about 60% of the country's productive agricultural land.

III. PURPOSE OF THE ENVIRONMENTAL ASSESSMENT.

The purpose of the EA is to examine the foreseeable positive and negative impacts of the proposed project on the human and natural environment, propose measures to reduce or eliminate any such negative impacts, and assure that any recommended environmental protection subcomponents are adequately incorporated into the project. All this analysis is done in conformance with AID's Environmental Procedures (22 CFR Part 216).

Because this project will involve the handling, use and promotion of chemical pesticides, AID regulations require that a special Pesticide Use Assessment be carried out. This Assessment forms the bulk of the EA. The Project Implementation Document and the AID/W review called for an EA of the pesticide use aspects of this project, to be carried out as an integral part of the Project Paper development. The purpose of this analysis is to identify appropriate and safe pesticides which can be procured or used under the project, the Integrated Pest Management research needs, needed GOB pesticide policy reforms, training requirements, technical assistance needs and procedures for packaging, distribution, storage and disposal of pesticides.

IV. PESTICIDE USE ASSESSMENT

A. Basis for Selection of Pesticides

The guiding principles underlying the selection of pesticides to be used in association with any AID project include: conformity with AID and Host Country regulations, effectiveness for demonstrated crop protection needs under prevailing environmental conditions, minimization of human and environmental hazards and promotion of the IPM approach. These concerns are addressed in detail in the following sections of this EA.

The selection of pesticides for use in this project cannot be finalized at this stage for two reasons: (1) the full range of crop species which will be investigated has not been determined, and (2) the pest problems which will arise are not fully predictable. The identity of the project participants and of the ultimate beneficiaries also has not been fully established, yet it is a significant factor in determining the potential hazards associated with pesticide use.

The approach which we have taken for the purposes of this EA is to evaluate the acceptability of a number of pesticide products which are currently available and widely used in Belize and to authorize some additional materials which we feel are likely to be requested by the Prime Contractor in the future, based on the range of crops which have been proposed and the nature of the pest problems which have been reported for those crops in Belize and in comparable locations.

Information on pesticide availability and current and projected pest problems came primarily from interviews with local agrochemical retailers and the crop protection specialists at CARDI and at the MNR's Central Farm, as well as from a report on the subject prepared for AID by Dr. Carl Barfield in 1982 (USAID/Belize files).

At the time of writing this EA, the principal crops being considered for inclusion in the project include: (for the export market) cucumbers, squashes, melons, peppers, tomatoes and okra, and (for domestic use/import substitution) sesame and soybeans. Research on traditional crops such as rice, maize and beans will be limited to increasing production efficiency. The principal disease and pest problems expected to arise in the vegetable crops include: downy mildew (Pseudoperonospora cubensis), stem blights and cankers, (Didymella spp.), Rhizoctonia foliar blight, late blight (Phytophthora sp.), Cercospora leaf spot, Alternaria leaf spot, Watermelon mosaic virus (along with its aphid vectors), bacterial wilt, root-knot nematode, pickleworm (Palpita), pepper weevil (Anthonomus eugenia), cucumber beetles (Diabrotica sp.), tomato fruit worm (Pseudoplusia includens), and occasional outbreaks of armyworm (Spodoptera frugiperda). According to Dr. Singha, CARDI entomologist, researchers at CARDI do not anticipate serious pest problems requiring chemical control in sesame and soybean.

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The principal products being used at this time to control vegetable pests and diseases in Belize include: Pirimphos-M (Actellic), Carbofuran (Curater), Methamidophos (Tamaron), Carbaryl (Sevin), Permethrin (Ambush, Pounce), Diazinon, Trichlorfon (Dipterex), Phoxime (Volaton), Methyl-parathion, Chlorothalonil (Bravo), Streptomycin sulfate (Agri-mycin), Propineb (Antracol), Maneb, Zineb, and inorganic copper fungicides.

Herbicides are rarely used in Belize on vegetable crops at this time (although paraquat and other herbicides are the principal chemical control agents used on sugarcane and Cannabis). Manual weeding is the preferred method of weed control. However, because this may prove to be impractical when the acreage planted to vegetables increases, we have included on the list several effective and relatively safe herbicides which are used in other areas.

The list of project-approved pesticide materials which follows in the next section should be seen as flexible, that is, to be modified as needed in response to conditions such as changes in AID or GOB regulations or policies, or the development of unforeseen pest or disease problems. The Prime Contractor may request that additional products be authorized; such requests should be evaluated on a case-by-case basis by the BABCO Board, USAID/Belize and the AID/LAC Bureau Environmental Officer. If necessary, based on new regulations or information, the BABCO Board or AID may also remove a product from the authorized list.

As a rule, pesticides should be used only on those crops for which residue tolerances have been established by the EPA or for which maximum residue limits have been recommended by the WHO/FAO joint expert meeting on pesticide residues. Adherence to EPA registrations is critical in the case of crops intended for export to the U.S., as failure to do so may lead to the rejection of the produce by U.S. officials at the port of entry. For crops intended for domestic use, the existence of WHO/FAO recommended MRL's and/or registration for the same or similar use in selected other countries (such as EEC countries) may be considered sufficient. (See also Section IV, B.)

The list of products authorized in this EA for project use is based on the assumption that crop production technology "packages" developed under this project may eventually be adopted and applied, without direct supervision or special training, by a large number of individual farmers. For this reason, products which in the U.S. are restricted to use by certified applicators, and which can only be used safely with extensive safety precautions or specialized equipment and protective clothing, are not authorized.

AID regulations do permit the use of otherwise restricted products "for research or limited field evaluation purposes by or under the supervision of project personnel". The EPA restricted products may therefore be used in this project for research purposes under the conditions described in Section IV, H of this EA. However, they should not be used as the basis for crop protection methods intended for general extension to farmers. Products which have been

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cancelled by the EPA for agricultural uses should not be used in this project even for experimental purposes. Products which are not registered for use on any crop currently being considered in this project are also not authorized at this time, although they may be approvable under other circumstances (see Section IV, B).

B. Registration Status of Requested Pesticides

The pesticides listed in Tables 2 and 3 are either available and used in Belize at the present time or are judged by the authors as likely to be requested by the Prime Contractor over the course of the project. In accordance with AID Regulation 16, Table 2 indicates whether each material is registered by the USEPA for General Use, Restricted Use by certified applicators or Cancelled for uses related to this project. The LD₅₀ and WHO toxicity classification is also provided for each product. Products approved for use in this project are indicated by a "+" and those not approved are indicated with a "-" in the column headed "Project Authorization".

Table 3 indicates the currently approved uses for products authorized in this project, but the table may be updated as additional information becomes available and/or additional crops are added. Uses not authorized in Table 3 may be approvable if a special need is demonstrated. In such a case, ST/AGR is prepared to advise and assist BABCO and the Prime Contractor in an effort to gain special need or minor use clearances from regulatory agencies and to encourage manufacturers to provide needed data for this purpose. It should be noted, however, that this procedure can entail some cost, which may have to be borne by the project. In most cases it will prove more cost effective to seek suitable alternative pesticides already registered for that use. Project personnel should request specific guidance from ST/AGR on a case-by-case basis.

Explanations and Specific Recommendations Accompanying Tables 2 and 3

The EPA has ruled that, on the basis of environmental and human hazards, Aldrin, Dieldrin, Chlordane, Heptachlor and Mirex cannot be used for agricultural purposes; therefore, they should not be used in this project.

A number of products which in the U.S. are restricted to use by certified applicators are commonly used in Belize but cannot be used safely by untrained individuals who usually cannot be expected to follow label instructions calling for special application equipment and protective clothing, particularly in hot climates. These materials (including Carbofuran [except as five percent granular formation], Monocrotophos, Fenamiphos, Methamidophos, Methomyl, Paraquat, and Methyl-parathion) should be used in the project only for research purposes where they are specifically required (see above) and then should be applied by or under the direct supervision of trained project personnel. They should not form the basis of crop protection methods intended to be extended to farmers untrained in the safe use of such materials. This point should be specifically addressed in contractual agreements with the Prime Contractor and its subcontractors.

TABLE 2
PESTICIDES CONSIDERED FOR PROJECT USE

NAME ¹	PROJECT AUTHORIZATION	EPA REGISTRATION STATUS ²	LD ₅₀ mg/kg ORAL/DERMAL ³	WHO TOXICITY CLASSIFIC. ⁴	CURRENTLY AVAILABLE IN BELIZE ⁵
<u>Insecticides and Nematicides</u>					
Acephate (Orthene)	+	G	945/ 2,000	II	
Aldrin	-	C	98/	Ib	+
Bacillus thuring. (Dipel)	+	G	nil/nil	IV	+
Carbaryl (Sevin)	+	G	500/	II	+
Carbofuran (Furadan/Curater)	+ ⁶	R	11/10,200	Ib	+
Chlordane	-	C	460/	II	+
Chlorpyrifos (Dursban)	+	G	135/ 200	II	
Dazomet	+	G	640/	III	
Diazinon	+	G	300/ 3,600	II	+
Dieldrin	-	C	10	Ia	+
Dimethoate	+	G	215/10,000	II	
Endosulfan	+	G	80/ 359	II	
Fenamiphos (Nemacur)	-	R	15/	Ia	+
Heptachlor	-	C	100/	II	
Malathion	+	G	1,375/ 4,100	III	+
Metam-Sodium (Vapam)	+	G	285/	II	
Metasystox-R	+	G	75		+
Methamidophos (Tamaron)	-	R	30/	Ib	+
Methomyl (Lannate)	-	R	17	Ib	+
Methoxychlor	+	G	6,000	IV	
Parathion/ M-parathion (Folidol)	-	R	14/	Ia	+
Mirex (Paramex)	-	C	300/	II	+
Monocrotophos (Azodrin)	-	R	14/	Ib	+
Permethrin (Ambush, Pounce)	+	G	4,000/	V	+
Phoxime (Volaton)	-	G	1,845/	II	+
Pirimiphos-M (Actellic)	+	G	2,000/ 4,592	III	+
Propoxur (Unden)	+	G	95/	II	+
Trichlorfon (Dipterex)	+	G	560/	III	+

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TABLE 2, Continued

NAME ¹	PROJECT AUTHORIZATION	EPA REGISTRATION STATUS ²	LD ₅₀ mg/kg ORAL/DERMAL ³	WHO TOXICITY CLASSIFIC. ⁴	CURRENTLY AVAILABLE IN BELIZE ⁵
<u>Fungicides and Antibiotics</u>					
Benomyl (Benlate)	+	G	10,000/10,000	IV	+
Captafol	+	G	6,200/	IV	
Captan	+	Spec. Review	10,000/	IV	+
Clorothalonil (Bravo)	+	G	10,000/10,000	IV	+
Copper-based fungicides: (Kocide, copper sulfate, cupravit, etc.)	+	G	400-1,000/	II, III	+
Mancozeb	+	G	8,000/	IV	+
Maneb	+	G	6,750/	IV	
Metalaxyl (Ridomil)	+	G	699/ 3,100	III	
Metiram	+	G	6,200	IV	
Propineb (Antracol)	+		8,500/ 1,000	IV	+
Streptomycin sulfate (Agri-mycin)	+	G	9,000/		+
Thiabendazole	+	G	3,100	IV	
Thiram (seed treatment)	+	G	780/	III	
Triadimefon (Bayleton)	+	G	400-1000/1,000		

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TABLE 2, Continued

NAME ¹	PROJECT AUTHORIZATION	EPA REGISTRATION STATUS ²	LD ₅₀ mg/kg ORAL/DERMAL ³	WHO TOXICITY CLASSIFIC. ⁴	CURRENTLY AVAILABLE IN BELIZE ⁵
<u>Herbicides</u>					
Alachlor (Lasso)	+	G	1,800/		+
Bensulide (Prefar)	+	G	826-1778/		+
Chloramben (Amiben)	+	G	5,620/		
Chlorthal dimethyl (Dacthal)	+	G	10,000/10,000		
2,4-D	+	G	375-800/		+
Devrinol	+	G			
Diphenamid (Enide)	+	G	1,000/		+
Diuron (Karmex)	+	G	3,400/		+
Glyphosate (Roundup)	+	G	4,300/		+
Hexazinone (Velpar)	+	G	1,690/ 5,278		
Linuron (Lorox)	+	G	4,000/		
Metribuzin (Sencor/Lexone)	+	G	1100-2300/20,000		
Naptalam (Alanap)	+	G	8,200/		
Oxyfluorfen (Goal)	+	G			
Paraquat (Gramoxone)	-	R	150/		+
Pebulate (Tillam)	+	G	921-1900/4,640		+
Trifluralin (Treflan)	+	G	10,000/		
Vernolate (Vername)	+	G	1,780/		+

- 1 Trade names (parentheses) are provided for convenience, and do not imply endorsement of a particular commercial product
- 2 G = General Use, R = Restricted to use by certified applicators, C = agricultural uses cancelled.
- 3 Based on technical product. From: Farm Chemicals Handbook, 1984, Meister Publishing Co., Willoughby, Ohio, USA.
- 4 Ia = Extremely Hazardous, Ib = Highly Hazardous, II = Moderately Hazardous, III = Slightly Hazardous, IV = Unlikely to present acute hazard in normal use. Classifications based on technical product.
- 5 Based on survey of retail outlets, courtesy of Mr. Jose Novelo, Entomologist, Belize School of Agriculture and MNR.
- 6 Only granular formulations containing no greater than five percent active ingredient.

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AUTHORIZED CROP USES OF APPROVED PESTICIDES BASED ON US/EPA
REGISTRATION AND/OR FAO MAXIMUM RESIDUE LIMITS

Pesticide	Tomato	Pepper	Cucurbits ¹	Olcra ²	Cabbage	Onion	Soybean	Sesame
Insecticides & Nematicides								
Acephate	X	X		X	X	X	X	
Bacillus thur.	-----Exempt-----							
Carbaryl	X	X	X	X	X	X	X	
Carbofuran		X	X			X		
Chlorpyrifos	X	X	X		X	X	X	
Dazomet	-----Soil Fumigant Only-----							
Diazinon	X	X	X		X	X	X	X
Dimethoate	X	X	X	X	X	X	X	
Endosulfan	X	X	X	X	X	X		
Malathion	X	X	X	X	X	X		
Metam-Sodium	-----Soil Fumigant Only-----							
Metasystox-R.		X	X		X	Dry Bulb Only		
Methoxychlor	X	X	X	X	X	X		
Parathion	X	X	X	X	X	X	X	
Permethrin	X	X Bell Only			X	X	X	
Pirimphos-M	X	X	X		X	X		
Propoxur						X Dry Bulb Only		
Trichlorfon	X	X			X		X	X

1 This category includes cucumbers and melons (cantaloupe, cassava, crenshaw, honeyball, honeydew, musk, persian, waternelon and hybrids). Some products are not registered for use on all species listed.

2 Classified as a seed and pod vegetable.

TABLE 3, Continued

AUTHORIZED CROP USES OF APPROVED PESTICIDES BASED ON US/EPA
REGISTRATION AND/OR FAO MAXIMUM RESIDUE LIMITS

Pesticide	Tomato	Pepper	Cucurbits ¹	Okra ²	Cabbage	Onion	Soybean	Sesame
Fungicides & Other Antibiotics								
Benomyl	X		X		X	X	X	
Captafol	X		X			X		
Captan	X	X	X		X	X	X	
Chlorothalonil	X	X	X		X	X	X	
-----Exempt-----								
Copper								
Mancozeb	X	X	X		X	X	X	
Maneb	X	X	X		X	X	X	X
Metalaxyl	X		X			X		
Metiram	X		X					
Propineb	X	X	X		X	X	X	X
Streptomycin	X	X				X	X	
Thiabendazole	X							
-----Seed Treatment Only-----								
Thiram								
Triadimefon			X				X Green Only	

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Most formulations of Carbofuran are currently restricted by the EPA to use by certified applicators and it is expected that all will be restricted by the end of 1986. However, while the higher concentration flowable and wetttable powder formulations are considered significantly hazardous to the user, lower concentration granular formulations are restricted primarily on the basis of hazard to wildlife. At this time, Carbofuran is authorized for use in the project only as a granular formation containing five percent or less of the active ingredient.

Captan is currently under special review by the EPA; its general use in this project is authorized at present, but this status may change if further regulatory action is taken by the EPA.

Phoxime (Volaton) is currently available in Belize and has a relatively low acute toxicity; however, it is not registered in the U.S. and has no WHO/FAO recommended Maximum Residue Limits for any crop at this time, and therefore should not be used in this project in the absence of a more detailed risk/benefit analysis.

A number of other pesticides approved for use in this project, including Dimethoate, Chlorpyrifos, Endosulfan and the soil fumigant Vapam, are registered for general use by the EPA but possess a high acute toxicity and present significant hazards to untrained users. It is critical that label requirements regarding protective clothing and application practices be enforced when these products are used. The authors also recommend that low-toxicity formulations of these products be used whenever possible. Seed treatments and granules with low concentrations of active ingredients are generally preferable to emulsifiable concentrates and are recommended whenever they can be used; however, great care must be taken to ensure that mixing and application are never done with bare hands. Project personnel may contact ST/AGR for recommendations concerning preferred formulations of specific compounds.

Metalaxyl (Ridomil) is an effective and widely used product with a relatively low acute toxicity. However, it should be noted that there have been widespread problems with the development of resistance to this material. If Metalaxyl is to be used extensively, researchers should make use of resistance management tactics and monitor the product's continued effectiveness.

2,4-D is registered for general use in the U.S. and is approved for use in the project at this time, but its use is not recommended. A number of countries have taken legislative action against 2,4-D based on suspected long-term adverse health effects of the compound and of the common contaminant Dioxin. In addition, drift of this material onto nearby crops and other non-target plants is difficult to prevent and will result in serious losses. Weed control specialists contacted by the authors maintain that there is no need to use 2,4-D in this project.

In general, the authors recommend that the research program emphasize (1) alternatives to chemical control, and (2) the testing of lower-hazard substitutes for highly hazardous and widely abused materials such as Paraquat, Monocrotophos, Metamidophos, etc. Of particular interest would be a means of making Glyphosate more competitive in cost with Paraquat, possibly by applying it in combination with other products, such as Urea. Other possibilities for substitution include Acephate as an alternative to Dimethoate, and Dazomet or Carbofuran to replace Fenamiphos for control of nematodes and other soil pests.

C. Extent to Which the Proposed Pesticide Use is Part of an Integrated Pest Management Program

The Project Paper does not lay out specific research plans; these are to be developed later by the Prime Contractor. The core contract can specify certain types of research to be carried out by the Prime Contractor and provision can be made for research plans to be reviewed and approved by BABCO and AID. The contract specifications cannot be overly restrictive; contractors must be allowed considerable flexibility to exercise their professional judgment in carrying out their research activities. However, the following aspects should be included in the research plans and set up during the first year of implementation:

- 1) Identification of economically significant diseases and pest species;¹
- 2) Crop loss assessment studies, including the establishment of approximate control thresholds;
- 3) The development of pest density scouting methods appropriate for use by farmers with minimal training and limited time and resources;
- 4) The development of appropriate disease diagnostic methods;
- 5) Research related to biological control methods, including identification and bionomics of endemic natural enemies of key pest species, and investigation of potential introduced control agents;
- 6) Investigation of cultural control methods including crop rotation, field sanitation, planting schedules;
- 7) Varietal screening for disease and pest resistance;

¹ A comprehensive survey of pests and diseases of crop species in Belize is currently being prepared by James Merteley and Jose Novelo of the MNR's Central Farm.

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- 8) Efficacy testing of narrow-spectrum pesticides which are most compatible with an IPM approach;
- 9) Investigation of optimal methods and timing for pesticide applications; and
- 10) Pesticide resistance management.

The Prime Contractor is expected to draw heavily upon subcontractors and consultants with expertise in a variety of areas. Because the focus of this EA is the use and promotion of chemical pesticides, our principal concern here is with consultants and subcontractors in the area of crop protection, whose orientation and capabilities will play a major role in determining the extent to which the Integrated Pest Management approach is emphasized in this project. Consultants should be selected by the prime contractor in coordination with AID and should be brought in at an early stage of the project to assist in designing the overall research plan. Criteria for their selection should include experience and a demonstrated interest in the safe and cost-effective use of pesticides and the application of the IPM approach to crop protection.

AID/ST/AGR can assist the project in several ways: by helping to prepare appropriate Requests for Proposal for crop protection subcontractors, by recommending possible long-term subcontractors, by providing short-term consultants in specific crop protection areas (e.g., entomologists, plant pathologists, nematologists, etc.) and by reviewing proposed research plans. These services can be obtained through a Mission buy-in to the centrally funded pest management project.

At the time of writing of this EA, CARDI appears to be the most likely candidate as subcontractor for the domestic use/import substitution aspect of the project. This aspect will be based in the Cayo district and will concentrate on oilseeds (sesame and soybean).

Discussions with Dr. Singha indicated that CARDI's research philosophy is consistent with the approach to pest and pesticide management which is recommended by the authors and which should be followed in this project. Research at the CARDI facilities emphasizes screening for locally adapted, pest- and disease-resistant varieties. The use of chemical inputs is discouraged due to cost and safety factors. For example, Dr. Singha noted that he is trying to discourage farmers in the area from using Lannate because its volatility increases with temperature, making it particularly dangerous under local conditions. The principal herbicides being used, Alachlor and Metribuzin, are among those authorized in this EA for project use. At the present time no insecticides or fungicides are being used in CARDI's work on sesame or soybeans; while pests are present in the fields, they are not considered to be economically significant. Dr. Singha does not foresee changing this approach in the future, although investigators continue to monitor pest populations and yields and will initiate crop protection research if needed.

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Because there is not an extensive history of vegetable farming in Belize (Mennonite communities and milpa farmers cultivate some vegetables for domestic sale and consumption), the ecosystem has not been exposed to the disruptions (such as the destruction of populations of natural enemies, the establishment of secondary pest species and the development of pesticide resistance) which invariably accompany indiscriminate use of chemical pesticides. This project should take advantage of this unusual opportunity to develop and disseminate cost-effective production technologies based on rational crop protection methods.

D. Proposed Methods of Application and Availability of Equipment and Protective Clothing

Pesticide use recommendations made by the Prime Contractor should take into account the types of equipment readily available to farmers in Belize. Most pesticides currently used are applied with backpack sprayers. Some pesticide retail outlets, such as Central Ag Service in Cayo district, service the equipment and carry stocks of spare parts. Some granular formations are used but application equipment is generally not available and application is done with bare hands (leading to a number of cases of poisoning in the past, according to J. Novelo of Central Farm). Aerial spraying of sugarcane and rice fields is occasionally practiced by the larger growers.

The Prime Contractor should be responsible for ensuring that appropriate, properly maintained equipment and protective clothing are available for project use. When equipment and clothing are washed, care should be taken that sources of drinking water are not contaminated. If participating farmers are to apply pesticides (see Section IV, H), they should be provided with the necessary equipment, or their own equipment should be inspected and calibrated by project personnel. Some training may be required to improve local capabilities in this area.

It is unreasonable to expect pesticide applicators to wear extensive protective clothing in a hot, humid climate. The products authorized for use in this project have been selected to reduce the hazards to users under these conditions, but certain basic precautions should always be observed. All participants should wear long sleeves, long pants and shoes or boots when applying pesticides in the field and rubber gloves and face shields when handling concentrates. Handling and application should be confined whenever possible to the early morning or late afternoon, when the cooler temperatures will encourage users to wear appropriate clothing. The clothing should be washed regularly. No fumigants whose use requires specialized equipment are authorized for use in the project.

E. Acute and Long-Term Toxicological Hazards

Whenever pesticides are used there is the risk of excessive exposure resulting in toxicological effects, both to individuals directly involved in handling the materials and to the general public through residues on foods and contamination of drinking water.

All the pesticides recommended for use in this project are registered by the EPA for General Use in the U.S. This classification, based on studies of both acute and chronic toxicity indicates that they have been judged not to present an unacceptably high short- or long-term health risk to a user who understands and follows all label instructions, including the required interval before re-entry into a treated field.

If products which are registered for Restricted Use in the U.S. are used in the project (under the conditions specified in Section IV, H) individuals involved in handling and application should be periodically monitored for exposure. If there is any indication that misuse possibly leading to excessive exposure to any of these materials may have occurred, users and any other individuals who are judged to be at risk should be tested. The project design should make resources available for this monitoring and testing. Technical assistance for assessment of the need and for design and implementation of such programs is available through a buy-in to the centrally funded pest management project.

All pesticides should be handled and used in such a way as to prevent contamination of drinking water. Contamination can occur through pesticide run-off from fields, through spills, through washing equipment or clothing in or near farm water supplies, or through simple dumping of excess materials. Cautions against such practices should be an important part of the training for project participants, and the Prime Contractor should provide supervision to ensure that they do not occur in the project. (Unfortunately, there is no way to assure that they will not occur later in the aftermath of the project.) If there is any indication that water contamination may have occurred, water samples should be analyzed immediately.

The Prime Contractor should make project personnel, cooperating farmers and local health officials aware of general symptoms of pesticide poisonings and of any particular symptoms known to be frequently associated with specific materials being used (e.g., eye irritation from Chlorothalonil). In each area where the project is active, a public health official should be designated and given instructions and medical supplies for dealing with poisoning cases.

The most effective way to reduce the risk of toxicological hazards due to pesticide residues in foods is to ensure that label instructions, particularly specific registered crop uses and pre-harvest intervals, are followed completely. Prescribed use patterns may differ if the crop is being grown for human food or for animal feed. In cases (such as soybean and sesame in this project) where the same crop is intended for both purposes, the more stringent requirements, leading to the lower residue levels, must of course be followed.

Because compliance with label instructions cannot always be ensured and because environmental conditions can influence residue levels, it is necessary periodically to analyze samples of harvested crops. Presumably the Prime Contractor will undertake this for crops which are being developed for export to the U.S., since quarantine officials will reject products if residue levels exceed U.S. tolerances. Such precautions may be needed for the soybean and sesame as well as the export vegetable crops, since seedcakes produced following oil extraction are to be used to feed livestock which may be exported.

For crops intended for the domestic market there is presently no system in Belize for monitoring or control of residue levels in foods. The proposed Pesticides Control Act will establish residue limits, but the government will not have resources to enforce this legislation for some time. Although this project will not address this important problem, it will seek to promote proper pesticide use practices and increase growers' awareness of residue problems by producing educational materials on these subjects in sufficient quantity to disseminate in the ensuing years to all interested parties.

F. Effectiveness of the Selected Pesticides for the Proposed Use

Pesticides approved for use in this project were selected in part on the basis of their effectiveness for anticipated disease and pest problems under environmental conditions similar to those in Belize. The research conducted under the project will include testing the effectiveness of specific pesticides and other crop protection methods. (See also Section IV, B.)

G. Compatibility of Pesticides With Target and Non-Target Ecosystems

Many of the pesticides selected for use in this project on the basis of their relatively low mammalian toxicity nonetheless present significant potential hazards to non-target organisms. In the short term, due to the limited scope of the project, the primary concern will be effects on beneficial insects (including both natural enemies of pest species and honeybees) and on fish and other aquatic organisms in the vicinity of field trials. The toxicity of project-approved pesticides to these organisms is indicated in Table 4.

Honeybees are an important resource for Belizean farmers both as pollinators and in the honey industry, which is steadily gaining importance as a source of cash income in the targeted districts (see the MNR Agricultural Development Plan, 1984-1990). There are now an estimated 10,000 domestic hives in Belize, and exports of honey total approximately \$200,000 per year. Protecting honeybees should therefore be a significant priority in this project. Similarly, parasitic and predatory arthropods are essential elements of any agro-ecosystem, providing a significant check on pest populations. One of the most frequent and devastating effects of overuse and misuse of agricultural pesticides is the destruction of these natural enemies and the resulting rebound in pest populations.

To protect bees and other non-target insects it is important to use narrow-spectrum, specific pesticides whenever possible. Bacillus thuringiensis and other biological pesticides are ideal in this regard. However, many of the most useful pesticide products are broadly toxic to insects, and when these are used it is essential that precautions be taken to reduce exposure of non-target species. This involves utilizing alternative control methods whenever possible, establishing action thresholds (knowledge of when to apply pesticides based on field monitoring of pest populations), reducing the area of exposure through careful application, reducing frequency of applications, and timing applications to coincide with the most susceptible stages of the pest species. Applying pesticides early in the morning or late in the evening, when bees are least active, is also recommended.

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TABLE 4

TOXICITY OF PESTICIDES TO NON-TARGET ORGANISMS

Pesticide	Bees	Birds	Fish
<u>Insecticides</u> & Nematicides			
Acephate	T		
<u>B. thuringiensis</u>			
Carbaryl	T		
Carbofuran	T	T	T
Chlorpyrifos	T		T
Dazomet			T
Diazinon	T		T
Dimethoate	T	T	T
Endosulfan			T
Malathion	T		T
Metam-sodium			
Metasystox-R	T	T	T
Methoxychlor	T		T
Parathion	T		
Permethrin			T
Pirimiphos-M			T
Propoxur	T	T	T
Trichloron			

Fungicides

(Benomyl, Captafol, Chlorothalonil, Copper comps.,
Mancozeb, Maneb, Metiram and Thiram are toxic to fish)

Herbicides

(Devrinol and Oxyfluorfen are toxic to fish)

T = Highly Toxic; Blank = relatively safe

Perhaps the most important factor in protecting beneficial insects is raising awareness among farmers so that they will take the appropriate precautions. It is not uncommon for farmers to confuse beneficial species with pests and to spray when they see them in the fields. Educating farmers as to the importance of beneficial insect species should be made an integral part of the pest and pesticide management training courses to be provided to participating farmers (see Section IV, K). Educational materials will be developed to assist this effort.

While specific sites for field trials have not yet been selected, some of the best conditions for vegetable production in Belize lie on alluvial plains alongside rivers. Consequently, contamination of water resources by pesticide runoffs from the fields is a significant concern, particularly in later stages when acreages planted increase. Such runoff presents a human health hazard because much of the population relies on surface water, and a hazard to fish and other aquatic organisms. The growing importance of mariculture in Belize underlies the importance of preventing such contamination.

The Prime Contractor should consider drainage systems when selecting field sites and should establish a sampling system to monitor pesticide levels in soil water and any nearby surface water into which runoff may drain. Short-term technical assistance should be brought in as needed to assist with field trial siting and water sampling. Where contamination of water resources is judged to be a significant hazard, pesticides which are highly toxic to fish and other aquatic organisms should not be used.

Finally, Belize is favored with an abundance of wildlife, a number of which represent rare or endangered species. These include 15 species of mammals, such as the Jaguar, the Black Spider Monkey and Baird's Tapir; two birds, the Harpy Eagle and the Peregrine Falcon; and several reptiles including the Crocodile, River Turtle and Iguana. Fortunately, these are mostly located in areas remote from those locations judged suitable for agronomic crops, and crop protection practices are expected to have no or minimal impact on their survival.

H. Conditions Under Which the Pesticides Are to be Used

Pesticide research will be largely adaptive. Sites have not been selected but may include some at Central Farm in the Cayo district. Initial research will involve surveys for potential pest problems and small-scale tests on pesticide efficacy. These tests will be conducted under the direct supervision of the Prime Contractor Crop Protection Specialist. Selected pesticides will be applied with knapsack sprayers or other suitable manually operated equipment. Label directions regarding dosages and pre-harvest intervals must be strictly adhered to, or the crops must be destroyed to preclude their being used as food or animal feed. Educational materials on such methods will either be developed and disseminated or copied from existing sources for use by applicators and other personnel.

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As the project begins to narrow its focus on selected crop commodities it is expected that plot sizes will increase and programs will begin to move to on-farm trials with cooperating local growers. Several alternative patterns of pesticide use will be under consideration for this phase.

- . Option 1: Growers purchase the recommended pesticides on the open market and conduct their own applications.
- . Option 2: Farmers purchase their pesticides through BABCO and apply them themselves.
- . Option 3: The Prime Contractor determines the need (i.e., establish action thresholds and determine pest densities) and makes the applications.

Whatever the format selected, it will be based on a predetermined control strategy developed by the Prime Contractor and approved by BABCO and USAID, and accompanied by suitable applicator training programs where indicated.

I. Availability and Effectiveness of Other Pesticides or Control Methods

Presently a wide variety of pesticides, effective for use in vegetable pest management programs, are readily available on the open market in Belize. Many of these possess acute toxicological characteristics which result in unacceptable risks to the untrained user. These pesticides are being purchased and used particularly by farmers entering Belize from Guatemala, Honduras, El Salvador, etc. These are areas with a history of pesticide use and misuse, particularly with more toxic materials such as Parathion, Methamidophos (Tamaron) and Ethoprop (Mocap). It is regrettable that as agriculture develops in Belize it may tend to follow the misdirected lead of these immigrant farmers. Every effort must be made to curtail these practices.

Screening for varieties of crops which are resistant to diseases and other pests represents an important aspect of ongoing research at CARDI, and many resistant varieties of vegetable crops have been developed in the U.S. and elsewhere which may be screened for possible cultivation in Belize. However, because such varieties often have very specific agronomic requirements it will be necessary to concentrate on developing varieties which are adapted to local growing conditions.

It is recommended that crop protection research in this project should emphasize non-chemical control methods. For example, if cabbage is to be included as a crop, further studies on the effectiveness of the parasite Apanteles plutelae for controlling the diamond back moth (Plutella) remain to be conducted. The use of certified or hot water-treated seed for downy mildew should be considered. Disease management in most crops is based largely on host resistance, field sanitation, and cultural controls such as rotation, fallowing and maintaining good soil drainage and aeration.

J. Ability of GOB to Regulate Distribution, Storage, Use and Disposal of Pesticides (and related project provisions)

Up to the present time there has been no legislation governing the importation, distribution or use of pesticides in Belize; any retailer can get

a permit to import any product and sell it to any individual for any purpose. However, draft legislation (the Pesticide Control Act of 1985) was presented to the House of Representatives and the Senate of Belize in early July. This Bill has been tabled for one sitting of the House to provide opportunity for public comment. Mr. Rodney Neal, Permanent Secretary of the Ministry of Natural Resources, estimates that the Bill could be enacted into law by the end of August, 1985.

The Belizean legislation, modelled on the Jamaican pesticide law, provides for the establishment of a Pesticides Control Board which will have a wide range of responsibilities including:

- registration of pesticides,
- licensing persons to import pesticides,
- authorizing persons to sell restricted pesticides,
- registering premises in which a restricted pesticide may be sold,
- authorizing pesticide applicators to use restricted pesticides,
- considering and determining applications to deal with all aspects of the importation, manufacture, packaging, preparation for sale, sale, disposal and use of pesticides and to advise the Minister on all related manners, and
- making regulations concerning all aspects of pesticide use, including (of particular concern to this project) matters relating to the taking and analyzing of samples and prescribing the permissible level of pesticide and metabolite residues on human food or animal feed.¹

Clearly it will be some time before this ambitious legislation can be effectively implemented, particularly in light of the extremely limited resources available to the MNR. The first step will be the appointment of the Board Membership (based on criteria set forth in the Bill). Mr. Neal anticipates that the first acts of the Board will be to impose import prohibitions on certain materials and inventory existing stocks of pesticides in the country.

It is outside the scope of this project to provide direct assistance to the GOB in the development of pesticide regulation or enforcement capabilities, although there will be an institutional study of the MNR to develop a strategy and implementation plan for making the best use of its limited resources to meet future agricultural needs including those dictated by the new emphasis on export of agricultural commodities.

Under a previous project, AID assisted the GOB to equip and staff an analytical laboratory for meats, to be based at the Central Veterinary Investigatory Laboratory and Clinic in Belize City. According to Director Dr. Erasmo Franklin, the residue analysis laboratory is expected to become functional by the end of 1985. This laboratory could be pressed into service for analysis of domestic and export food crops in the future.

¹ Abstracted from the text of the Bill for the Pesticides Control Act of 1985.

Dr. Franklin and one of the Veterinary Laboratory technicians received training in pesticide residue analysis at the University of Miami (with AID support) and could certainly carry out the needed analyses. However space, money for supplies and maintenance of equipment, and staff time are all critically short even now. If the laboratory is to take on this additional function further inputs will be needed, particularly to employ an additional technician.

In the absence of existing effective governmental regulation in Belize, it is the responsibility of BABCO and the Prime Contractor to ensure that pesticides provided through the project are distributed only to authorized personnel and that appropriate requirements for labelling, storage and disposal of pesticides are met in the project. These requirements are outlined in Section VIII of this EA.

The most effective means to ensure conformity with these requirements will depend upon some aspects of overall project design which have not yet been established (see Section IV, H). For example, pesticide storage and disposal may be done directly by the Prime Contractor or by individual farmers. In any case, it should be the responsibility of BABCO to develop an appropriate approach which may be reviewed by AID, and periodic spot checking for compliance may be indicated.

During early development it is unlikely that the project will make use of the residue analysis laboratory because it will probably prove more efficient to send samples to other Central American countries or the U.S. However, in later stages private firms may be encouraged to contract with the laboratory for analysis of export samples. A similar arrangement is currently being discussed with some of the maricultural operations in Belize.

K. Provisions Made for Training Pesticide Users and Applicators

As with many other aspects of this project, the question of training must be considered as it relates to all stages of the project, from the initial research, through the trials in farmers' fields and, eventually, to the anticipated adoption by farmers of promising technologies.

During the research phase the Prime Contractor should be directly involved in all pesticide use and can instruct any assistants on an individual basis. It is imperative that provisions for training project personnel and cooperating farmers be incorporated into any contractual agreements.

The agreements should specify that AID-approved training in safe and effective pesticide use and principles of pest management will be provided prior to disbursement of pesticides under project auspices. Depending upon the number and location of cooperating farmers involved in the project, one or more short courses may be presented, either in one central location or in each of the districts. It may prove most efficient to present one course for all Spanish-speaking farmers and one for all English-speaking farmers.

Funding should be allocated in the project budget for these training courses, both for short-term technical assistance to present the course and for travel and expenses for the participants. AID/ST/AGR can provide experienced trainers and course materials in Spanish and English through a buy-in to its centrally-funded pest management project. ST/AGR will supply cost estimates for such training upon request. Alternatively, the project can contract with a local organization, such as the Belize School of Agriculture to present these courses. The authors were informed by members of the BSA faculty that they have presented such courses in the past (most recently in 1983) as part of their curriculum, but no course materials or copies of the syllabus were available to the EA Team. AID/ST/AGR could review the BSA course syllabus and make recommendations. Project funds could be allocated for preparing or printing course materials.

While the intent is to interest a significant number of Belizean farmers in growing vegetables, it is clearly beyond the scope of this project to provide a nationwide pest management training program. If private firms engaged in exporting crops eventually contract with individual growers, they may require that particular practices be followed, such as the use of specific pesticide dosage rates and pre-harvest intervals to ensure that residues not exceed tolerance limits. However, it may be anticipated that the primary impact of the project's training activities on the community at large will be through example and word-of-mouth on the part of farmers who participated directly in the project and the training courses. In anticipation of future needs, educational/instructional materials will be produced during the LOP.

Therefore, it is important to select influential individuals as project participants. Area agricultural extension agents and local retailers of agricultural products could help to identify these individuals. In view of the growing predominance of Central American refugees in Belizean agriculture, it would be highly advisable to include some prominent members of these communities as participants in the project.

In anticipation of future needs, educational/instructional materials on pesticide use and safety, the significance of pesticide residue levels and the principles of pest management will also be produced during LOP.

L. Provisions Made for Monitoring the Use and Effectiveness of the Pesticides

During the expanded, on-farm phases of the project, several options (see Section IV, H) for pesticide use and application will be available to the Prime Contractor. It will be difficult to monitor use under Option 1, in which the cooperating farmer is allowed to purchase pesticides on the open market. Clearly, use can best be monitored if the pesticides are dispersed and/or used under the direction of the Prime Contractor. This is the preferred approach, and in the absence of enforcement of pesticide residue limits and other regulations in Belize, it may be the only means of providing reasonable assurance for the proper use of chemical pesticides in this project

(see also Section IV, J). Modifications of this approach are dependent on the development of and enforcement of effective pesticide legislation and the future abilities of GOB or the contractors to conduct suitable sampling and residue analysis of treated crops.

Pesticide effectiveness will be determined within the adaptive research phase early in the project. Pesticide effectiveness in later phases will not be formally monitored, but will be, in effect, monitored by grower satisfaction with the prescribed treatments. Reported failures should be promptly investigated, and determinations made as to reasons for failure, i.e., poor application, timing or quality of pesticides versus possible development of resistance in pest populations. Where a history of pesticide resistance is known for a particular product, special tactics should be developed to delay its onset.

V. REASONABLY FORESEEABLE IMPACT ON THE HUMAN ENVIRONMENT

Any pesticide added to the environment will have at least a marginally disruptive impact on that environment. In Belize, where vegetables have not been extensively grown, it may be reasonably expected that an expanded industry with the concomittant use of crop protection chemicals will lead to increased background levels of pesticide in the human environment. While no great increase in pesticide use is anticipated during the implementation phase of this project, the possibility for greatly increased use in the industry following termination of the project are of concern. Such increases and potentially disruptive impacts on the human environment will be minimized if selected, minimum risk pesticides are used on a sound, as-needed basis, alternative management strategies are utilized where feasible, and proper training in the safe use of pesticides is provided. The proposed project will seek to establish an ecologically sound baseline to minimize ipacts by developing appropriate crop protection packages under the above regime.

VI. ALTERNATIVES TO THE PROPOSED ACTION

The major project goal is to strengthen the economic basis of Belizean agriculture. With import substitution crops, as with export vegetable crops, plant protection is an essential component in the proposed technology package. If significant yields of a high quality product as demanded by the export market are to be attained, it is clear that some level of chemical pest control will be needed. While traditional, non-chemical methods of crop protection will be utilized in specific crop/pest situations, there remains no satisfactory alternative to the use of chemicals in the pest management program. It is thus vital that the crop protection component of the Prime Contractor implement the agromedical approach to pesticide management as proposed by USAID/ST/AGR (Davies, et.al., 1982).

VII. UNAVOIDABLE ADVERSE ENVIRONMENTAL AFFECTS

Unavoidable affects of pesticide use include increased risks for accidental human exposure and effects on other non-target organisms, as

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previously discussed. However, with proper training and care, these potentially disruptive effects can be reduced to an acceptable level in the risk/benefit ratio.

VIII. RELATIONSHIP BETWEEN SHORT-TERM AND LONG-TERM EFFECTS OF PROPOSED ACTION

The short-term risks involved in the use of the proposed pesticide have been discussed above. It is anticipated that ongoing research will demonstrate the utility of alternate control strategies, and that a viable integrated pest control program will evolve, further reducing dependence on chemical control methods.

The role of crop protection in the technology improvement aspects of crop diversification are self-evident. Beneficiaries of the project will include those farmers who have suffered eroding income due to declining sugar prices. Successful export vegetable production and/or import substitution enterprises will provide employment and an opportunity for these people to benefit from the production of cash crops and to improve living standards. Such long-term effects of the project would appear to adequately offset the short-term and largely manageable risks involved in the use of pesticides within an integrated pest control program.

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Table 5

ILLUSTRATIVE BUDGET: CROP PROTECTION

A. <u>Experts</u>		125,000
Crop Protection Specialist (8 mm at \$15,000)	\$120,000	
Pesticide Trainer (1 mm at \$6,000)	5,000	
B. <u>Pesticide Training Course</u> (one offered during LOP)		6,000
C. <u>Educational Materials</u>		4,500
a. Davies et.al. 1982 (100 copies at \$10)	1,000	
b. Pesticide application manual (250 copies at \$5)	1,250	
c. Belize Pesticides Control Act of 1985 (250 copies at \$1)	250	
d. Residue tolerances and export crops primer (250 copies at \$3)	750	
e. Beneficial and harmful insects of major crops in Belize (250 copies at \$5)	1,250	
D. <u>Exposure Monitoring</u> (200 samples at \$10/sample)		2,000
E. <u>Evaluation</u> (1 mm at \$6,000)		6,000
F. <u>Residue Analysis</u> (Univ. Miami - 200 samples at \$15/sample)		3,000
G. <u>Lab Equipment and Maintenance</u>		15,000
	TOTAL	<u>\$161,000</u>

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An Agromedical Approach to Pesticide Management, Consortium for International Crop Protection.

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APPENDIX

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- . Mr. Pedro Perez
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Corozal

Additional References:

- . Davies, J.E., Freed, V.H. and F.W. Whittemore, 1982, An Agromedical Approach to Pesticide Management: Some Health and Environmental Considerations. Published by the University of Miami Printing for A.I.D. and the Consortium for International Crop Protection.
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ANNEX 9 TABLE 1 FINANCIAL COST OF CORN PRODUCTION IN BELIZE

Annex 9

ESTIMATED REVENUE (U.S.\$)	UNIT PRICE	YIELD IN POUNDS PER ACRE			
		2000	2500	3000	3500
FARM GATE	\$0.32	\$180	\$200	\$240	\$280
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ESTIMATED COSTS OF PRODUCTION		FINANCIAL			
MACHINERY HIRE/ACRE	\$52.00	\$52.00	\$52.00	\$52.00	\$52.00
SEED/POUND	\$0.33	\$4.46	\$4.70	\$4.85	\$5.45
FERTILIZER/POUND	\$0.15	\$13.50	\$14.25	\$15.00	\$16.50
HERBICIDE/POUND	\$2.00	\$7.20	\$7.50	\$8.00	\$8.50
INSECTICIDE/POUND					
BAGS/EACH	\$0.10	\$2.00	\$2.50	\$3.00	\$3.50
TRANSPORT/CWT	\$0.50	\$10.00	\$12.50	\$15.00	\$17.50
LABOR/DAY	\$8.00	\$14.00	\$14.00	\$14.00	\$14.00
INTEREST/ANNUM	10%	\$4.46	\$4.82	\$4.90	\$5.19
TOTAL COSTS		\$237.61	\$242.23	\$246.95	\$252.63
NET REVENUE PER ACRE		(\$77.61)	(\$42.23)	(\$6.95)	\$27.07

ANNEX 9 TABLE 2 FINANCIAL COST OF BEAN PRODUCTION IN BELIZE

ESTIMATED REVENUE (U.S.\$)	UNIT PRICE	YIELD IN POUNDS PER ACRE			
		600	800	900	1000
FARM GATE	\$0.32	\$192	\$256	\$288	\$320
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ESTIMATED COSTS OF PRODUCTION		FINANCIAL			
MACHINERY HIRE/ACRE	\$52.00	\$52.00	\$52.00	\$52.00	\$52.00
SEED/POUND	\$0.75	\$25.50	\$27.00	\$30.00	\$33.00
FERTILIZER/POUND	\$0.15	\$13.50	\$13.50	\$15.00	\$16.50
HERBICIDE/POUND	\$2.00	\$7.20	\$7.50	\$8.00	\$8.50
INSECTICIDE/POUND	\$1.25	\$8.75	\$8.75	\$11.25	\$12.50
BAGS/EACH	\$0.10	\$0.50	\$0.50	\$0.50	\$1.00
TRANSPORT/CWT	\$0.50	\$3.00	\$4.00	\$4.50	\$5.00
LABOR/DAY	\$8.00	\$56.00	\$56.00	\$56.00	\$56.00
INTEREST/ANNUM	10%	\$5.84	\$5.82	\$6.12	\$6.45
TOTAL COSTS		\$169.34	\$172.93	\$182.17	\$189.93
NET REVENUE PER ACRE		\$22.16	\$83.07	\$105.83	\$130.07

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ANNEX 9 TABLE 3 FINANCIAL COST OF RICE PRODUCTION IN BELIZE

ESTIMATED REVENUE (U.S.\$)	UNIT PRICE	YIELD IN POUNDS PER ACRE			
		1000	1500	2000	2500
FARM GATE	\$0.10	\$100	\$150	\$200	\$250

ESTIMATED COSTS OF PRODUCTION		FINANCIAL			
		MILPA		MECHANIZED	
MACHINERY HIRE/ACRE	\$61.50			\$61.50	\$61.50
SEED/POUND	\$0.30	\$20.00	\$25.00	\$20.00	\$25.00
FERTILIZER/POUND	\$0.15			\$15.00	\$15.00
HERBICIDE/POUND	\$2.00	\$3.00	\$3.00	\$15.00	\$15.00
INSECTICIDE/POUND	\$1.25			\$5.33	\$5.00
BAGS/EACH	\$0.10	\$1.00	\$1.50	\$2.00	\$2.50
TRANSPORT/CWT	\$0.50			\$10.00	\$12.50
LABOR/DAY	\$6.00	\$198.00	\$220.00	\$35.80	\$38.50
INTEREST/ANNUUM	10%	\$1.20	\$1.51	\$7.10	\$7.51
TOTAL COSTS		\$223.20	\$251.51	\$135.98	\$135.51
NET REVENUE PER ACRE		(\$123.20)	(\$101.51)	\$ 4.02	\$53.38

ANNEX 9 TABLE 4 FINANCIAL COST OF SOYBEAN PRODUCTION IN BELIZE

ESTIMATED REVENUE (U.S.\$)	UNIT PRICE	YIELD IN POUNDS PER ACRE			
		900	1000	1500	2000
FARM GATE	\$0.17	\$135	\$170	\$255	\$340

ESTIMATED COSTS OF PRODUCTION		FINANCIAL			
MACHINERY HIRE/ACRE	\$52.00	\$52.00	\$52.00	\$52.00	\$52.00
SEED/POUND	\$0.35	\$8.00	\$9.00	\$9.75	\$10.75
FERTILIZER/POUND	\$0.15	\$13.50	\$14.00	\$15.00	\$15.50
HERBICIDE/POUND	\$0.20	\$7.00	\$7.00	\$9.00	\$9.50
INSECTICIDE/POUND					
BAGS/EACH	\$0.10	\$0.90	\$1.00	\$1.50	\$2.00
TRANSPORT/CWT	\$0.50			\$7.50	\$10.00
LABOR/DAY	\$6.00	\$66.00	\$69.00	\$66.00	\$66.00
INTEREST/ANNUUM	10%	\$4.10	\$4.21	\$4.85	\$5.00
TOTAL COSTS		\$182.40	\$184.21	\$184.47	\$201.26
NET REVENUE PER ACRE		(\$46.40)	(\$14.21)	\$60.53	\$138.54

ANNEX 9 TABLE 5 FINANCIAL COST OF SESAME PRODUCTION IN BELIZE

ESTIMATED REVENUE (U.S. \$)	UNIT PRICE	YIELD IN POUNDS PER ACRE			
		500	600	800	900
FARM GATE	\$1.00	\$500	\$600	\$800	\$900
ESTIMATED COSTS OF PRODUCTION		FINANCIAL			
MACHINERY HIRE/ACRE	\$50.00	\$50.00	\$50.00	\$50.00	\$50.00
SEED/POUND	\$0.65	\$39.00	\$39.00	\$39.00	\$39.00
FERTILIZER/POUND	\$0.15	\$13.50	\$14.00	\$15.00	\$16.00
HERBICIDE/POUND	\$0.20	\$7.20	\$7.50	\$8.00	\$8.00
INSECTICIDE/POUND					
BAGS/EACH	\$0.10	\$0.50	\$0.60	\$0.80	\$0.90
TRANSPORT/CWT	\$0.50	\$0.50	\$3.00	\$4.00	\$4.50
LABOR/DAY	\$8.00	\$198.00	\$220.00	\$35.00	\$35.00
INTEREST/ANNUUM	10%	\$4.23	\$4.34	\$4.48	\$4.67
TOTAL COSTS		\$296.73	\$311.08	\$130.88	\$134.88
NET REVENUE PER ACRE		\$203.27	\$278.92	\$669.14	\$765.07

ANNEX 9 TABLE 6 FINANCIAL COST OF CANE PRODUCTION IN BELIZE

ESTIMATED REVENUE (U.S. \$)	UNIT PRICE	YIELD IN TONS PER ACRE			
		10	15	20	25
AT MILL	\$14.50	\$145	\$218	\$290	\$355
ESTIMATED COSTS OF PRODUCTION		FINANCIAL			
ESTABLISHMENT COSTS FOR EACH REPLANTING					
MACHINERY HIRE/ACRE	\$199.00	\$19.90	\$19.90	\$19.90	\$19.90
SEED/ACRE	\$50.00	\$5.00	\$5.00	\$5.00	\$5.00
LABOR/ACRE	\$130.00	\$13.00	\$13.00	\$13.00	\$13.00
YEARS BETWEEN PLANTING	10				
FERTILIZER/POUND	\$0.15	\$0.21	\$7.50	\$1.05	\$15.00
APPLICATION LABOR/DAY	\$5.00	\$0.00	\$12.00	\$0.00	\$35.00
HARVESTING LABOR/TON	\$5.00	\$50.00	\$75.00	\$100.00	\$125.00
TRANSPORT/TON	\$4.00	\$40.00	\$60.00	\$80.00	\$100.00
FEE TO COBAYTON	\$0.20	\$0.20	\$3.00	\$4.00	\$5.00
INTEREST	10%	\$6.48	\$9.24	\$11.80	\$13.88
TOTAL COSTS		\$136.38	\$204.84	\$284.77	\$332.88
NET REVENUE PER ACRE		\$8.61	\$12.96	\$29.24	\$23.61

ANNEX 3 TABLE 7 FINANCIAL COST OF CUCUMBER PRODUCTION IN BELIZE

ESTIMATED REVENUE	YIELD IN BOXES PER ACRE						
			500	600	700	800	900
	\$/LB	\$/CTN	\$/ACRE	\$/ACRE	\$/ACRE	\$/ACRE	\$/ACRE
N.Y. WHOLESALE '82-83 AVE. PRICE	\$0.3400	\$19.70	\$9,350	\$11,220	\$13,090	\$14,960	\$16,830
COMMISSION	\$0.0510	\$2.31	\$1,403	\$1,683	\$1,964	\$2,244	\$2,525
FREIGHT (BEL/NY)	\$0.1352	\$7.49	\$3,745	\$4,494	\$5,243	\$5,992	\$6,741
INSPECTIONS	\$0.0027	\$0.15	\$75	\$90	\$105	\$120	\$135
MISCELLANY	\$0.0018	\$0.10	\$50	\$60	\$70	\$80	\$90
SUB-TOTAL	\$0.1917	\$10.55	\$5,273	\$6,327	\$7,382	\$8,436	\$9,491
VARIOUS (10%)	\$0.0192	\$1.05	\$527	\$633	\$738	\$844	\$949
FARM GATE	\$0.1291	\$7.1005	\$3,550	\$4,260	\$4,970	\$5,680	\$6,390
PRODUCTION COSTS							
MECHANIZATION	\$0.0031	\$0.17	\$101	\$64	\$53	\$65	\$71
CHEMICALS	\$0.0211	\$1.16	\$699	\$578	\$576	\$575	\$573
SEED	\$0.0009	\$0.05	\$30	\$24	\$24	\$24	\$24
LABOR	\$0.0044	\$0.24	\$144	\$144	\$133	\$174	\$192
HARVESTING	\$0.0022	\$0.12	\$72	\$60	\$64	\$65	\$102
PACKING	\$0.0336	\$1.85	\$925	\$1,113	\$1,255	\$1,480	\$1,555
ADMINISTRATION	\$0.0135	\$0.75	\$375	\$450	\$525	\$600	\$675
SUB-TOTAL	\$0.0789	\$4.34	\$2,343	\$2,413	\$2,721	\$3,015	\$3,311
VARIOUS (10%)	\$0.0079	\$0.43	\$234	\$242	\$272	\$302	\$331
TOTAL COSTS	\$0.0868	\$4.77	\$2,577	\$2,660	\$2,994	\$3,317	\$3,642
NET REVENUE PER ACRE			\$973	\$1,601	\$1,977	\$2,364	\$2,749

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ANNEX 3 TABLE 8 FINANCIAL COST OF MELON PRODUCTION IN BELIZE

ESTIMATED REVENUE	MELON		BOXES PER ACRE				
	\$/LB	\$/CTN	400	500	600	700	800
			\$/ACRE	\$/ACRE	\$/ACRE	\$/ACRE	\$/ACRE
N.Y. WHOLESALE '82-83 AVE. PRICE	\$0.4675	\$19.80	\$7,520	\$9,400	\$11,280	\$13,160	\$15,040
COMMISSION	\$0.0671	\$2.82	\$1,128	\$1,410	\$1,692	\$1,974	\$2,256
FREIGHT (BEL/NY)	\$0.1271	\$5.34	\$2,136	\$2,570	\$3,004	\$3,738	\$4,272
INSPECTIONS	\$0.0029	\$0.12	\$48	\$60	\$72	\$84	\$96
MISCELLANY	\$0.0024	\$0.10	\$40	\$50	\$60	\$70	\$80
SUB-TOTAL	\$0.1995	\$8.38	\$3,352	\$4,190	\$5,023	\$5,966	\$6,704
VARIOUS (10%)	\$0.0200	\$0.84	\$305	\$419	\$503	\$597	\$670
FARM GATE	\$0.2480	\$9.5820	\$3,833	\$4,791	\$5,749	\$6,707	\$7,668
PRODUCTION COSTS US \$							
MECHANIZATION	\$0.0067	\$0.28	\$50	\$140	\$55	\$91	\$67
CHEMICALS	\$0.0393	\$1.65	\$630	\$630	\$620	\$630	\$630
SEED	\$0.0067	\$0.28	\$140	\$140	\$140	\$140	\$140
LABOR	\$0.0086	\$0.36	\$180	\$180	\$193	\$218	\$240
HARVESTING	\$0.0043	\$0.18	\$72	\$60	\$108	\$126	\$144
PACKING	\$0.0363	\$1.55	\$620	\$775	\$930	\$1,085	\$1,240
ADMINISTRATION	\$0.0233	\$1.00	\$500	\$500	\$550	\$605	\$665
SUB-TOTAL	\$0.1262	\$5.30	\$2,240	\$2,905	\$2,961	\$3,315	\$3,176
VARIOUS (10%)	\$0.0126	\$0.53	\$224	\$291	\$296	\$331	\$316
TOTAL COSTS	\$0.1388	\$5.83	\$2,466	\$2,756	\$2,927	\$3,206	\$3,494
NET REVENUE PER ACRE			\$1,367	\$2,035	\$2,922	\$3,501	\$4,172

ANNEX 9 TABLE 9 CROPPING PATTERN
 ASSUMPTIONS: WITHOUT THE PROJECT
 (EACH YEAR)

CROP	ACREAGE	NET REVENUE PER ACRE (U.S. \$)	TOTAL REVENUE (U.S. \$)
CANE	17000	\$29.61	\$503,370
CORN	6000	\$27.07	\$162,406
BEANS	5000	\$130.32	\$651,500
RICE	4000	\$53.39	\$213,560
			\$1,530,837

ANNEX 9 TABLE 9A CROPPING PATTERN ASSUMPTIONS
 WITH THE PROJECT

YEAR	CROP	ACREAGE	NET REVENUE PER ACRE (U.S. \$)	TOTAL REVENUE (U.S. \$)	TOTAL ANNUAL (U.S. \$)
1	NONE	0	\$0.00	\$0	\$0
2	NONE	0	\$0.00	\$0	\$0
3	CUCUMBER	500	\$973.17	\$486,585	\$1,520,795
	MELONS	500	\$1,366.60	\$683,300	
	SOYBEAN	1200	\$60.53	\$72,637	
	SESAME	1000	\$338.27	\$338,273	
4	CUCUMBER	900	\$973.17	\$875,853	\$1,976,719
	MELONS	500	\$1,366.60	\$683,300	
	SOYBEAN	1300	\$60.53	\$78,689	
	SESAME	1200	\$338.27	\$405,887	
5	CUCUMBER	1100	\$973.17	\$1,070,487	\$3,742,969
	MELONS	900	\$1,366.60	\$1,229,940	
	SOYBEAN	2200	\$138.94	\$305,588	
	SESAME	2400	\$438.32	\$1,051,954	
6	CUCUMBER	1500	\$973.17	\$1,459,755	\$4,372,157
	MELONS	1200	\$1,366.60	\$1,639,920	
	SOYBEAN	4000	\$138.94	\$555,760	
	SESAME	3000	\$438.32	\$1,314,720	
7	CUCUMBER	1500	\$973.17	\$1,459,755	\$6,093,977
	MELONS	1500	\$1,366.60	\$2,049,900	
	SOYBEAN	6000	\$138.94	\$833,640	
	SESAME	4000	\$438.32	\$1,753,282	

ANNEX 9 TABLE 10 CROPPING PATTERN
ASSUMPTIONS: WITHOUT PROJECT
(EACH YEAR)

CROP	ACREAGE	NET REVENUE PER ACRE (U.S. \$)	TOTAL REVENUE (U.S. \$)
CANE	17000	\$172.96	\$2,940,308
CORN	6000	\$99.51	\$597,060
BEANS	5000	\$69.14	\$345,678
RICE	4000	\$22.50	\$89,984

			\$3,973,031

ANNEX 9 TABLE 11 CROPPING PATTERN ASSUMPTIONS
WITH THE PROJECT

YEAR	CROP	ACREAGE	NET REVENUE PER ACRE (U.S. \$)	TOTAL REVENUE (U.S. \$)	TOTAL ANNUAL REVENUE (U.S. \$)
1	NONE	0	\$0.00	\$0	\$0
2	NONE	0	\$0.00	\$0	\$0
3	CUCUMBER	500	\$1,078.55	\$539,275	\$1,938,338
	MELONS	500	\$1,650.40	\$825,200	
	SOYBEAN	1200	\$87.56	\$105,074	
	SESAME	1000	\$465.79	\$465,790	
4	CUCUMBER	800	\$1,078.55	\$862,840	\$2,847,187
	MELONS	500	\$1,650.40	\$825,200	
	SOYBEAN	1800	\$166.77	\$300,178	
	SESAME	1200	\$465.79	\$558,948	
5	CUCUMBER	1100	\$1,435.50	\$1,579,050	\$3,144,742
	MELONS	900	\$2,200.50	\$1,980,450	
	SOYBEAN	2800	\$166.77	\$466,948	
	SESAME	2400	\$465.79	\$1,117,896	
6	CUCUMBER	1500	\$1,435.50	\$2,153,250	\$3,888,288
	MELONS	1200	\$2,200.50	\$2,640,600	
	SOYBEAN	4000	\$166.77	\$667,088	
	SESAME	3000	\$465.79	\$1,397,370	
7	CUCUMBER	1500	\$1,435.50	\$2,153,250	\$3,317,787
	MELONS	1500	\$2,200.50	\$3,300,750	
	SOYBEAN	6000	\$166.77	\$1,000,587	
	SESAME	4000	\$465.79	\$1,863,160	

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ANNEX 9 TABLE 12 ECONOMIC COST OF CORN PRODUCTION IN BELIZE

ESTIMATED REVENUE (U.S.\$)	UNIT PRICE	YIELD IN POUNDS PER ACRE			
		2000	2500	3000	3500
FARM GATE	\$0.08	\$160.	\$200	\$240	\$280
<hr/>					
ESTIMATED COSTS OF PRODUCTION		ECONOMIC			
MACHINERY HIRE/ACRE	\$0.62	\$0.62	\$0.62	\$0.62	\$0.62
SEED/POUND	\$0.69	\$9.29	\$9.60	\$10.32	\$11.35
FERTILIZER/POUND	\$0.14	\$12.93	\$13.64	\$14.35	\$15.06
HERBICIDE/POUND	\$1.71	\$6.16	\$6.50	\$6.84	\$7.18
INSECTICIDE/POUND					
BAGS/EACH	\$0.10	\$2.00	\$2.50	\$3.00	\$3.50
TRANSPORT/CWT	\$0.35	\$7.00	\$8.75	\$10.50	\$12.25
LABOR/DAY	\$4.00	\$72.00	\$72.00	\$72.00	\$72.00
INTEREST/ANNUUM	15%	\$6.59	\$6.88	\$7.16	\$7.57
TOTAL COSTS		\$166.48	\$170.99	\$174.33	\$182.49
NET REVENUE PER ACRE		(\$6.48)	\$29.41	\$65.31	\$95.51

ANNEX 9 TABLE 13 ECONOMIC COST OF BEAN PRODUCTION IN BELIZE

ESTIMATED REVENUE (U.S.\$)	UNIT PRICE	YIELD IN POUNDS PER ACRE			
		500	600	800	900
FARM GATE	\$0.32	\$160	\$192	\$256	\$288
<hr/>					
ESTIMATED COSTS OF PRODUCTION		ECONOMIC			
MACHINERY HIRE/ACRE	\$0.62	\$0.62	\$0.62	\$0.62	\$0.62
SEED/POUND	\$0.31	\$27.70	\$30.00	\$32.40	\$35.64
FERTILIZER/POUND	\$0.14	\$12.93	\$12.93	\$14.35	\$15.69
HERBICIDE/POUND	\$1.71	\$6.16	\$6.50	\$7.50	\$8.21
INSECTICIDE/POUND	\$1.15	\$18.10	\$18.10	\$20.70	\$22.42
BAGS/EACH	\$0.12	\$1.50	\$2.00	\$2.80	\$3.60
TRANSPORT/CWT	\$0.35	\$1.75	\$2.10	\$2.80	\$3.15
LABOR/DAY	\$4.00	\$72.00	\$72.00	\$72.00	\$72.00
INTEREST/ANNUUM	15%	\$8.57	\$8.88	\$9.69	\$10.29
TOTAL COSTS		\$195.33	\$167.40	\$210.79	\$216.86
NET REVENUE PER ACRE		(\$35.33)	\$24.60	\$45.21	\$69.14

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ANNEX 3 TABLE 14 ECONOMIC COST OF RICE PRODUCTION IN BELIZE

ESTIMATED REVENUE (U.S.\$)	UNIT PRICE	YIELD IN POUNDS PER ACRE			
		1000	1500	2000	2500
FARM GATE	\$0.10	\$100	\$150	\$200	\$250

ESTIMATED COSTS OF PRODUCTION		ECONOMIC			
		MILPA		MECHANIZED	
MACHINERY HIRE/ACRE	\$9.86			\$9.86	\$9.86
SEED/POUND	\$0.84	\$21.00	\$29.25	\$33.60	\$36.96
FERTILIZER/POUND	\$0.14			\$14.25	\$15.33
HERBICIDE/POUND	\$1.71	\$2.57	\$3.08	\$13.65	\$15.33
INSECTICIDE/POUND	\$1.15			\$4.64	\$5.32
BAGS/EACH	\$0.10	\$1.00	\$1.50	\$2.00	\$2.50
TRANSPORT/CWT	\$0.35	\$3.50	\$5.25	\$7.00	\$8.75
LABOR/DAY	\$4.00	\$72.00	\$72.00	\$72.00	\$72.00
INTEREST/ANNUM	15%	\$2.10	\$2.71	\$10.16	\$10.85
TOTAL COSTS		\$102.17	\$110.78	\$217.67	\$227.50
NET REVENUE PER ACRE		(\$2.17)	\$33.22	(\$17.37)	\$22.50

ESTIMATED REVENUE (U.S.\$)	UNIT PRICE	YIELD IN POUNDS PER ACRE			
		800	1000	1500	2000
FARM GATE	\$0.17	\$136	\$170	\$255	\$340

ESTIMATED COSTS OF PRODUCTION		ECONOMIC			
		MACHINERY HIRE/ACRE	\$0.62	\$70.62	\$50.62
SEED/POUND	\$0.69	\$9.29	\$9.50	\$10.32	\$11.35
FERTILIZER/POUND	\$0.14	\$12.83	\$13.54	\$14.25	\$15.66
HERBICIDE/POUND	\$1.71	\$6.15	\$6.50	\$6.84	\$7.52
INSECTICIDE/POUND					
BAGS/EACH	\$0.10	\$0.90	\$1.00	\$1.50	\$2.00
TRANSPORT/CWT	\$0.35	\$2.80	\$3.50	\$5.25	\$7.00
LABOR/DAY	\$4.00	\$72.00	\$72.00	\$72.00	\$72.00
INTEREST/ANNUM	15%	\$6.19	\$6.37	\$6.66	\$7.05
TOTAL COSTS		\$150.68	\$163.33	\$167.44	\$173.23
NET REVENUE PER ACRE		(\$14.68)	\$6.87	\$8.55	\$168.77

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ANNEX 9 TABLE 15 ECONOMIC COST OF SOYBEAN PRODUCTION IN BELIZE

ESTIMATED REVENUE (U.S.\$)	UNIT PRICE	YIELD IN POUNDS PER ACRE			
		500	1000	1500	2000
FARM GATE	\$0.17	\$136	\$170	\$255	\$340
<hr/>					
ESTIMATED COSTS OF PRODUCTION		ECONOMIC			
MACHINERY HIRE/ACRE	\$0.62	\$50.62	\$50.62	\$50.62	\$50.62
SEED/POUND	\$0.59	\$9.29	\$9.29	\$10.32	\$11.35
FERTILIZER/POUND	\$0.14	\$12.23	\$13.54	\$14.25	\$15.52
HERBICIDE/POUND	\$1.71	\$6.16	\$6.50	\$6.84	\$7.52
INSECTICIDE/POUND					
BAGS/EACH	\$0.10	\$0.80	\$1.00	\$1.50	\$2.00
TRANSPORT/CWT	\$0.35	\$2.80	\$3.50	\$5.25	\$7.00
LABOR/DAY	\$4.00	\$72.00	\$72.00	\$72.00	\$72.00
INTEREST/ANNUUM	15%	\$6.19	\$6.37	\$6.65	\$7.06
TOTAL COSTS		\$150.99	\$163.33	\$167.44	\$173.23
NET REVENUE PER ACRE		(\$24.53)	\$6.67	\$87.55	\$166.77

ANNEX 9 TABLE 16 ECONOMIC COST OF SESAME PRODUCTION IN BELIZE

ESTIMATED REVENUE (U.S.\$)	UNIT PRICE	YIELD IN POUNDS PER ACRE			
		500	600	800	900
FARM GATE	\$1.25	\$625	\$750	\$1,000	\$1,125
<hr/>					
ESTIMATED COSTS OF PRODUCTION		ECONOMIC			
MACHINERY HIRE/ACRE	\$0.62	\$50.62	\$50.62	\$50.62	\$50.62
SEED/POUND	0.627	\$9.27	\$9.79	\$10.31	\$11.34
FERTILIZER/POUND	\$0.14	\$12.93	\$13.54	\$14.25	\$15.52
HERBICIDE/POUND	\$1.71	\$6.16	\$6.50	\$6.84	\$7.52
INSECTICIDE/POUND					
BAGS/EACH	\$0.10	\$0.80	\$0.80	\$0.80	\$0.80
TRANSPORT/CWT	\$0.35	\$1.75	\$2.10	\$2.80	\$3.15
LABOR/DAY	\$4.00	\$72.00	\$72.00	\$72.00	\$72.00
INTEREST/ANNUUM	15%	\$6.08	\$6.24	\$6.42	\$6.58
TOTAL COSTS		\$159.21	\$161.33	\$164.04	\$167.99
NET REVENUE PER ACRE		\$465.79	\$588.62	\$835.96	\$957.11

ANNEX 9 TABLE 17 ECONOMIC COST OF SUGARCANE PRODUCTION IN BELIZE

ESTIMATED REVENUE (U.S. \$)	UNIT PRICE	YIELD IN TONS PER ACRE			
		10	15	20	25
AT MILL	\$15.24	\$152.40	\$228.60	\$304.80	\$381.00
<hr/>					
ESTIMATED COSTS OF PRODUCTION	ECONOMIC				
ESTABLISHMENT COSTS FOR EACH REPLANTING					
MACHINERY HIRE/ACRE	\$160.00	\$16.00	\$16.00	\$16.00	\$16.00
SEED/ACRE	\$50.00	\$5.00	\$5.00	\$5.00	\$5.00
LABOR/ACRE	\$28.00	\$2.80	\$2.80	\$2.80	\$2.80
YEARS BETWEEN PLANTING	10				
FERTILIZER/POUND	\$2.14	\$0.00	\$7.13	\$10.69	\$14.25
APPLICATION LABOR/DAY	\$6.00	\$0.00	\$9.00	\$13.00	\$17.00
HARVESTING LABOR/TON	\$2.00	\$20.00	\$20.00	\$40.00	\$50.00
TRANSPORT/TON	\$1.20	\$12.00	\$18.00	\$24.00	\$30.00
FEE TO CGA/TON	\$0.20	\$2.00	\$3.00	\$4.00	\$5.00
INTEREST	15%	\$4.95	\$8.92	\$13.35	\$19.75
TOTAL COSTS		\$68.75	\$105.94	\$131.94	\$165.94
NET REVENUE PER ACRE		\$83.65	\$124.76	\$172.86	\$215.16

ANNEX 9 TABLE 18 ECONOMIC COST OF CUCUMBER PRODUCTION IN BELIZE

ESTIMATED REVENUE	CUCUMBER		YIELD IN BOXES PER ACRE				
			500	500	700	800	900
	\$/LB	\$/CTN	\$/ACRE	\$/ACRE	\$/ACRE	\$/ACRE	\$/ACRE
N.Y. WHOLESALE 32-33 AVE. PRICE	\$0.3400	\$18.70	\$9,350	\$11,220	\$13,090	\$14,960	\$16,830
COMMISSION	\$0.0510	\$2.61	\$1,403	\$1,663	\$1,954	\$2,244	\$2,525
FREIGHT (BEL/NY)	\$0.1362	\$7.19	\$3,745	\$4,494	\$5,243	\$5,992	\$6,741
INSPECTIONS	\$0.0027	\$0.15	\$75	\$90	\$105	\$120	\$135
MISCELLANY	\$0.0018	\$0.10	\$50	\$60	\$70	\$80	\$90
SUB-TOTAL	\$0.1917	\$10.55	\$5,273	\$6,327	\$7,382	\$8,436	\$9,491
VARIOUS (10%)	\$0.0192	\$1.05	\$527	\$633	\$739	\$844	\$949
FARM GATE	\$0.1291	\$7.1005	\$3,550	\$4,260	\$4,970	\$5,680	\$6,390
PRODUCTION COSTS							
MECHANIZATION	\$0.0016	\$0.09	\$54	\$54	\$59	\$65	\$71
CHEMICALS	\$0.0175	\$0.93	\$576	\$576	\$576	\$576	\$576
SEED	\$0.0007	\$0.04	\$24	\$24	\$24	\$24	\$24
LABEL	\$0.0029	\$0.16	\$95	\$114	\$133	\$174	\$192
HARVESTING	\$0.0022	\$0.12	\$72	\$90	\$90	\$90	\$90
PACKING	\$0.0335	\$1.85	\$925	\$1,110	\$1,295	\$1,480	\$1,665
ADMINISTRATION	\$0.0132	\$1.00	\$500	\$600	\$700	\$800	\$900
SUB-TOTAL	\$0.0767	\$4.22	\$2,247	\$2,589	\$2,812	\$3,116	\$3,423
VARIOUS (10%)	\$0.0077	\$0.42	\$225	\$257	\$281	\$312	\$343
TOTAL COSTS	\$0.0844	\$4.64	\$2,472	\$2,825	\$3,094	\$3,431	\$3,770
NET REVENUE PER ACRE			\$1,079	\$1,436	\$1,877	\$2,249	\$2,620

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ANNEX 9 TABLE 19 ECONOMIC COST OF MELON PRODUCTION IN BELIZE

ESTIMATED REVENUE	MELON		BOXES PER ACRE				
	\$/LB	\$/CTN	400	500	600	700	900
			\$/ACRE	\$/ACRE	\$/ACRE	\$/ACRE	\$/ACRE
N.Y. WHOLESALE '92-93 AVE. PRICE	\$0.4675	\$18.80	\$7,520	\$9,400	\$11,280	\$13,160	\$15,040
COMMISSION	\$0.0671	\$2.82	\$1,068	\$1,410	\$1,692	\$1,974	\$2,256
FREIGHT (BEL/NY)	\$0.1271	\$5.34	\$2,136	\$2,570	\$3,204	\$3,738	\$4,272
INSPECTIONS	\$0.0029	\$0.12	\$48	\$50	\$72	\$84	\$96
MISCELLANY	\$0.0024	\$0.10	\$40	\$50	\$60	\$70	\$80
SUB-TOTAL	\$0.1995	\$8.38	\$3,352	\$4,190	\$5,028	\$5,865	\$6,704
VARIOUS (10%)	\$0.0200	\$0.84	\$335	\$419	\$503	\$587	\$670
FARM GATE	\$0.2480	\$9.5820	\$3,833	\$4,791	\$5,749	\$6,707	\$7,666
PRODUCTION COSTS US \$							
MECHANIZATION	\$0.0024	\$0.10	\$40	\$50	\$60	\$70	\$80
CHEMICALS	\$0.0324	\$1.36	\$544	\$680	\$816	\$952	\$1,088
SEED	\$0.0067	\$0.28	\$112	\$140	\$168	\$196	\$224
LABOR	\$0.0057	\$0.24	\$96	\$120	\$144	\$168	\$192
HARVESTING	\$0.0043	\$0.18	\$72	\$90	\$108	\$126	\$144
PACKING	\$0.0363	\$1.55	\$620	\$775	\$930	\$1,085	\$1,240
ADMINISTRATION	\$0.0238	\$1.00	\$400	\$500	\$600	\$700	\$800
SUB-TOTAL	\$0.1121	\$4.71	\$1,994	\$2,355	\$2,776	\$3,202	\$3,634
VARIOUS (10%)	\$0.0112	\$0.47	\$188	\$236	\$278	\$320	\$363
TOTAL COSTS	\$0.1234	\$5.18	\$2,162	\$2,591	\$3,054	\$3,522	\$3,997
NET REVENUE PER ACRE			\$1,650	\$2,201	\$2,696	\$3,185	\$3,669

ANNEX 10 TABLE 1 SUMMARY PROJECT COSTS BY COMPONENT AND YEARS

Private Sector Component	Year One	Year Two	Year Three	Year Four	Year Five	LCP TOTAL
(U.S. \$000)						
Technical Assistance	\$333	\$547	\$578	\$494	\$212	\$2,164
Local Staff	\$0	\$65	\$55	\$65	\$65	\$318
Vehicles & Equipment	\$92	\$0	\$0	\$0	\$0	\$92
Operating Expenses	\$30	\$44	\$39	\$38	\$27	\$178
Sub-contracts	\$0	\$150	\$195	\$130	\$80	\$615
Admin-Evaluation/Audit	\$80	\$155	\$80	\$105	\$150	\$570
Contingency & Inflation	\$54	\$149	\$210	\$252	\$183	\$848
Sub-Total Component I	\$594	\$1,109	\$1,158	\$1,173	\$727	\$4,900
Public Sector Component						
A.I.D. Funded						
Technical Assistance	\$0	\$147	\$372	\$203	\$41	\$762
Vehicles & Equipment	\$0	\$29	\$258	\$90	\$0	\$376
Sub-contracts	\$0	\$65	\$70	\$80	\$65	\$300
Off Shore Training	\$30	\$30	\$30	\$0	\$0	\$90
Project Evaluation	\$0	\$0	\$50	\$0	\$50	\$100
Contingency & Inflation	\$3	\$42	\$168	\$39	\$53	\$305
Sub-Total A.I.D.	\$33	\$312	\$953	\$461	\$239	\$2,000
GOS Funded						
Personnel	\$30	\$30	\$30	\$30	\$30	\$150
Operating Expense	\$50	\$52	\$127	\$121	\$56	\$406
Contingency & Inflation	\$8	\$13	\$33	\$41	\$29	\$124
Sub-Total GOS	\$88	\$95	\$190	\$192	\$115	\$680
Total Component II	\$121	\$407	\$1,148	\$654	\$350	\$2,660
Project Total Costs	\$715	\$1,516	\$2,345	\$1,827	\$1,077	\$7,480

ANNEX 10 TABLE 2 DETAILED PROJECT BUDGET - PRIVATE SECTOR COMPONENT

Private Sector Component	Year One	Year Two	Year Three	Year Four	Year Five	LOP TOTAL
(U.S. \$200)						
Technical Assistance Contract:						
Salaries and Allowances						
Long Term Staff						
Chief of Party	\$60	\$180	\$180	\$180	\$120	\$720
Ag. Economist	\$48	\$144	\$144	\$55	\$0	\$432
Agronomist	\$48	\$144	\$144	\$95	\$0	\$432
Support Costs	\$150	\$0	\$0	\$11	\$5	\$166
Short Term Staff						
Various Skills	\$16	\$48	\$64	\$72	\$64	\$264
Local Hire Staff						
Admin. Assistant	\$0	\$10	\$10	\$10	\$10	\$40
Secretary	\$0	\$8	\$8	\$8	\$8	\$32
Agronomist	\$0	\$18	\$18	\$18	\$18	\$72
Ag. Economist	\$0	\$18	\$18	\$18	\$18	\$72
Fieldmen	\$0	\$10	\$40	\$40	\$10	\$100
International Travel	\$7	\$8	\$10	\$11	\$6	\$42
Per Diem	\$8	\$23	\$28	\$28	\$17	\$113
Vehicles						
Pick-up 4X4	\$34	\$0	\$0	\$0	\$0	\$34
Pick-up	\$28	\$0	\$0	\$0	\$0	\$28
Jeep Type	\$15	\$0	\$0	\$0	\$0	\$15
Van	\$15	\$0	\$0	\$0	\$0	\$15
Operating Expenses						
Fuel & Maintenance	\$3	\$15	\$15	\$15	\$7	\$55
Office Rent & Util.	\$4	\$15	\$15	\$15	\$14	\$59
Office Supplies	\$8	\$5	\$5	\$4	\$2	\$24
Office Equipment	\$15	\$5	\$0	\$0	\$0	\$20
Local Travel	\$0	\$4	\$4	\$4	\$4	\$16
Sub-contracts						
R & D-Processing	\$0	\$15	\$25	\$20	\$0	\$60
Field Trials	\$0	\$120	\$130	\$120	\$60	\$430
Marketing/New Crops	\$0	\$15	\$40	\$50	\$20	\$125
Administrative Cost	\$60	\$30	\$30	\$30	\$30	\$240
Evaluation/Audit	0	75	0	25	30	\$130
Sub-total	\$640	\$961	\$936	\$820	\$644	\$3,992
Contingency/Inflation*	\$54	\$148	\$240	\$282	\$180	\$804
Total-Private Sector	\$694	\$1,109	\$1,176	\$1,102	\$824	\$4,800

*Inflation 5% compounded annually
Contingency 10%

ANNEX 12 TABLE 3 UNIT DATA FOR DETAILED PROJECT BUDGET - PRIVATE SECTOR COMPONENT

Technical Assistance Contract	Unit Cost	Total Units	Year One	Year Two	Year Three	Year Four	Year Five
Salaries and Allowances \$ (000)							
Long Term Staff							
Chief of Party	.15	48	4	12	12	12	8
Ag. Economist	.12	36	4	12	12	8	0
Agronomist	.12	36	4	12	12	8	0
Short Term Staff							
Various Skills	.8	33	2	6	8	9	8
Local Hire Staff							
Admin. Assistant	0.35	48	0	12	12	12	12
Secretary	0.7	48	0	12	12	12	12
Agronomist	1.5	48	0	12	12	12	12
Ag. Economist	1.5	48	0	12	12	12	12
Fieldmen	1	100	0	10	40	40	10
International Travel	0.7	60	10	12	14	15	9
Per Diem	0.075	1500	120	300	450	375	225
Vehicles							
Pick-up 4x4	.17	2	2				
Pick-up	.14	2	2				
Jeep Type	.15	1	1				
Van	.15	1	1				

ANNEX 10 TABLE 4 DETAILED PROJECT BUDGET - PUBLIC SECTOR COMPONENT

Public Sector Component	Year One	Year Two	Year Three	Year Four	Year Five	LDP TOTAL
(U.S. \$000)						
Technical Assistance Contract						
Salaries and Allowances						
Long-Term Staff						
Management Spec.	\$0	\$0	\$180	\$180	\$0	\$360
Support Costs	\$0	\$0	\$60	\$6	\$0	\$66
Short-Term Staff						
Management Spec.	\$0	\$48	\$21	\$0	\$24	\$95
Financial Spec.	\$0	\$27	\$9	\$0	\$0	\$36
Personnel Spec.	\$0	\$24	\$16	\$0	\$0	\$40
Project Planning Spec.	\$0	\$16	\$16	\$0	\$0	\$32
Educ. Instit. Cons.	\$0	\$0	\$27	\$9	\$9	\$45
Procurement Spec.	\$0	\$0	\$8	\$0	\$0	\$8
International Travel	\$0	\$5	\$7	\$6	\$1	\$19
Per Diem	\$0	\$27	\$25	\$2	\$7	\$61
Vehicle	\$0	\$15	\$0	\$0	\$0	\$15
Fuel and Maintenance	\$0	\$0	\$5	\$5	\$0	\$10
Office Supplies	\$0	\$4	\$3	\$2	\$0	\$9
Office Equipment	\$0	\$8	\$0	\$0	\$0	\$8
Equipment for MNR						
Office Equipment	\$0	\$0	\$60	\$15	\$0	\$75
Field Equipment	\$0	\$0	\$25	\$15	\$0	\$40
Laboratory Equipment	\$0	\$0	\$50	\$15	\$0	\$65
Diagnostic Equipment	\$0	\$0	\$60	\$10	\$0	\$70
Equipment for BSA						
Training Equipment	\$0	\$0	\$15	\$10	\$0	\$25
Computer Lab Equip.	\$0	\$0	\$50	\$3	\$0	\$53
Sub-contract R & D	\$0	\$65	\$70	\$80	\$85	\$300
Off Shore Training	\$30	\$30	\$30	\$0	\$0	\$90
Project Evaluation	\$0	\$0	\$50	\$0	\$50	\$100
Sub-Total	\$30	\$270	\$790	\$363	\$176	\$1,629
Contingency/Inflation*	\$3	\$42	\$168	\$99	\$53	\$371
Total-Public Sector-A.I.D.	\$33	\$312	\$958	\$462	\$236	\$2,000

*Inflation 5% compounded annually
Contingency 10%

ANNEX 10 TABLE 5 UNIT DATA FOR TECHNICAL ASSISTANCE - PUBLIC SECTOR COMPONENT

	UNIT COST \$ (000)	TOTAL UNITS	Year One	Year Two	Year Three	Year Four	Year Five
Technical Assistance Contract							
Salaries and Allowances							
Long-Term Staff							
Management Spec.	15	24	0	12	12	0	0
Short-Term Staff							
Management Spec.	12	8	0	4	2	0	2
Financial Spec.	9	4	0	3	1	0	0
Personnel Spec.	9	5	0	3	2	0	0
Project Planning Spe	8	4	0	2	2	0	0
Educ. Instit. Cons.	9	5	0	0	3	1	1
Procurement Spec.	8	1	0	0	1	0	0
International Travel	0.7	27	0	7	10	8	2
Per Diem	3.275	310	0	330	330	30	30

ANNEX 10 TABLE 6 G08 DETAILED PROJECT BUDGET - PUBLIC SECTOR COMPONENT

Public Sector Component	Year One	Year Two	Year Three	Year Four	Year Five	L0P TOTAL
(U.S. \$000)						
Technical Assistance Contract						
G08 Funded ESF Local Currency						
Personnel	\$30	\$30	\$30	\$30	\$30	\$150
Operating Expenses						
Fuel and Maintenance	\$20	\$25	\$30	\$30	\$30	\$135
Office Supplies	\$10	\$8	\$8	\$8	\$8	\$42
Local Travel	\$10	\$9	\$9	\$8	\$8	\$44
Installation of Equip.	\$0	\$0	\$70	\$65	\$0	\$135
Land & Facilities	\$10	\$10	\$10	\$10	\$10	\$50
Sub-Total	\$80	\$82	\$157	\$151	\$86	\$656
Contingency/Inflation*	\$8	\$13	\$33	\$41	\$29	\$124
Total-Public Sector G08	\$88	\$95	\$190	\$192	\$115	\$820

*Inflation 5% compounded annually
Contingency 10%

ANNEX 10 TABLE 7 SUMMARY PROJECT COSTS: OUTPUTS BY INPUTS

Project Outputs	Project Outputs					LOP
	Component I			Component II		
	One	Two	Three	One	Two	
Specific Inputs						
Technical Assistance	\$217	\$1,084	\$868	\$75	\$686	\$2,931
Local Staff	\$32	\$159	\$127	\$15	\$135	\$468
Vehicles & Equipment	\$0	\$207	\$111	\$0	\$150	\$468
Operating Expenses	\$10	\$114	\$51	\$13	\$286	\$524
Sub-contracts	\$0	\$429	\$121	\$0	\$302	\$815
Admin-Evaluation/Audit	\$58	\$289	\$231	\$19	\$173	\$770
Contingency & Inflation	\$65	\$423	\$338	\$50	\$447	\$1,343
Total Project Funding	\$401	\$2,706	\$1,914	\$131	\$2,279	\$7,490

Component I Outputs - Private Sector:

- One - Creation of BAFCO
- Two - Production/Marketing of Non-Traditional Exports
- Three - Production/Processing/Marketing of Import Substitutes

Component II Outputs - Public Sector:

- One - Participation in BAFCO
- Two - Development, Implementation of an Action Plan

TABLE 8
METHODS OF IMPLEMENTATION AND FINANCING
(US\$000)

Inputs	Implementation	Financing	Approx Amount
I. <u>AID Grant</u>			
A. <u>BABCO</u>			
Technical Assistance	Contract	Direct Pay	42,169
Local Staff	Contract	Direct Pay	318
Vehicles and Equipment	Contract for Comm.	Direct L/Comm.	82
		Direct Reimbursement	10
Operating Expenses	Non-profit Contract	Direct Reimbursement	178
Sub-contracts	Contract	Direct Pay	615
Admin.-Evaluation/Audit	Contract	Direct Pay	580
Contingency - Inflation	N/A	N/A	848
Total AID Grant - BABCO			<u>\$4,800</u>
II. <u>GOB</u>			
Technical Assistance	Contract	Direct Pay	763
Vehicles and Equipment	Contract for Comm.	Direct L/Comm.	300
		Direct Reimbursement	76
Sub-contracts	Contract	Direct Pay	300
Out-of-country Training	Direct Placement	Direct Pay	90
Evaluation/Audit	Contract	Direct Pay	100
Contingency/Inflation	N/A	N/A	371
Total AID Grant - GOB			<u>\$2,000</u>
II. <u>Host Country Counterpart</u>			
Counterpart GOB			<u>680</u>
Total Project			<u>\$7,480</u>

JUSTIFICATION FOR WAIVERS1. Sole Source Procurement of Vehicles and Spare Parts

BABCO and GOB have requested that the vehicles procured under this Grant be of a specific manufacture, thereby requiring a sole source proprietary procurement waiver. The items in that category are as follows:

Proprietary Procurement

<u>Make</u>	<u>Type</u>	<u>Number</u>	<u>Total Cost (U.S.)</u>
Ford	Pick-up 4x4	2	34,000
Ford	Pick-up	2	28,000
Ford	Jeep type	2	30,000
Ford	Van	<u>1</u>	<u>15,000</u>
	Total	7	107,000

The waiver is justified by the following factors:

a. The GOB has begun to standardize its vehicle fleet around the U.S. manufactured Ford Motor Company line. The Ministry of Works, the Ministry of Natural Resources, and the Ministry of Trade and Industry have, for example, upon retirement of trucks of other manufacturers, purchased Ford equipment as replacements. The GOB has set this policy based on its experience with local costs, availability of parts and service, and their desire to reduce spare parts and specialized tool inventories to a minimum.

b. The local Ford dealer is the only U.S. manufacturers' representative to stock spare parts and provide maintenance and repair service in Belize.

In light of the above factors, the Mission requests a waiver to permit proprietary procurement of Ford vehicles and spare parts.

2. Shipping

There is no ocean freight service to Belize from the U.S. on U.S. registered bottoms or by U.S. shipping firms. While one Miami-based shipping firm maintains a biweekly container schedule to Belize, it is incorporated in Grand Cayman. Further, project procurement will not be made in such a coordinated fashion to make it feasible to hire an entire vessel for a single shipment.

Given these constraints, it will be necessary to grant blanket certification on non-availability of U.S. flag vessels and a waiver to permit payment for shipment on vessels registered in AID Geographic Code 899 countries, subject to reexamination if a U.S. flag vessel becomes available at a later date.

3. Third Country Training and Technical Assistance

A limited amount of training will likely be carried out at the Pan American Agricultural School in Honduras. PAAS's course is geared to climatic conditions found in Belize and it has been used by Belizeans for many years. While Belize is officially English speaking it is, in fact, a bi-lingual country, therefore the Spanish language training at PAAS offers no difficulty. In addition, it is contemplated that some technical assistance will be contracted from the Caribbean Agricultural Research and Development Institute (CARDI). The advantage of using CARDI is its extensive experience in and knowledge of the Caribbean region.

4. AID Financed Participant Travel

Chapter 15 of the AID Handbook 10 requires that the international travel of AID-financed participants be paid by the Host Country, the participant, or other sponsor unless waived by the USAID Director in the case of USAID-funded programs.

Grant funding training is envisaged under the project. USAID/Belize considers that AID funding of international travel costs is justified based on the current foreign exchange difficulties of the GOB. Accordingly, the USAID Director, in approving this Project Paper waives the requirement of Host Country funding of participant travel under the Project. This Project Paper serves as the required notification.

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