Rapid Assessment for Colombia Alternative Development

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Rapid Assessment

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List of Acronyms

CAD	**Colombia Alternative Development**
US	**United States**
USAID	**United States Agency for International Development**
USDA	**United States Department of Agriculture**
CIPAV	**Centro para la Investigacion en Sistemos Sustenibls de Produccion Agropecuria**
CCI	**Corporacion Colombia Internacional**
UMATA	**Unidad Municipal de Asistencia Technico Agropecuria**
PNDA	**Plan de Nacional Desarrollo Alternativo**
CIAT	**Centro Internacional de Agricultura Tropical**
INIBAP	**International Network for the Improvement of Banana and Plantain**
USITC	**United States International Trade Commission**
CMDR	**Consejo Municipal de Desarrollo Rural**
URPA	**Unidad Regional de Planificacion Agropecuria**
IPM	**Integrated Pest Management**
CORPOICA	**Corpocion Colombiana de Investigacion Agropecuaria**
CLAYUCA	**Consorcio Latinoamericano y del Caribe de Apoyo a la Investigacion y Desarrolla de la Yuca**
DANE	**Departmento Admistrativo Nacional de Estadistica**
DIAN	**Direccion de Impuestos y Aduanas Nacional**
TA	**Technical Assistance**
FARC	**Fuerzas Armadas Revolucionarias de Colombia**
EU	**European Union**
IITA	**International Institute of Tropical Agricultural**
HACCP	**Hazardous Analysis of Critical Control Points**
CGIAR	**Consultative Group on International Agricultural Research**

CHAPTER 1 INTRODUCTION

Colombia is a country of vast resources, which are agriculture, petroleum, and minerals. Unfortunately it also has the reputation for an illicit economy, drugs. The region that the rapid assessment is being developed on is Putumayo, Colombia. Putumayo is in the southern portion of Columbia. It is in the Amazon region. In the Putumayo region, over 160 thousand hectares of coca are grown. This comprises approximately 65 percent of the world's cocaine source. Therefore, the Unites States Government through USAID, wants to eradicate coca being grown in the Putumayo region and replace the coca with alternative crops. The scope of the CAD is to determine alternative crops to be grown in Putumayo in place of coca.

The objective of this consultant's investigation in Colombia was to conduct a rapid assessment of the potential for production, consumption, and potential markets of horticultural and tropical flowers/foliage products to be grown by pact signers residing in the Putumayo region of Colombia.

This consultant researched the markets for horticultural and tropical flowers/foliage products on a regional, domestic, and export basis. Tropical flowers were found to have very little ability for export due to the heavy weight of the tropical flowers and the preponderance of tropical flowers that are exported from the Central American countries. The only tropical flowers that were determined to be exportable were orchids. So far as tropical foliage, in the opinion of this consultant, foliage could be a domestic import substitute. As will be illustrated in this report, foliage can be marketed to flower growers in the Bogotá, Columbia region.

In regards to horticultural crops, this consultant determined that there were three markets that could be targeted for horticultural crops. A first market would be a regional market. This would be for vegetable products that are imported from Ecuador and Narino, Colombia. These are mostly vegetables such as bell peppers (pimentones), string beans (habichuela), onions, carrots, cucumbers (pepino comhombro), tomatoes, pumpkins, sweet corn, green onions, and rice. These would all be considered as regional market imports substitutes. These are products that are not being grown in sufficient amounts in the Putumayo region and need to be imported from outside Putumayo to fulfill the consumption requirements of Putumayo residents.

Furthermore, assessed for regional market and consumption was yuca, platano, and corn (maize). These are the major commodities consumed by Putumayo residents, and the

yields that are attained in Putumayo are excessively low compared to the balance of Colombia.

The next market assessed was the domestic import substitution market. In the assessment of this market, it was determined that palmito, tropical foliage, and yuca could be grown, processed, and marketed as import substitutes. The last market that was assessed was the export market. Again, palmito, orchids, and yuca were the products that could be utilized in the export market.

Furthermore, this consultant was to identify the technical assistance that would be required to be utilized in order to assist the pact signers in the Putumayo region to implement the production, harvesting, post harvest, processing, and marketing of the aforementioned products. And lastly, it was the requirements of this consultant to prepare a guide for Chemonics International for a rapid roll out of the recommended activities that will be illustrated and elucidated in this report for the future.

The methodologies that were utilized by consultant were to obtain my information from various sources. One source was to contact private organizations, or NGO. People within NGO's such as CIPAV, CCI, and Chemonics were interviewed and relevant information was given to this consultant. Individuals from governmental organizations were also contacted. The governmental organizations that were contacted were CORPOICO, PROEXPORT, UMATA, and PNDA. Individuals were contacted from international organizations, CIAT and INIBAP.

Further research was done on the Internet. Numerous individuals were contacted through research on the Internet to various organizations such as the University of Hawaii, the USITC, US Department of Commerce, colleagues and friends of this consultant's. Information was gathered for statistical verification. Such as imports and exports by Colombia and the US. Furthermore production and economic information was gathered via this means and utilized in this report.

The method that this report will be written will be in several chapters. The first chapter will be an overview and background of Putumayo and Colombia. The next chapter will be on the constraints that are endemic within the Putumayo region that inhibit the production, harvesting, processing, and marketing of the aforementioned horticultural and tropical flowers/foliage products. The next chapter will be entitled opportunities, which will illustrate the opportunities that are available for the aforementioned products in Putumayo, Colombia, and the export market. The next chapter will cover recommendations and solutions that will need to be instituted in order for the opportunities to be achieved and the rollout of a future program based upon the concepts that are enunciated in this report. The last chapter will be the conclusion and concluding points made by this consultant. The annex will contain some of the pertinent tables and the technical assistance packages for each individual product.

CHAPTER 2 OVERVIEW AND BACKGROUND

The Putumayo region is made up of numerous municipalities. Within these municipalities, there are some fairly large cities. These cities are Mocoa, Puerto Guzman, San Francisco,

Orito, Puerto Asis, San Miguel, Villagarzon, and Cacedo. Most of these cities were founded in the twentieth century, and therefore rather new as cities. San Miguel and Mocoa were founded in the sixteenth century. Mocoa was founded in 1557.

The total population of Putumayo region is 332,434 as measured by the census in 1999. In order to drive from Mocoa, which is in the most northern and western portion of Putumayo, to Bogota, it will take between 16 and 18 hours to travel. The reason for this is the poor roads that are from Mocoa through the Putumayo Department in the travel to Bogotá.

The first area that will be reviewed in this chapter is economics. Overall the Putumayo region is a very poor region. Columbia has a system of categorizing their population in categories one through six. Category one is the poorest category and Category six being the wealthiest category. Two percent of the population of Putumayo is in Category four, five, and six. Ninety-three percent of the population of Putumayo is in Category one and two. The balance of the population, five percent, are in Categories three and four.

The population of Putumayo is basically a rural population. (Refer to Table 1 below.)

Table 1-Urban Rural Populations of Putumayo, Puerto Guzman, and Mocoa

Year	Territory	Total	Urban	Per-centage	Rural	Per-Centage
2000	**Puerto Guzman**	31,479	3,479	11%	28,006	89%
	Mocoa	32,590	18,675	57.3%	13,915	42.7%
	Putumayo	332,434	106,926	32%	225,508	67.9%

Source: DANE

Mocoa, which is the oldest city of Putumayo, is 57.3% urban and 42.7% rural, the majority of the balance of the population in Putumayo is rural rather than urban, 67.9% rural and 32% urban.

The indigenous and ethnic people of Putumayo are many. The main indigenous and ethnic inhabitants of Putumayo are the Inga, Icamentza, Cofunes, Sionius, Huitoteso, Macaguajes, and Correguajes. Most of these indigenous live within the older cities of Putumayo. The immigration that has taken place over the last century has been mostly to the newer cities of the Putumayo region. (Refer to Table 2 Population Growth)

Table 2- Population Growth of Putumayo, Mocoa, and Puerto Guzman

Territory	Inhabitants 1993	Inhabitants 1999	Variation Percentage
Putumayo	204,309	332,434	62.27%
Mocoa	20,736	31,719	52.96%
Puerto Guzman	18,770	30,627	63.16%

Source: DANE

Seventy-five percent of the Putumayo population is involved in agriculture. Commerce is still very small within the Putumayo region. The average income of the Putumayo population is $1200 per year.

The educational system Putumayo is very poor. Education is not equal to that of the balance of Columbia. As is illustrated in Table 3, one can see that the Putumayo inhabitants are not well educated, especially in the rural areas.

Table 3- education Breakdown of Rural and Urban Population

Zone	Without Education	1 & 2	3 & 4	5	6 & 7	8 & 9	10 & 11	12 years & more
Percnetage	%	%	%	%	%	%	%	%
Urban	44	9	8	11	7	6	8	7
Rural	58	11	12	8	5	3	2	1

Source: DANE

The major non-agricultural economy is driven by petroleum which is in Orito and copper, gold, and rubber which are in the Mocoa municipalities. Minerals are believed to be throughout the Putumayo region, but due to the violence and insecurity throughout the Putumayo region, this portion of the economy is not being utilized and realized.

The number one factor of the Putumayo economy is coca. But, the growing of coca in the Putumayo region has caused the economy to be poor and has caused the region to have high inflation. The cause of this inflation in the economy of Putumayo is the violence and insecurity that is paramount in the region. Vendors double if not triple the price of their products in the region in order to cover the costs that are paid by them to the guerillas in order to conduct business throughout Putumayo. Furthermore, unemployment is high throughout the Putumayo region, due to the scarcity of gainful employment.

Mocoa has the most potential to grow a diversity of crops due to the different elevations that are in that municipality. With the various elevations, Mocoa can grow various horticultural crops. Most of the Putumayo region is in the Amazonic region, hot, humid, and with a significant amount of precipitation, and therefore limited to the variety of horticultural crops that can be grown.

Throughout the Putumayo region, the shopping is done at what is called the “Plaza de Mercado”. There are a few stores in the Putumayo region as are illustrated in Table 4, Popayan is a small town like those in Putumayo.

Table 4- Market Breakout for the Large and Rural Towns

	Market Plaza	Small Stores	Supermarkets	Street Vendors	Other Places
Large Cities					
Bogota	31	29	36	4	-
Cali	42	15	38	4	1
Small Towns					
Popayán	90	4	6	-	-
Pasto	79	15	5	-	-

Income Strata	35	7	52	3	3
High	36	30	30	4	-
Middle	56	24	17	3	-
Low					

Source: Corporación Colombia Internacional (CCI)

In the major of Colombia, Bogotá, Cali, Medellin, and Bucaramanga, the trend is to change from "Plaza de Mercado" to stores, supermarkets, and hypermarkets. As illustrated in Table 4, one will notice that there is significant difference between the major cities and the lesser populations such as Popayan, where the "Plaza de Mercados" are still highly utilized. In the Putumayo region, it is very difficult to grow the vegetables aforementioned such as carrots, string beans, bell peppers, onions, etc. This consultant could not determine through an investigation of governmental information the consumption of vegetables throughout Putumayo region. In conversations with various governmental people from the Putumayo region, this consultant determined that vegetables were consumed in Putumayo along with yuca, platano, rice, and corn. It was represented to this consultant that the younger people within the Putumayo region were more likely to eat the vegetables. The vegetables are very expensive since they cannot be grown in the Putumayo region and must be imported from other areas such as Ecuador and Narino within Columbia, therefore consumption is decreased.

One of the main staples of the population of Putumayo is rice. Mr. Ruben Dario Pinzan of the PNDA of Puerto Asis told this consultant, that approximately three-quarters of a kilogram of rice were consumed per day by the average resident of Putumayo. The inhabitants of Putumayo also eat chontuduro and pineapple. Meat and chicken are very important to the population of Putumayo. Although there are many rivers in the Putumayo region, fish is not a mainstay of the dietary habit of Putumayo. Those fish that are eaten are Cachama, Bocochica, and Tilapia.

The soils of Putumayo are very poor. This is attributed to the fact that 80 percent of the Putumayo is in what is considered the hot zone of Columbia. This zone is an area that between 200 and 500 meters in elevation. The temperatures will range between 25 and 30 centigrade. Refer to Table 5 for the zones and the populations of these zones.

Table 5- Illustration of the different zones of Putumayo and populations

Elevataion	Municipalities	% of Population
1000-2500 M	Santiago, Colon, Sibundoy, San Francisco	10.65%
300-1000 M	Puerto Guzman, Mocoa, Vill Amazonica, Puerto Caicedo, Orito, Valle del Guamuez, & San Miguel	61.25%
100-300	Puerto Assis & Puerto Lugizamo	28.1%

Source: CD from CORPOICA

In the middle zone, 300 to 1000 meters, 75% of Putumayo yuca, platano, lulo, feijou, para ciruela, and tomatoes are grown. In the higher elevations, 1000 to 2500 meters, five percent, of the Putumayo region, there is very little that is grown at this elevation. In fact,

the reason for this is that most of the region is very mountainous with slopes of 50% to 70%, where it is very difficult to grow anything.

The soil of the Putumayo region is very low in organic matter, calcium, potash, magnesium, and phosphorous. There is also a high level of aluminum and iron toxicity in the soil. There is poor water penetration into the soil due to the extent of rain that occurs in the Putumayo region. Refer to Tables 5 and 6 that detail the soil and land utilization.

Table 5- Puerto Asis breakdown of soil utilization

Use of Soil	Area (Has)	% of Total
Agriculture	16,500	2.148%
Pastures	35,000	12.192%
Forests	176,500	66.64%
Coca	35,000	14.05%
Others	13,000	4.97%

Source: CD from CORPOICA

Table 6- Utilization of Land of Putumayo

Usage	Percentage
Forest	92.94%
Pastures	3.10%
Agriculture	1.16%
Other Uses	2.67%
Sector Urban	0.13%

Source: CD from CORPOICA

The many rivers that flow throughout the Putumayo region, such as the Putumayo River, the San Pedro River, and the Qichoa River, have formed most of the land. The topography of this area has very little slope to it and therefore the water does not move rapidly and will tend to create new soil due to the fragments and such that are within the river. The land and rivers of the area are becoming environmentally contaminated due to the amount of improper usage of pesticides within the Putumayo region being utilized.

As heretofore mentioned, the weather within the Putumayo area is hot, 24 to 30 degrees Centigrade, humid a high precipitation and windy. Tables 6 & 7 illustrate the typical weather in Putumayo.

Table 6- Weather in cities of Putumayo

Temperatures					Relative Humidity	
CEA MOCOA		PUERTO ASIS			CEA MOCOA	PUERTO ASIS
Max	Min	Max	Med	Min		
27.3	21.7	31	28	25.6	88.1	86.2

Source: Asociacion de Caucheros del Putumayo - ASOCAP

Table 7- Precipitation in cities in Putumayo

	CEA MOCOA	YUNGUILLO MOCOA	VIGARSON	PTO. ASIS	ORITO
December	**326**	**143**	**413**	**155**	**250**
January	**144**	**81**	**255**	**164**	**100**
Total	**4585**	**2807**	**6230**	**4403**	**3604**
Total	**404**	**233**	**519**	**367**	**300**

Source: Asociacion de Caucheros del Putumayo - ASOCAP

The infrastructure within the Putumayo region is poor. Albeit, there are four airports located in the Putumayo region. There are in the cities of Puerto Leguizamo, Puerto Asis, Orito, and Villagarzon. There is commercial utilization in all of these airports.

Road in the city of Yungillo

The paved roads within the Putumayo region are only within the major cities of Putumayo. Approximately 50 percent of these roads are paved within the downtown areas of the cities. Electricity and sewer services throughout the major cities are also quite poor. Within the rural areas of Putumayo there is very little basis services such as running water, electricity, telephones, paved roads, sewers, health services, and schools. Therefore leading to difficulty economic situations in the rural areas.

The average size of farms in the Putumayo is 12.4 hectares. There are 58% of these farms that are approximately 30 hectares, 30% are more than 20 hectares, and 20 % are less than 30 hectares. Seventy-five to eighty percent of the inhabitants that are farming on these farms do not have titles to the land. The areas that are north and south of the Putumayo region in the Andes at higher elevations are areas that have a better climate and soil conditions, and therefore grow more favorable crops with higher yields than in Putumayo.

The local organizations in the Putumayo region are UMATA, CMDR, URPA, and PNDA. These organizations have been established to assist the growth of the Putumayo region by the Colombia government.

The government of Colombia has not established laws that create difficulty for the import of various inputs that are needed for the agricultural industry of Columbia. There is almost unlimited access to inputs throughout Colombia and Putumayo. There are tariffs that are charged, but they are reasonable.

There is a governmental law that does require all non-vegetable seeds to be registered and handled under a registration process that entails a two-year period of registration. All vegetables seeds such as carrots, string beans, tomatoes, and bell peppers, etc. do not have to meet the registration requirements. These seeds can be imported and utilized immediately. So far as machinery, fertilizer, packaging material, and irrigation equipment, they are readily available throughout Columbia.

Multinational companies such as Syngenta have manufacturing facilities in Colombia and manufacture a replete supply of various pesticides. The active ingredients are not manufactured in Columbia, but imported and added to the balance of the material that is utilized.

Equipment such as tractors and irrigation equipment are readily available in Colombia. Irrigation equipment is either manufactured in Colombia or imported. There are a good number of distributors in the Putumayo area with various inputs and other supplies. But the costs of inputs and equipment are double if not more than that of the costs of the same products in Bogotá. The reason for this increase cost as heretofore mentioned, is the insecurity and violence within the Putumayo region. Import taxes on imported products range from five to sixteen percent, which for the most part is quite reasonable.

Seedlings are readily available in the Bogotá area. One company that this consultant visited, Almacigos had two and one-half hectares under roof of transplant material. The methodologies and equipment that were utilized by Almacigos are transferred from the US, California mostly. The seed is purchased from international companies.

Packaging material is readily available throughout Colombia. There are numerous large firms in the Bogotá area. One company that this consultant visited, Flexo-Spring, manufactures numerous different types of harvesting and packaging materials. They manufacture products that are used by many of the multinational companies that are located in Colombia, such as Nestle, Coca-Cola, Gatoraid, and Parmalait. Flexo-Spring manufactures polyethylene bags, plastic cartons, aluminum foil packages and more. International Paper has a plant in Chili that manufactures fiberboard that is readily available in Colombia, although the fibreboard in Colombia is excellent. There are over 20 companies in Colombia that are printing various types of packaging materials.

The rural city markets have dietary habits and trends, which are similar to those aforementioned in Putumayo. These area's populations for the most part, eat more vegetables than the inhabitants of Putumayo. There are some large supermarkets in some of the smaller rural city markets. The variety of fruits and vegetables are also more prevalent in these rural city markets than in Putumayo.

The major cities have much more of a variety of fruits and vegetables than the markets of the rural city. There are more processed food products in the major city markets. There is approximately two percent of the food that is purchased in the major cities that is frozen. This is compared to the United States and European markets that have over 30 percent of their food that is frozen.

CHAPTER THREE CONSTRAINTS

As the reader as probably already realized, there are numerous constraints that inhabit the Putumayo region from having an active and productive economy.

Weather

As illustrated below in Tables 8 & 9, the high temperatures, high relative humidity, and high precipitation cause the Putumayo region to have significant deficits as compared to other areas within Colombia. Due to the extent of the extensive rains, the hour of sunlight is low. The average amount of sunlight per month is 115 hours. This limits the type of crops that can be grown feasibly and economically.

Table 8- Weather in cities of Putumayo

Temperatures					**Relative Humidity**	
CEA MOCOA		**PUERTO ASIS**			**CEA MOCOA**	**PUERTO ASIS**
Max	**Min**	**Max**	**Med**	**Min**		
27.3	21.7	31	28	25.6	88.1	86.2

Source: Asociacion de Caucheros del Putumayo - ASOCAP

Table 9- Precipitation in cities in Putumayo

	CEA MOCOA	**YUNGUILLO MOCOA**	**VIGARSON**	**PTO. ASIS**	**ORITO**
December	326	143	413	155	250
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Total	4585	2807	6230	4403	3604
Total	404	233	519	367	300

Source: Asociacion de Caucheros del Putumayo - ASOCAP

Infrastructure

Roads, energy, communications, schools, sewage, and health care are poor in the cities or urban areas of the Putumayo region and almost non-existent in the rural areas of Putumayo. The urban areas of Putumayo have approximately 60 percent of the houses served with electricity. Some houses have telephones and only 50 percent of the roads are paved within the city areas. Running water services only 40 percent of the municipal homes within the major cities of Putumayo. In the major cities there is a paucity of sewer systems for the most part only in center of the major cities.

Puerto Asis is 895 kilometers from Bogotá. To travel from Puerto Asis to Bogotá it would take one 22-hours by vehicle to arrive at Bogotá.

Transportation of products after harvest causes a negative impact on agricultural growth. Due to the poorness of the roads, timing and roughness of the roads causes severe damage to the products that transported across the road and are not able to transport on roads. There is little contact with the rural areas by the urban areas due to poor roads.

The educational system within the Putumayo region is poor. In the rural areas as Table 10 illustrates, education levels of the rural areas are quite low.

Table 10- education Breakdown of Rural and Urban Population

Zone	Without Education	1 & 2	3 & 4	5	6 & 7	8 & 9	10 & 11	12 years & more
Percnetage	%	%	%	%	%	%	%	%
Urban	44	9	8	11	7	6	8	7
Rural	58	11	12	8	5	3	2	1

Source: DANE

Housing and Roads in Mocoa

Source: CD from CORPOICA

Marketing

Agricultural producers in the Putumayo region lack the knowledge and access to information enabling them to make informed short run decisions on production and markets to target. There is little strategic planning for long run investment, export, and new product development in the Putumayo region. Due to the poor infrastructure, weather, and soil, very little agricultural products are marketed outside of the Putumayo region. In fact, there is very little inter-regional agricultural marketing accomplished within the Putumayo region.

Soil

The soil of the Putumayo region is very acidic, 4.5 or more and low in Ph, 3 to 3.5. The soil contains a high level of toxicity of aluminum and iron, due to the extensive precipitation and

lack of soil drainage throughout the lower elevation areas of Putumayo. The soil has low drainage factors, therefore not allowing rain to penetrate the soil. The soil is also low in major elements such as phosphorous and potash.

The soil is low in organic matter. The soil is also highly compacted due to the extensive precipitation of the Putumayo region. Ninety percent or more of the soils are of this nature in the lower plain areas of the Putumayo region.

The poor soil, weather, and infrastructure have cause food shortages and food insecurity throughout the Putumayo region. The inhabitants of Putumayo region, therefore rely on coca to enable them to generate income to import from other areas the necessary food items.

Competitiveness

The agricultural producers of the Putumayo region are inefficient in their agricultural production and production transformation method that result in high costs and low quality of their products. These products are not competitive in either local markets, domestic markets, or export markets.

There is packaging material that is available, but it is not utilized for the most part by the producers in the Putumayo region. Approximately 50 percent of all products that are harvested are destroyed prior to reaching market levels. There is very little cold chain of harvested and processed product in the Putumayo region.

The production costs of Putumayo region are equal or in most cases higher than the production costs of other regions of Colombia. Due to the poor yields in the Putumayo regions, the per unit costs of production for agricultural products from Putumayo are significantly higher on products produced in Putumayo. The reasons for this are that input costs are higher, and fewer inputs therefore are utilized throughout Putumayo. This is illustrated in Table 11 below. As an example, a significant amount of rice is imported to Putumayo from other regions in Colombia. The rice growers in the Putumayo region are not able to compete on a price basis with those other regions of Columbia. Furthermore, few vegetables are grown in the Putumayo region, consequently most are imported either from Ecuador or other regions near Putumayo in Colombia.

Table 11- Growing cost of corn in Putumayo

Description	Cost
Direct Costs	$425,000
Indirect Costs	$103,000
Total Costs	$528,000

Source: PNDA

Table 12- Growing costs for corn in Sur de Bolivar

Description	Cost
Direct Costs	$387,000
Indirect Costs	$144,000
Total Costs	$531,000

Source: Dr. Pablo Agusto Lamprea

Table 13- Comparative Yields Metric Tons Per Hectare

	Areas		
Product	**Putumayo**	**Narino**	**Tolima**
Platano	4.5	8	8
Yuca	5.5-7.5	10-15	15
Maiz	0.8	3	3
Arroz	2.25	5	6

Source: Dr. Pablo Agusto Lamprea and CIAT

The technical knowledge of the agricultural producers in Putumayo is quite poor. They lack the technical knowledge of correct soil tillage and the ability to add soil amendments to the soil to improve the quality of the soil. There is little technical knowledge of weed, pest, and disease identification, management, application.

With the hot weather and high relative humidity throughout the Putumayo region, post harvest handling of products present a significant problem. As aforementioned in this report, there is a lack of cold storage and, therefore, very little presence of the cold chain for those products that need it. Furthermore, there is a lack of technical knowledge of how to handle the cold chain or the post harvest of products, for the Putumayo agricultural producers.

The various methods that are needed for the processing of agricultural products produced in the Putumayo are not done correctly due to the lack of technical knowledge. Furthermore, there is a lack of credit to build facilities that are needed in order to correctly process agricultural products. The technological type of equipment that is needed for the processing of agricultural products for all intents and purposes does not exist in the Putumayo region.

Therefore, the overall agricultural economy of Putumayo is very rudimentary, and significantly higher in cost than that within the more modernized and technologically advanced regions in the Andes of Putumayo such as Medellin, Bogota, and Cali.

Guerillas

One of the major constraints in the Putumayo region is guerillas. These are armed individuals that are throughout the Putumayo region. The major guerilla force in Putumayo is the FARC. Land was deeded to this guerilla group from the Colombian government that is located very near the Putumayo region. Therefore, they have easy access to the Putumayo region. Due to the integration of these guerillas throughout the Putumayo region, as heretofore mentioned there is significant violence and a high degree of insecurity throughout the Putumayo region, therefore causing inflation of inputs and other products into the Putumayo region in fear of various international organizations from assisting agricultural producers in the Putumayo region.

CHAPTER 4 OPPORTUNITIES—Create Licit Economy in Putumayo

It is paramount not only for this project, but other projects to develop licit economies in the Putumayo region. The objective is to make success permanent over time by creating a substantial licit economy with an improved environment for participating communities and producers.

Tropical Flowers/Foliage

This will be delineated below, imbue an opportunity for the Putumayo region to increase employment, income, and therefore food security. Presently, as can be noted in the Table 14 below, Colombia is importing in excess of $73 million dollars of tropical foliage. The reason for this as can be noted in Table 15, Colombia has developed significantly large export business in flowers and now in bouquets of flowers that are exported to the US. In order to meet this new demand, Colombia flower producers are importing tropical foliage from the Central American countries. 97% of all flowers exported from Colombia are destined for the US markets.

Table 14- Imported foliage to Colombia

Year	**1997**	**1998**	**1999**	**Increase**
Amount	$59,146,000	$66,424,000	$73,891,000	25%

Source: PROEXPORT

Table 15- Bouquet making for export to the US

Year	**1995**	**1996**	**1997**	**1998**	**1999**	**2000**	**2001**
Percentage of Flowers Exported	2%	10%	15%	18%	22%	28%	35-40%

Source: Various shippers in Bogota

The major product that is used for tropical foliage in bouquets is Leatherleaf. Approximately 75% of the tropical foliage that is utilized in flower bouquets is Leatherleaf. The price that is paid by bouquets makers is approximately $.08 per large stem and $.03 for medium stems in the Colombia market.

The second most utilized tropical foliage for bouquets is Treefern. The sales price for Treefern is $.08 for large stems and $.03 for medium stems. As can be noted in Table 16, there are other types of tropical foliages that are also utilized for the balance of the 20% of tropical foliage utilized in bouquets.

Table 16: Foliages that are utilized by bouquet makers

Names	Eucalyptus-baby blue and spiral, palm, areca, chamaerodrea, lilaceae (family of asparagus fern), cinnera, dracenas, cinnerea, rhaeis, gunny, variegated lauhala, papyrus-fern, bamboo, and ruscus

Source: Dr. Alberto Roldan

All of these types of tropical foliages can be grown and packaged for shipment to Bogotá flower producers in the Putumayo region. There are a few companies in Colombia at this present time that are producing foliage, but in conversations that this consultant had with the flower producers in the Bogota region, they were very amenable to purchasing quality tropical foliage from producers in the Putumayo region if that could be accomplished. The production, processing, and packaging of tropical foliage in the Putumayo region would be an excellent opportunity for domestic import substitution. Furthermore, as noted in Table 17, there is an opportunity for export into the United States market. In excess of 27 million dollars of tropical foliage is imported by the bouquet makers in the United States, most located in the Miami, Florida area.

Table 17: Imports of foliage to the US

Year	**1996**	**1997**	**1998**	**1999**	**2000**	**2001 Projected**
Amount	6,039,997	7,998,295	10,870,321	13,301,596	17,886,516	22,456,322

Source: USITC

The market for flowers to the US from Colombia has grown 41% from 1998 through 2001. With this type of growth, there is a built in market growth for foliage, and if the Bogota produces continue to increase the bouquet making, as most think that they will, this is an excellent opportunity for growth for Putumayo. All of the foliages that are represented Table 16 can be grown in Putumayo according to Dr. Roldan. Table 19 illustrates the growth of exported flowers by Colombia.

Table 19: Flower export growth of Colombia

Year	**1998**	**1999**	**2000**	**2001**
Amount	$170,116,514	$185,938,534	$213,649,902	Projected $244,601,114

Source: PROEXPORT

Orchids also avail another opportunity for the Putumayo region. It can be noted in Table 20, that an excess of $22 million dollars in orchids are imported by the US. This is an increase of 264% in the last six years. Again, a growing market to target.

Table 20: Imports of orchids to the US

Year	**1996**	**1997**	**1998**	**1999**	**2000**	**2001 Projected**	**% Increase**
Amount	$6,039,997	$7,998,295	$10,870,321	$13,301,596	$17,886,516	$22,000,000	+264%

Source: USITC

Of the global flower market, orchid only comprise only one percent of that market. The global orchid market is in excess of $160 million dollars per year. The most important orchid that is utilized is the Cattleya. The major orchid that is imported by the US is Dendrobiun. Most of these orchids are imported through Miami from Thailand.

The major orchid supplier internationally is Thailand. Thailand has approximately 95% of the US market. Colombia has very inexpensive air rates to Miami and several other cities in the US, therefore giving it the freight advantage over Thailand. The major importers of orchids in the EU are Italy and Germany. It is the recommendation of this consultant for the

CAD project to subscribe to EUROSTATS. This is information on the EU and would enable the project to have relevant and current information on the imported items to the EU.

With the development of an economically feasible tropical flower/foliage production in the Putumayo region, a significant amount of income would be derived in the Putumayo region. Therefore increasing the overall economy of the Putumayo inhabitants.

Horticultural Crops

The inhabitants of the Putumayo region lack the technical skills on how to farm the soil and farm much by the indigenous ancestral methods that have been utilized for many years in the Putumayo region. Improved soil structure and balances would enable the producers from the Putumayo region to improve their overall product production. As in discussions with Dr. Edgar Amezqita of CIAT, many of the problems aforementioned in soils in this report can be alleviated through proper management and tillage of soils in the Putumayo region.

This would improve the yield on such commodities such as rice, platano, maize, and yuca. Therefore, alleviating the need to import rice and other products from Ecuador or other regions within Columbia.

Yuca (Manihot Esculenta) finds is origins in the Putumayo region. The temperature that yuca best grows is 25 to 29 degrees centigrade. Yuca will grow at areas from see level to 2000 meters. Yuca can also grow in heavy precipitation.

Colombia imports approximately two billion dollars of animal feed. This is constituted of soybean, corn, wheat, and other animal feed products. In discussions with individuals from CIAT, yuca is being produced as a supplement for animal feed in Africa and Southeast Asia. Although the protein level of yuca is low, the carbohydrate level of yuca is very high.

CLAYUCA, a unit of CIAT, has in conjunction with Proton International has developed a facility and machinery that will produce yuca flower that can be utilized as a supplement for animal feed. This would comprise approximately 20 percent of the animal feed that is utilized by feeding operations throughout Columbia. Therefore, if one took 20 percent of the 2 billion dollar import market, that would equivalent to $400 million opportunity market for the production of animal feed from yuca. As can be noted in Table 21 below, the cost of production is fairly inexpensive therefore allowing importers and/or processors of animal feed in Columbia to purchase this product as a supplement of that which is being imported from other countries.

Table 21: Cost of production, producer payment, and net return of yuca for animal feed

Description	Cost USD$
Payment of roots to the producer	$84.74
Total cost of yucca flour per ton	$104.99
Selling price	$120.00
Profit per ton	$15.01

Source: CLAYUCA of CIAT

In order to modernize the yuca operations within the Putumayo area, CLAYUCA has also developed methodologies for planting and harvesting that are mechanical and reduce overall costs and product damage for yuca. (Please refer to annex.) Such equipment could be utilized on larger operations.

CIAT has in excess of six thousand cultivars in their germ plasm banks in Cali, Colombia of yuca. CIAT through their breeding programs with this germ plasm can alter the carbohydrates and/or nutritional levels of the yuca and specifically design germ plasm for the Putumayo region.

Another form of import substitute is glucose. Colombia is importing in excess of $107 million dollars of glucose on an annual basis. Again this would be import market substitution opportunity. In discussions with Bernardo Ospina and Dr. Hernan Ceballos, glucose can be extracted from yuca. The type of yuca that would be grown for the glucose processing, including aforementioned one of animal feed, would be high in cyanide. This type of yuca would not be utilized for human consumption, only for processing. As can be noted in Table 22, the cost of operation and return to the producer is excellent for glucose production. There are glucose facilities in operation in Thailand and other Asian countries.

Table 22- Cost of production for glucose from yuca

Function of Cost	Cost per Ton
Depreciation	$40.00
Labor, Electricity, and Other Processing Costs	$60.00
Raw Material	$125.00
Total Costs	$225.00
Net Profit	$275.00
Market Price	$500.00

Source: Bernardo Ospina of CIAT

The world market for glucose is approximately $300 to $400 dollars per ton. With import tariffs that are placed on imported glucose by the Colombia government, the imported price of glucose in Colombia is thought to be $700 per ton. As can be noted in Table 22 using this as an import price, glucose produced in Putumayo could be profitable for operations in the Putumayo region.

Another opportunity is manufactured yuca chips for the snack food market in the United States. Although this consultant concerning this, in discussions with Dr. Hernan, could locate little information yuca can be manufactured to produce a yuca chip that is similar to a potato chip. This would be a niche market in the US.

Platano, corn, and rice can have increased yields through the Putumayo region. By utilizing improved soil management and tillage techniques, correct for newly developed cultivars, and correct harvesting and processing, yields could be increased significantly throughout the Putumayo region. By increasing yields and more efficiently producing the processed produce, the cost of final product would be significantly less.

Horticultural vegetables could be grown in greenhouses throughout the Putumayo region. One of the difficulties in growing vegetables in the open air such, as string beans, bell peppers, carrots, onions, etc., is that with the high precipitation, temperatures, and relative humidity, these types of vegetables cannot be grown without severe damage or loss. And

yet, greenhouses are utilized in around the Bogota area not only grow flowers, but also to grow various types of vegetables. The science of growing numerous vegetables in a greenhouse environment is one that has been advanced significantly over the last years internationally. Many areas that have similar weather conditions to Putumayo region are utilizing different forms of greenhouses in order to grow vegetable products.

By the utilization of greenhouses to grow vegetables throughout the year, would alleviate the need for importing vegetables from other areas and enhance food security throughout the Putumayo region.

Palmito grows excellently in the type of weather in the plains of the Putumayo region. As can be seen in Table 23 below, Palmito is a product that is imported in excess of $6 million worth Palmitos are imported into Colombia in the year 1998. Presently, Colombia is only exporting approximately $385 thousand dollars worth of Palmitos to the world. The United States and the EU are markets that could be targeted for exports, refer to Tables 24 & 25.

Table 23- Imports by Colombia of glucose

Year	**1997**	**1998**
Amount	$6,182,000	$6,646,000

Source: PROEXPORT

Table 24- Imports to the US of Hearts of Palm

Year	**1998**	**1999**	**2000**	**2001-Projected**
Amount	$8,298,304	$9,230,225	$9,104,108	$10,013,023

Source:USITC

Table 25- Imported by EU Countries Hearts of Palm

Country	**1989**	**1990**	**1991**	**1992**
Spain	$829,000	$1,021,000	$1,591,000	$1,000,000
France	$8,271,00	$9,092,000	$8,850,000	$9,080,000
Belgium	$307,000	$294,000	$217,000	$262,000
Italy	$322,000	$358,000	$412,000	$221,000

Source: J.A. Austin Associates “Palmitos”

The EU is a significant importer of palmitos. The largest country for this importation of palmitos is France followed by Spain. Eastern Europe also imports a significant amount palmitos, refer to Table 25. These opportunities avail the Putymayo region the possibility of attaining the objectives that were listed in the beginning of this report. Deductive of replacing coca with licit commodities such as palmitos, yuca, vegetables, and increased yields on rice, platano, and corn. By being able to achieve these opportunities, the Putuymayo region will increase its economy and decrease food insecurity for the region. Employment would be increased and technology would be increased.

CHAPTER 5—SOLUTIONS AND RECOMMENDATIONS

In this chapter, this consultant concerning the opportunities that have been previously listed will make solutions and recommendations. One of the major concepts that will be enunciated in this chapter will be the utilization of “Consolidator”. The consolidator concept is an opportunity for entrepreneurial individuals to utilize their agricultural and business knowledge in the development of a consolidator function or role in the Putumayo region. An entrepreneur could establish arrangements with producers in certain areas to grow various horticultural products, foliage, and/or orchids for him/her.

The consolidator would provide technical assistance to the various producers that are aligned with the consolidator. The producer would possibly also receive seed and/or seedlings plus other inputs from the consolidator. By purchasing inputs and seed or seedlings in larger quantities, this would enable the consolidator to achieve reduced prices and be able to pass them on to the producers. The consolidator would define the planting schedules of the products that are to be grown and therefore be able to organize supply of the harvested product for processing and the market.

The consolidator also would have control and management over the harvesting of the products. The consolidator could also lease land to provide some of his/her own production to combine with that of small producers throughout the area. This would act as a model to further decrease costs of production and improve quality. The consolidator would provide market information in the production, processing, and marketing chain to the producers of the products.

One of the major issues explained to this consultant by flower producers in the Bogota area was the need for quality foliage to make their bouquets with and for export to the US. The buyers of horticultural products stated that the Putumayo region was noted for poor quality, therefore they were skeptical to purchase product. The consolidation of products by the consolidator on a firm schedule of planting and harvesting dates, many of these problems of quality would be eliminated. The consolidator would understand the need for quality and reliable delivery to the customer. The buyers of foliage and/or orchids, and other horticultural products from Putumayo, would have more assurance of quality. The buyer would also have fewer individuals to contact and discuss problems with in order to reach resolutions. If there were many producers supplying buyers, then this would be a multitude of individuals that the buyer would need to contact.

Certain conditions would require the entrepreneur to construct storage, grading, and packing facilities; however this would require acquisition of technical knowledge in order to operate the cold storage, rating, storage, and post harvest handling.

With the consolidator concept, the consolidator would specialize in specific kinds of product and establish facilities throughout the Putumayo region. This would enable the consolidator to collect, harvest, process, transport, and market products throughout the season. As an example, various farms could be established of foliage growers throughout the Puerto Asis area. The consolidator could organize the marketing of these various producers by staggering the harvesting and planting dates for the peaks and valleys of supply. In addition, the consolidator might also need to construct a facility to grade and pack the foliage from the producers and more it efficiently to the market. If the consolidator wants to stay in business, he will supply buyers with consistent products on a timely basis that they desire.

Over time, the consolidator would develop a detailed understanding of markets, prices, and competition. The consolidator would improve his/her ability to forecast future markets demands with respect to products, timing, and price.

The widespread introduction of the consolidation role or function would lead to higher quality, lower costs of agricultural production over time, and reaching market when and where the market requires.

It is important to note that the importance of the consolidator is not the physical assets or the facilities that he/she might provide. In principle, consolidators might function with no fixed location or facility. In this human dimension of understanding the costs, quality, the market, recognizing the signals the market sends, and organizing production to respond to the market, the consolidator would improve the profits of the producers. This is how orderly markets function.

In similar fashion, the consolidator does not have to be an individual entrepreneur. Groups of producers might organize themselves to consolidate their own products. The most important perquisite is for the consolidator whether group of producers or an individual, is to invest the time to understand and respond to the needs of the market and the customer and supply the producers with technical assistance when and where needed. These needs may change constantly and the consolidator has to work constantly to keep up with the needs of the customers, the market, and the producers.

Tropical Flowers/Foliage

Tropical flowers such as Helaconia and Birds of Paradise are not recommend by this consultant to be produced in the Putumayo region. The Central American countries produce these types of tropical flowers and have saturated the US market. Therefore, the Putumayo region would not be able to be competitive with these countries from the Central American area.

Orchids are a unique tropical flowers that are grown almost anywhere in the world. Although the word tropical goes in front of orchid, orchids can be grown in places such as the United States and Europe where the weather is more temperate. As heretofore mentioned, the world market for the importation of orchids is approximately a $160 million market. The market in the United States is approximately $22 million of imports. Therefore, enabling countries like Colombia to partake is such international markets. The US market has grown by 264 per cent in the since 1996, see table 26 below. The US market requires investigation and research done on growing the type of orchids that are being imported to the US.

Table 26- US imports of orchids

Year	1996	1997	1998	1999	2000	2001 Projected	% Increase
Amount	$6,039,997	$7,998,295	$10,870,321	$13,301,596	$17,886,516	$22,000,000	+264%

Source: USITC

The type of orchids that are being imported to the US and Japan are the type that need to be grown in tropical type weather. These types of varieties like high humidity, not less than 50 percent and temperatures that are not less than 20 degrees centigrade. The various varieties that are grown in this type of environment are listed in Table 27. All of these varieties can be grown in the Putumayo region. The major ones are Dendrobiums, Oncidiums, Cymbidiums, Dendrochilum. There are many of different species of these cultivars that can be bred. Sourcing unique cultivars or acquiring access to already popular commercial cultivars is a matter of the project scope and the marketing strategy of the project for the intended producers.

Table 27: Sample of varieties of Orchids that can grow in Putumayo

Varieties	Aeranthes citrata v rhodostica; Angraecum distichum; Angraecum eburneum; Angraecum eburneum superbum; Angraecum eichlerianum; Angraecum eichlerianum; Angraecum leonis; Cochleanthes discolor; Cymbidium Pinkade; Degarmoara Winter Wonderland 'White Fairy'; Dendrobium Anna Bibus; Dendrochilum cornutum; Dialaelia Fair Jewel; Encyclia alata; Epidendrum calanthum; Herschelia lugens; Lycaste fulvescens; Masdevallia angulata 'Bloodstone'; Maxillaria rufescens; Miltonidium Pupukea Sunset; Morkaras; Odontoglossum rossii; Oncidium barbatum; Pescatorea lehmanii; Phal hieroglyphica; Pleurothallis tribuloides; Sigmatostalix radicans; Sophronitella violacea; Thunia marshalliana

Source: University of Hawaii, Hector Valenzuela, Ph.D., Mr. Zeb Jones of Honolul, Hawaii, and Dr. Enrique Murguetio of CIPAV

Foliage has the same opportunity as orchids to be produced in the Putumayo area. The aforementioned foliage, Leatherleaf, and Treefern, both can be grown in the type of weather environment that is in the Putumayo region. These foliage and the others that have been listed, like weather with high humidity. One important factor is that soil must be loose and well drained. The foliage must be covered by mesh for protection from the sun, for they are sensitive to direct sunlight.

The foliage during the growth cycle, must be kept moist through a misting irrigation system. Furthermore, these types of foliage like high temperatures.

Soil testing should be performed by local organizations such as UMATA in order to determine that the soil which is closest to the needs of the foliage. Soil preparation and soil amendments should be added in order to increase the soil nutritional level and to reduce the acid, aluminum, and iron toxicities in order to grow the foliage. Also, the Ph will have to be increased along with phosphorous, potash, and other micronutrient elements in order to achieve the levels that are suitable for growing these foliages.

Leatherleaf from time of planting until time of harvest will take approximately one and one-half years to mature. Treefern and the other types of foliages will take approximately one-year to mature. Please refer to Table 16 for the different foliages**.** The rollout section of this report, testing requirements will be elucidated concerning these different foliages.

The harvesting and post harvest handling of foliages is very important. Due to the high humidity and high temperatures, product degradation will occur quire rapidly if not handled well. Approximately one and one-half stems per month per hectare can be harvested from the Leatherleaf plant. There are approximately 50 thousand plants planted per hectare to

be harvested. Treefern has approximately the same number of plants per hectare, and they also harvest about one and one-half stems per month. Each plant will harvest approximately every 21-days.

The main factor on harvesting is to minimize product degradation after being harvested. This can be achieved by utilizing cold water at the field and once the product is harvest putting it into cold water. The water temperature should be between six and eight degrees centigrade. Once placed in this cold water, the foliage will then remain fresh and crisp. The product would then have to be transported to the consolidator who would size and package it for transportation to the market. Please refer to annex for various sizes of Treefern and Leatherleaf, Table I. Once the product has been delivered to the production facility, the consolidator is responsible for packaging and sizing of the foliage.

Furthermore the responsibility of the consolidator would be to provide the producers with the necessary information to grow the foliage, such as planting dates, varieties, fertilizer, irrigation management, insect control, leaf disease control, and weed control. The consolidator would have direct control over time of harvesting and quality of harvesting to be performed with the foliage at the farm site level. This would enable the product to be improved with quality to be shipped to the market. More than not, the producers want to package everything, and therefore have degradation of quality unacceptable at the market level.

Therefore, the consolidator would need to have a good quality assurance program. intertwined within the quality assurance plan, would be an excellent production plan, that would project sales as per product that is being grown.

The facility that will process the foliage will require a cold storage room. This cold storage room will have to be able to hold internal temperatures of six to eight degrees centigrade with ambient temperatures from 25 to 30 degrees centigrade. It is the recommendation of this consultant that such facilities be built in cities that are near the airports in order to transfer product via air to Bogota expeditiously and inexpensively.

Furthermore the consolidator will need refrigerated trucks in order to move the product from the facility to the airport for loading on transportation to the market. Within the facility there will be a need for either tables or belts in order to perform the sizing and packaging of the foliage into cartons. Cartons would be utilized that are very similar to the cartons that are utilized by the flower industry and packaged product that is exported to the US. These are 1 meter in length, 60 cm by 20 cm. There are approximately 800 Leatherleaf per package and 600 Treeferns per package.

The important quality standards of Leatherleaf are color to be dark green, no disease or damage, width of leaves, length, and no bug damage. The important quality standards of Treefern are thickness of stem, small foliage, dark green, and no thrip damage.

In addition to cold storage facilities, the facility will need to have ice-making capacity and storage. The ice will be utilized to put in water to transport to growers for cold water for harvesting of products. It will be the responsibility of the consolidator to distribute this ice to the various producers in order to have them harvest their product and minimize product degradation.

The target markets for orchids would be the US through Miami. There is also a possibility of the EU market, due to the fact that they import 3,185 tons of orchids per year. The largest markets in Europe are Italy and Germany. Japan is also a large importer of orchids, but Asian countries such as Thailand, Singapore, Malaysia, and India supply the EU. It is the opinion of this consultant that Putumayo would not be competitive in the Japanese market due to the proximity of the Asian countries to the Japanese market.

The strategy would be to establish linkages with various flower exporters in the Bogota area to allow them to be the marketing agent for handling and exportation of orchids to the US. These companies already have direct contact with the various flower importers in the US and this would alleviate the need to develop new markets in the US.

Concerning foliage, import substitution would be the main objective of this marketing. With imports increasing of foliage, 25% the last two years, and the significant increase in bouquet making in Bogota, there is a built-in market of opportunity for producers of foliage in the Putumayo region. A producer in Putumayo could gain 20 percent of the present market. That would be in excess of $14 million per year. Since the trend of bouquet making is increasing in Bogota, therefore there is a growth trend that producers of foliage from Putumayo would be able to penetrate and be price competitive without having to discount the price domestically. Quality would be the key to the success of the project.

The target markets would be rose and carnation growers in the Bogota area that are exporting bouquets to the US. Not all exporters of flowers in the Bogota region are producing bouquets for the US market. Therefore, target customers need to be those growers that are large in bouquet making or have increased over the last several years in bouquet making in the Bogota region.

The best method of transportation from the Putumayo region is airplane to Bogota. Although that may be more expensive, air travel would be much simpler and time of travel would be significantly reduced. The margin of profit of foliage and orchids are such that there is enough room for the producer to utilize air instead of road transportation.

The projected costs of growing Leatherleaf would be approximately three cents per stem for producing, harvesting, and packaging. For Treefern, Italian Ruscus, Eucalyptus, and others, it is one and one-half cents to two cents per stem for producing, harvesting, and packaging. The cost for an irrigation system for one hectare is approximately $15,000, this would include the mist sprinklers and the micro system of sprinklers that are needed plus the pumps that are necessary. The meshing and the stands for the meshing would be approximately $2,000 for the one hectare.

Approximately 20 to 25 percent of that product that is harvested will be not utilized and discarded as culls. Sixty percent will be utilized for medium and forty percent for large of the harvested foliage. The technical assistance that will be needed for the production for foliage and orchids will be listed in the annex and can be referred to there. The technical assistance will be developed in pre-production of foliage and orchids. In other words, technical assistance that is needed to be provided to producers and consolidators attention prior to the production of foliage and orchids. There is also post project implementation of the production of foliage and orchids technical assistance delineated. As heretofore stated, a roll out of how to accomplish this will be part of the later portion of this chapter.

Associations that will need to be involved in the production of foliage and orchids will be CIPAV and ASOCOLFLORES and Dr. Alberto Roldan.

Horticultural Products

The first area of horticultural crops to be recommended will be vegetables. The testing requirements for the vegetables will be in the roll out phase of this report. Vegetable seeds can be purchased from Syngenta, Tropical Seeds, and Sun Seeds. It is also recommended by this consultant to have various products that would be grown in the aforementioned greenhouses to be seedlings. These seedlings can be grown by Almacigos and provided to the project for the test plots. The seedlings would be for cultivars such as tomatoes, onions, pumpkins, bell peppers, and cucumbers. Those that would be direct seeded, in other words seeds purchased and directly planted in aforementioned greenhouses would be carrots, green onions, sweet corn, and string beans. The various cultivars that would be utilized in testing are listed in the annex in Table II.

The types of greenhouses that would need to be constructed can be either wooden staked and cross-membered or steel staked and cross-membered built. The cost of these two types of greenhouses will be enunciated further in this portion of the report. Once the decision is made on what type of greenhouse to construct, the greenhouse that is constructed will have to have a high height in order to better control heat and humidity. The greenhouse will have moving sides in order to open and close to control heat and humidity within the greenhouse. The producer must receive technical training on how to control both the heat and humidity within the greenhouse.

Soil preparation will be very important for the producer to understand. The producer must eliminate soil compaction in order to allow excellent root growth. The soil composition nutritionally will also be very important. Technical assistance will be need to be given to the producer in order to achieve the nutritional and ingredient levels of the soil for the products that are to be produced. This would include amending the soil with compost to build up the organic matter, adding lime to reduce the acidity of the soil, and adding various micro and macro nutrient elements such as phosphates and potash to the soil in order to bring into balance the different nutritional levels of the plants.

An irrigation system will be necessary for the production of the vegetable. This would be a drip system. The producer will need to have an understanding of how to utilize the drip system. Fertilizers will be applied to the plant through the drip system. Different crops have different needs of fertilizer and spacing in order to grow in the greenhouse.

Optimum planting dates will need to be realized in order for each variety to gain the best yield and quality. This will be gained by test block and planting of various varieties within the greenhouse over a period of time.

Seed and seedling spacing is critical to the quality and production of product. The understanding of the various seed and seedlings spacing will be important for the producer to produce an excellent quality crop. Once the seed or seedlings are planted, proper germination moisture is necessary for root growth and plant growth. Over irrigation may cause root dampening, which will either kill the plant and/or cause retarded growth and therefore substandard production.

The producer will need to learn the variety of vegetables that can be grown together. Certain vegetables cannot be grown together due to cross contamination and/or diseases that one might have towards the other. Furthermore, the producer will need to learn proper crop rotation due to the fact that certain vegetables cannot follow other vegetables due to contamination of the soil by either insecticides, herbicides, or plant enzymes that are produced by that particular vegetable root system. The producer will need to be able to identify, manage, and apply insecticides in an efficient manner. This will entail a good IPM program.

The producer will have to be aware of diseases. This is probably the single largest problem for growing vegetables in a greenhouse environment in the Putumayo region. The producer will have to be able to identify, manage, and apply the various fungicides on a timely and efficient manner in order to control the various fungal diseases and bacterial diseases that can originate in the type of environment that is in the Putumayo region.

Weed management for the producer will not be as significant as products that are grown outside of the greenhouse, but still the producer must be able to identify, manage, and apply the correct herbicides for the weed and plant that is being grown.

Soil amendments that will be utilized during the growth of the various vegetables are important to be utilized. Over fertilization can cause excessive plant growth and lack of quality product. Most of the amendments will be applied through the water, although some may be applied foliar by being sprayed on the plants that are being attended to.

Tomatoes and cucumbers will be of the pole variety and will need to be tied as they grow in order to achieve the proper height and ability to harvest. These will also need to be pollinated, and the producer will have to understand the requirements of pollination of the products.

Due to the high temperatures and humidity, the consolidator and the producer must coordinate harvesting time for the various products that are going to be grown in order to achieve a quality and highest yielding crops. When to harvest and how to take care of each vegetable that is being grown is of the utmost importance. If the producer is only going to use the vegetable for home consumption, the quality is not as important as those vegetables, which might be marketed to other areas within the Putumayo region.

If the product is one such as bell peppers, cucumbers, string beans, and carrots that need to have an appropriate cold chain. Understanding that cold chain will be of extreme importance to the producer. This is also where the consolidator becomes intricately involved with the producer in order to insure the quick transportation of harvested product to the entrepreneur's facility in order to size and package according to customer needs and requirements.

There will be a need of understanding for each individual vegetable that is being grown and transported to the consolidator's facility in the case of post-harvesting handling. As an example, onions need to be kept dry so a method of drying at post harvest handling will have to be implemented. Furthermore, bell peppers need require temperatures of approximately five to seven centigrade, whereas carrots require one to two degrees centigrade.

The consolidator will oversee the production, but will control the timing and quality of the harvesting. This will enable the product that is not being marketed in the Putumayo, to be of better quality and packaging for that market. The producers will often want to package everything into a package therefore denigrating the quality of that product. As heretofore mentioned, approximately 50 percent of all product that is harvested in Colombia, is severely damaged or lost and not consumed by Colombian consumers due to improper post harvest handling. With appropriate technical knowledge and skill for harvesting and post harvest handling of various vegetables, this significant loss may be reduced.

The consolidator will be responsible for the quality of the products that are being harvested and packaged. The consolidator will provide to the growers the necessary information to grow the crops such as planting dates, varieties, fertilizer applications, irrigation management, and harvesting techniques. In order to make this a feasible operation, production plans will need to be written by the consolidator and shared with the producers.

Understanding of transportation of product to the consolidator is important. Transportation must be swift and reduction of heat is very important to the product. As with vegetables, various methods will need to be implemented and executed by the producers in order to achieve the quality product delivered to the consolidator. This will develop to a certain degree on individual products specifications to maintain the cold chain requirements.

Training will need to be implemented and understood by both the producer and the consolidator for the costing of production, harvesting, and processing and storage of the various vegetables. Included within understand of costing will be the need for recording keeping, by both the consolidator and the producer. Record keeping would entail the various cultural activities by the producer that were performed such as spraying, planting, and type of soil and plant amendments that were added. This would enable the producer to access what was accomplished and this information could be utilized for the next crop. The consolidator would have records such as harvest dates, processing production, and various markets and prices that were achieved by these various products.

It will be incumbent for the consolidator to understand maintenance of the facility. Suggested is a good preventive maintenance program. Furthermore, the maintenance of the refrigeration will be extremely critical.

The consolidator must also understand the efficient handling and operation of the various products through the facility. This is to include the refrigeration and distribution of the product.

Inventory keeping and the management of this inventory of the harvested and packaged product will be of the utmost importance. As an example, bell peppers will need to be kept at five to seven degrees centigrade whereas onions will need to be kept dry and can be held at higher degrees. Carrots, if chosen to be grown, will need to be kept at one to four degrees centigrade. Accurate inventory record keeping will be essential in order to determine the age and quality of the inventoried product.

In developing markets of these various vegetables in the regional markets, methods of communication are essential. This can be accomplished in various ways. Radio or some other form of inexpensive transmission can be utilized so that not only the consolidator, but also the producer can have available market information. Market studies could be performed by CCI in order to have this type of information available to the consolidator.

For regional market import substitution, the consolidator will need to have a good understanding of what the prices are and the quality of what is being imported into that area. The prices and the quality of the product that is being sold on a regional basis will need to be equal to that which is being imported.

In the case of that product which is being consumed individually and/or locally and not even utilized through the consolidator, the requirements of quality for that product are not as stringent as that which would be marketed on a regional basis.

As an example, consolidator could be in Puerto Asis and have products grown in the Puerto Asis immediate area. These products could be transported to other locations of Putumayo and sold in those markets, "Plaza de Mercado". Furthermore, products could be grown in the greenhouses and consumed in the local area of either Puerto Asis or even within the rural areas that these products are grown in various greenhouses that may be situated. The target markets would be the "Plazas de Mercados".

This will enable the areas to have food security and higher quality products since it would not have to be transported such a far distance from other areas. By the utilization of the greenhouses, as heretofore mentioned, vegetables would be harvested to have a continual supply. Due to the weather that exists in Putumayo, vegetables presently cannot be grown in this manner.

It will take at last two years to train a capable local technician to assist the various greenhouse producers and the wide variety of crops that are being grown. It will take about five months total to get a greenhouse constructed, planted and through the first harvest. It will take at least two years for a producer to be self-sufficient.

What makes a project grow more quickly is the sharing information and techniques between greenhouse producers. An association can be formed that would share information and techniques.

There are times that the major markets in Bogota, Bucaramanga, Cali, and Medellin may have shortages and there are price spikes that would enable producers or consolidators from Putumayo region to supply these markets with the various vegetables that are being grown. It is essential that the consolidators have market information in order to determine costs of transportation of product to those markets. In reviewing information from CCI, it was determined by this consultant that there are various times during periods of the year that prices spike up that may enable the consolidator market into these major cities of Colombia. This cannot be the sole objective of the consolidator, but one to augment if profit is available. Listed in the annex are several markets and commodities that illustrate these various price spikes, Tables III, IV, V, VII, & VII. The difficulty that this consultant had was determining the transportation costs of products from the Putumayo region to the major markets.

The cost of an irrigation system for one and one-half hectares in a greenhouse would be approximately $17 thousand dollars. For one-half hectare the cost would be approximately eight thousand dollars. For both of these this would include the pump filters, pump, tubing, and connectors. In order to have fertilizer injectors, one thousand dollars would have to be added to each system. The two different greenhouses aforementioned one of wooden pole standard and the other of steel differ in price. The wood pole standard greenhouse would

cost approximately four dollars per square meter whereas the steel standard greenhouse would cost approximately $15 dollars per square meter to construct.

The cost to grow, harvest, and pack tomatoes in the greenhouse would be approximately $13 thousand dollars per hectare. There are 22 thousand plants per hectare and the average yield of six kilograms of harvested tomato plant per hectare. This would entail a six-month process from time of planting of seedlings to final harvesting of the tomatoes.

Cucumbers would be approximately the same as tomatoes. The cost would be approximately $13 thousand dollars per hectare and there would be 22 thousand plants per hectare. The yields would differ, in that cucumbers would yield approximately seven kilograms per plant. This would also take six-months from time of planting to harvest completion.

Bell Peppers would also take six-months from planting of seedlings to completion of harvest. The cost would be different, in that it would cost approximately $15 thousand dollars per hectare to grow, harvest, and pack bell peppers. Bell Peppers would yield approximately 20 kilograms per plant. There would be approximately 18 thousand plants per hectare.

Concerning the other vegetables such as carrots, onions, green onions, and string beans, this consultant was unable to gather accurate information as to the cost of such commodities to be grown in a greenhouse environment. It is the suggestion of this consultant that further investigation be done to determine the costs of growing these vegetables.

For a processing facility that would be five thousand square feet, the construction costs would be between $125 to $150 thousand dollars constructed and the equipment installed. This facility would have cold/ice storage of 2,500 square feet and a processing area of 3500 square feet. There would be a need for some transportation of some type such as a small truck in order to take product from facility to other markets. This truck would need a refrigerated van on the truck in order to maintain product cold chain temperatures.

Technical assistance given to the beneficiaries will be significant. Again this will be detailed in the annex. This will be pre-project implementation and post-project implementation forms of technical assistance.

Organizations that strategic alliances and linkages would be needed to be established with would be as follows: CORPOICA, UMATA, and SYNGENTA.

Non-Vegetable Horticultural Crops

The first non-horticultural crop to be presented will be yuca. The testing requirements will be enunciated in the roll out. Yuca is a mainstay of the Colombian diet. In the rural areas, especially in the Putumayo region, yuca is consumed significantly more than vegetables and fruits as illustrated heretofore in the major cities of Colombia. As heretofore stated, the origin of yuca is the Putumayo region. Therefore, CIAT has its research and development facility in the Cali area and has facilities to provide significant technical assistance for yuca growing and processing.

In discussions with those individuals responsible for yuca at CIAT, this consultant learned that there are two varieties of yuca. There is one that has a high cyanide level and one that has a low cyanide level. The low cyanide cultivars are the types that are utilized for human consumption in Colombia and many other countries in Latin America, Africa, and Southeast Asia. High cyanide levels are the cultivars that can be utilized for processing and are not safe for human consumption. The advantage of the high cyanide cultivars is that the harvested tonnage of these cultivars exceeds the tonnage of the low cyanide cultivars.

The three cultivars that Dr. Hernan Ceballos of CIAT suggested are Catamre, Reina, and Rupert's Best. These cultivars are now being tested in the Putumayo region. Dr. Ceballos states that in some occasions, they have attained 50 tons per hectare with these cultivars in their test plots. As heretofore mentioned, the present average of yuca yields of Putumayo is approximately five and one-half tone per hectare.

The advantage of using the high cyanide and high yielding cultivars is that the processing of these to either animal feed flour and/or glucose, enables the price of the final product of yuca animal feed flour and glucose to be low enough to be competitive on import substitution domestic market. These high cyanide varieties are safe for consumption by animals and for the usage of glucose. When these high cyanide cultivars are processed into this format, the cyanide escapes the product and is not injurious to the environment or injurious as product utilization.

The acreage of yuca grown in Putumayo is fairly substantial. It is also heretofore noted, that the overall acreage for coca is very significant. It was the intent in thought process of this consultant, to ascertain products that would create food security for the inhabitants of the Putumayo region; create income for the inhabitants of the Putumayo region; produce a crop that the producers of Putumayo are comfortable with in the cultural aspects of growing; have value added potential; and investigate horticultural products that could have a substantial amount of acreage to replace the illicit coca that is being grown. Yuca offers this opportunity in the processed value added format as will be enunciated in the following paragraphs.

As heretofore mentioned, the market for imported animal feed is in excess of $2 billion dollars annually. If 20% of this can be replaced with domestic animal feed products such as yuca flour, this would create a market of $400 million dollars available for yuca production facilities in the Putumayo region.

In a hypothetical sense, if one were to take a $400 million dollar market and divide that by $120 dollars per ton for the yuca flour animal feed, this would be the equivalent of 3,333,333 tons finished product. Two and one-half tons of raw material would equal one ton of final product, this would be the equivalent of 8,333,333 tons of raw material. If through new cultivars utilization and different cultural production methodologies, the tonnage of 30 tons per hectare could be attained, this would mean a total of 277,777 hectares of yuca would be needed to fulfill the market. Albeit, to gain full market share in Putumayo would be very difficult if not impossible, there is a possible substantial amount of acreage that can be grown in order to fulfill import substitution of animal feed and replace the eradicated coca acreage. The acreage does not include the acreage that would be needed for glucose.

In order to grow higher tonnage yuca in the Putumayo region, several factors must be accomplished in order for the tonnage to be increased. As heretofore mentioned, new cultivars will need to be tested and proven to be significant tonnage producers. As stated by Dr. Cellabos, one of the most important factors is the health of the sticklings that are used

for transplanting of the yuca plant. If these cuttings are not healthy and/or cut from poor yielding plants, the results of the next plant will be deficient. The health and physiological condition of the planting material will have a great impact on the yuca productivity. Next of importance is selection of "target soils." Analysis must be done in order to determine what soils will be potentially productive for yuca. Only then will one be able to fine-tune the soil management practices when choosing the appropriate "target soils".

Soil preparation is extremely important. Compaction must be eliminated so that the root system can flourish and grow. To do this, some type of sub-soiling or chiseling must be performed on the soil in order to have non-compacted soil for water and root penetration.

Soil management also comes in the forefront in respect to the amendments that will be necessary to be applied to the soil prior to planting in order to obtain the appropriate soil nutritional and ingredient levels. There will be a need to apply compost, lime, phosphate, potash, and other micronutrients in order to bring the soil up in the ingredient and nutritional levels and reduce the acidity factors of the soil.

Plant selection is also extremely important. There are various cultivars that will be more tolerant or even resistant to different diseases in the different microclimates that exist throughout the Putumayo region.

Planting dates will have to be adhered to by the different producers in order to guarantee production continuity of the facility. This will be a facility that will operate on a year round basis for either glucose or animal feed flour.

New instruments and equipment will need to be introduced to the producers in order that they have the correct equipment to produce the quality crop and top tonnage. Nutritional management of the plant and soil during growth is quite important in order to maintain a healthy plant.

Disease identification, management, and application of fungicides is very important. Cassava bacterial blight, brown leaf spot, cassava mosaic disease, and cassava anthracrose disease are diseases that can be very harmful to the yuca plant and can either destroy the plant and/or significantly reduce the tonnage.

Weed identification, management, and application of herbicides and/or cultivation is important. Weeds, if allowed to grow to significant degrees, will retard the growth and remove the necessary soil nutrients from the soil that are required for the yuca plants.

Insect identification, management, and application of insecticides is quite important. There is a need for an excellent IPM program. The insects that are of danger to the yuca plants are green mites, thrips, cassava hornworm, ants, and mealy bugs.

The time of maturation for a yuca is plant is approximately one-year from the time of transplant of the stickling to maturity of the yuca roots. At harvest time, the yuca root has a high perishability. This not only increases the cost and risks for producers, but also risk for the facilities. The advantage of having a consolidator is that the consolidator can coordinate the harvesting dates of the yuca.

There are two types of deterioration that can affect yuca roots, physiological and microbial. Physiological deterioration appears when the root tissues turn bluish-black, especially in the

outer part of the roots. This deterioration is cause by post harvest accumulation of certain phenolic compounds, which are polymerized from the bluish-black pigments. Visible signs of physiological deterioration appear 24 to 48 hours after harvest; but before this occurs, the roots already show a brilliant blue florescence under ultraviolet lights due to the accumulation of fenol known as scopoletin, which is a true indication that deterioration has begun. Physiological deterioration begins in the wounds, which are produced during harvest.

Microbial deterioration usually starts after the fifth day, after the roots have been harvested. Tissues turn into soft rot accompanied by fermentation and maceration of the tissues. Physiological deterioration requires oxygen for its development and can be prevented by impeding the oxygen to have access to the tissues. Microbial deterioration, which is associated with action of pathogenic micro-organisms which are favored by environments with high relative humidity and high temperatures especially in roots with mechanical damage.

Therefore, it is essential that the yuca products be harvested under the control of the production facility and/or the consolidator. Furthermore, the 24 to 48 hour window must be adhered to for these physiological and microbial damages to be prevented and to extract the maximum yield from the yuca roots. Yuca roots can be stored in the ground even after maturity for up to 18-months, so there is no damage by leaving the yuca roots unharvested in the ground. Damage only occurs once that the plant is harvested.

Again the consolidator concept has heretofore mentioned in the opening paragraph of this section, is the ideal concept to be utilized for the processing of yuca flour or glucose. The consolidator will oversee the production of the product at the facility. As stated, the consolidator will manage the timing and the control of the harvesting in order to minimize product deterioration.

The consolidator can provide the producers with the necessary technical assistance to produce the maximum yielding and quality yuca. As an example, the consolidator can organize the planting dates, the cultivars to be planted, fertilizer to be utilized and amounts, ground preparation, planting equipment, irrigation management, etc.

The consolidator would be responsible for quality of the product that is produced. In order to maximize the efficiency of the operation, a production plan would need to be drafted by the consolidator in order to assure a steady supply of raw material. The consolidator can assist with transportation of the yuca product from the field to the processing facility. This again wound enable the consolidator to have a more consistent supply of product to the facility.

It is incumbent upon the consolidator to have a cost accounting system that would cover production, harvesting, and processing. This would allow the consolidator and the producer to have knowledge of what their total costs are and the profit that each will receive from the operations.

Furthermore, it is incumbent upon the producer and the consolidator to maintain accurate recording keeping. Accurate record keeping would include ground preparation, amendments placed upon the soil, date of planting, cultivars use in planting, different materials that were applied to the yuca post planting, harvest time, production costs, inventory, etc. The more detailed and accurate this recording keeping, the more benefit it

will be to the producer and the consolidator in future years in order to improve the production and processing of the yuca.

Facility maintenance will be essential for the consolidator. The equipment that will be utilized to either manufacture glucose or yuca flour for animal feed will be highly technical and will necessitate an excellent preventative maintenance schedule. There must also be technical knowledge of how to operate and maintain that equipment.

In order to insure that quality product is being marketed to the different buyers, inventory systems must be established to keep track of the various lots that are kept on inventory. Quality type of packaging products must be purchased in order to insure that the flour meal will be kept dry and not break from the container and be spilled during storage and/or handling. For glucose, there will be even further need to have quality collateral and packaging material. An accurate inventor will be a necessity.

This would entail that the consolidator have a QA program that would include everything from harvesting through delivery of product to the consumer.

It is incumbent upon the consolidator to have efficient techniques to produce the products of yuca flour and glucose. Efficiency of processing is only to the benefit of the consolidator, which will reduce the cost of production and increase the margin of profit for the consolidator.

In Table 21 an illustration is given of the production of yuca flour animal feed. As one can see the return per ton to the producer is significant. The return is $84 for packaged product of raw material. Since there is a two and one-half to one product change over from raw material to packaged material, that would be a return of approximately $33 per ton for raw material. If the producer were able to achieve 33 tons per hectare, this would be a return of $1000 per hectare. These types of facilities are being utilized in Southeast Asia, India, and there is at least one facility in Brazil. The technology is not a new technology and is being utilized profitably in other areas of the world. Concerning glucose as referred to in Table 22; the return is also significant for the consolidator and the producer.

The utilization of processed yuca for yuca flour animal feed and glucose would be for domestic import substitution. As reflected in Table 23, the market for glucose imported into Colombia in the year 2000 was approximately $107,000,000. If glucose production factoring in the Putumayo region could obtain a 20% market share, that would be in excess of $20,000,000 in annual sales per year. This would obviously be a significant boost to the economy of Putumayo.

In order to maximize marketing, a market plan should be written by each and every consolidator for both yuca flour for animal feed and glucose. This market plan should establish the target markets. The target markets for the animal feed would be importers of animal feed or those firms, which utilize the animal feed and mix it at their facility.

For glucose this could be manufacturers who utilize glucose in their processing facilities or importers of glucose into Colombia. Strategies to penetrate these markets would be established in the market plan. Strategy that would be initially beneficial to the processor or the consolidator would be to have a price for the glucose or yuca flour at a lesser price than the product is being purchased by the either the importer or the user. The international

market would be a potential market if the cost of production would be low enough to be internationally competitive.

In the annex, Table VIII, the cost of production of yuca is delineated. It can be noted, that the cost is approximately $747 per hectare. In reviewing the cost and production return for glucose or from yuca flour animal feed, the profits per hectare would be fairly substantial. If yields were able to reach 40 tons per acre, as stated by Dr. Hernan Cellabos, the net profit to the producer would be significant. This would also leave an excellent return for the consolidator at the processing facility.

Technical assistance that would be needed pre-implementation of the project and post implementation of the project can be found in the annex under the listing of yuca**.** Technical assistance in all aspects of this will be of significant importance in order for the objectives to be realized by both the producers and the consolidators. Organizations that would be necessary to have strategic linkages or alliances would be CIAT, CLAYUCA of CIAT, and CORPOICA, and UMATA.

Corn-Maize

Maize (musa balbisiana) is a non-vegetable horticultural crop that is essentially grown throughout the Putumayo region. Maize is mostly grown animal feed, but if harvested early it can be used for human consumption as sweet corn.

The different cultivars that would be recommended to be utilized for the Putumayo region would be the QPM cultivars that have been developed by CIAT. The names of the cultivars are Single Croos and Three WC. CIAT has the germ plasms for these varieties. The other varieties have been developed by CORPOICA are CORPOICA H-108 and CORPOICA H-111. These two varieties developed by CORPOICA have been developed for the acidic soils of Putumayo. There are also good open pollinated varieties that are being developed by CIAT, but there have been no names given to these cultivars. They are also showing excellent performance in the type of climate and soil conditions that are present in Putumayo.

Some of these aforementioned cultivars have achieved six to seven tons per hectare in the acidic and toxic soils that are prevalent throughout the Putumayo region.

In the aforementioned Table 11, the Putumayo average is 1.5 tons per hectare; by achieving 6 to 7 tons per hectare there would be an abundance of corn throughout the Putumayo region not only for human consumption, but for animal feed consumption.

In the Putumayo region there is a high incidence of acid soil with aluminum and iron toxicity due to the excessive rains. These washed out soils are also extremely poor in fertility. It would be necessary to analyze soil before planting of corn and see the amount of amendments needed to bring the soils to the acceptable Ph, nutritional levels, organic levels, acceptable acid levels, and toxicity levels.

Soil preparation will be important to alleviate soil compaction. With soil compaction, the root structure of corn is not able to reach the necessary depths, therefore reducing the yields of the maize.

Plant spacing will be essential in order to maximize the production. Most corn grown in the Putumayo region is planted for harvest twice a year, therefore by having two planting dates it is essential that maximum yields be achieved for each planting. Plant spacing is essential in doing this.

Nutritional management of the plant and soil once post germination is achieved, it is essential. Balanced nutritional levels for the corn are essential to obtain the maximum yield.

Disease identification, management, and application of fungicide are essential to prevent reduction of yield. The most prevalent diseases for corn in the Putumayo region are leaf spot rust, maize stredivirus, downy mildew, and fusarium verticlliods. Management and control of these various diseases with fungicide will enhance yields of the corn.

Weed identification, management, and application of herbicides are essential. Cultivation may also be practiced in order to minimize weed growth in the maize.

Insect identification, management, and application of insecticides for a good IPM is essential. The various types of insects that are dangerous to maize are carpophilus dimidiatus sitophilus zea mais, cutworm, armyworm, aphid, and freen moth. Management control of these insects will elevate product degradation and loss of yield at time of harvest.

The critical factor of post harvest handling of corn is to control the amount of moisture of the corn. With this the producer or the consolidator can control the spread of storage fungi. Separate factor in post harvest handling is the control of insect damage. The corn will need to be sprayed with an insecticide to prevent insect damage in post harvest handling or storage. To prevent storage fungi, the grain has to be dried to appropriate levels of 15% moisture after harvest and prior to storage.

This consultant did not investigate processing and marketing of corn. It is the recommendation of this consultant that both processing of corn and marketing be investigated in order to determine how to improve the industry throughout the Putumayo region.

The projected growing costs for growing corn in the Putumayo region are delineated in the annex. Please see annex, Table IX, to understand these costs.

The technical assistance that would be needed in order to grow maize is also delineated in the annex. Please refer to annex to understand the different technical assistance that will be needed to improve the corn yield throughout the Putumayo region.

Strategic alliances or linkages will need to be developed with CIAT, CORPOICA, SYNGENTA, and possibly UMATA. Linkages with these organizations, the potential for increased yields in the Putumayo region will be tripled.

Rice

Rice is one of the mainstays of the dietary intake of the inhabitants of the Putumayo region. As heretofore mentioned, approximately 0.75 kilograms are consumed by the inhabitants of the Putumayo region as stated to this consultant by Mr. Ruben Dario Pinzan of PNDA. As is

noted from the acreage of products grown in the Putumayo, rice is only approximately 438 hectares. This is not large considering the consumption of the Putumayo inhabitants of rice. Therefore, a significant amount of rice is imported from other regions in the Colombia such as Tolima, Colombia.

The rice that is grown in the Putumayo region is considered dry land rice. Which means that the rice is not irrigated rice and that the producers are relying on rain to grow the rice crops. Colombia is the largest grower of rice in Latin America. Most of the rice that is grown in the Tolima area is irrigated rice, and harvested mechanically with combines. Therefore, the costs of operation are significantly less than in Putumayo where the rice is harvested by hand and not harvested mechanically.

The yields on rice in Putumayo are 1/3 of those that are in the Tolima area, 2 tons in Putumayo and 6 tons per hectare in Tolima. In discussions with Dr. Cesar Martinez of CIAT, he stated that yields on dry land rice even in the Putumayo area could be significantly increased through proper utilization of cultivars, soil preparation, land preparation, pesticides applications, good supply of fertilizers, good supply and timely application of pesticides, and accurate timing of harvesting.

The cultivars recommended to be tested in the Putumayo region are as follows: Oryzica-1, Caribe, Oryzica-3, LINEA 30, Oryzica Savana 6, Savana 10, Fedearroz 50, Fedearroz 2000, Progreso 4-25, Selecta 3-20, and CICA 8.

These cultivars were recommended by CIAT, CORPOICA, Fedearroz, and Syngenta. Testing methods will be discussed in the roll out section of this report. These varieties are developed to be planted in irrigated and rain fed conditions, or can planted in dry land conditions. These varieties are also developed to be planted at lower altitudes that are prevalent throughout the Putumayo region.

Soil selection and preparation methodologies are paramount choosing where to plant rice in the Putumayo region. Soil analysis should be done in order to determine the soil which is best available for planting of rice. In preparation of the soil, once the ground is selected, correct soil preparation should be carried out in order to have soil acceptable to planting of the rice.

Soil management is also important in the context of amendments that need to be applied to the soil prior to the planting in order to attain the appropriate soil nutritional and ingredient levels. Soil may need to be amended with compost to increase the organic matter, lime to decrease the acidic levels, and major nutritional elements added such as phosphate and potash. An analysis of the soil, the relevant levels of these various soil conditions will become apparent.

Once soil sites have been selected and through testing cultivars have been determined to be more adaptable to that region, the seedlings or seeds need to be planted at the appropriate spacing in order to maximize yield.

Nutritional management of the plant and the soil post planting is important. Petioles of the plant can be taken in order to determine if there are any deficiencies in nutritional balance of the plant.

Disease identification, management, and application of fungicides are extremely important. Weed identification, management, and application of herbicides are also essential to eliminate and/or eradicate any type of weeds that are in competition with the rice. Competitive weeds will choke out either the rice or necessary nutrients from the soil that will not be available for the growth and maximum yield of the rice.

There will be need of trained personnel to advise the producers on crop management. One of the areas that will be essential is in insect identification, management, and application of insecticides or a good IPM program. The trained personnel can give the producers technical assistance in order to maximize yield of the rice.

In harvesting of the rice, harvesting on time is essential good quality crops. There needs to be a good transport system to take the wet rice to a rice mill. It is very important that the moisture content, which is approximately 23-26% at harvest time, be brought down to 14% as soon as possible. Otherwise, the grain quality will deteriorate rapidly and losses could be high. There are different types of dryers available on the market and Fedearroz can give technical assistance and expertise in this area.

This is another area that the consolidator concept would prove to be very beneficial. Although this consult did not have the time to contact Fedearroz to investigate and research the cost of a rice mill drying facility, it is recommended that this be done in order to determine if these types of facilities could be constructed in the Putumayo region. Since rice is such a important aspect of the Putumayo region diet and significant amount of funds are being utilized imported rice, the increase of rice being grown and milled in the Putumayo area would be of significant importance to the economy of the Putumayo region.

This consultant did not investigate marketing. It is recommended that this be investigated further; a similar type of marketing system would be one that is utilized within the fresh vegetable. This consultant does not believe that there is an economic feasibility for rice to be sold outside of the Putumayo region. It would be more one that the rice be utilized within the different municipalities of the Putumayo region. For example, rice mills could be built in the Puerto Asis area and rice could be sold and distributed throughout the Puerto Asis area to various Puerto Asis both urban and rural residents.

Technical assistance in both pre-implementation of the project and post-implementation of the project will be listed in the annex. Please refer to the annex for the technical assistance that will be needed. Please refer to Table X in the Annex for the growing costs of rice.

The organizations that are suggested to have strategic linkages or alliances would be Fedearroz, CORPOICA, CIAT, Syngenta, and possibly UMATA on the level.

Platanos

In regards to platanos, it is suggested by this consultant that further investigation and research be done concerning platanos. Cursory research illustrated to this consultant that the Putumayo region can grow a higher yielding of platanos. Presently the yield of platano is approximately 4½ tons per hectare in the Narino and Tolima areas. It is almost double or approximately 8 tons per hectare.

The silver amount in Putumayo is sufficient to grow platanos. The soil Ph will have to be increased where platanos are grown to 4.5 through 7.5. The optimum temperatures for platanos are 27 degrees centigrade. This can be noted from the weather Tables 6 & 7 in the Overview and Background section. This temperature exists throughout the Putumayo region.

Platanos like precipitation, a minimum of 1,800 milliliters annually and 150 millimeters minimum per month. Again, in reference to the overview and background chapter, this type of precipitation exists throughout the Putumayo region.

This consultant suggests to contact INIBAP and IITA. These two international organizations have research and development programs internationally involving platanos.

Research that was conducted by this consultant, it was discovered that the leaves from platano have a high quality fiber context. In certain countries throughout the world, they are used in the textile factory. Furthermore, platanos are high in phosphorus, calcium, potassium, vitamin C, and Vitamin A. It is further suggested that McCain Andina SA be contacted for further TA. In discussions with Mr. Bernardo Medaglia, McCain would be interested in possibly purchasing both platano and yuca for freezing purposes and providing TA to the producers in Putumayo. McCain is the largest freezer of agricultural products in Colombia. A strategic linkage could be developed with McCain.

CIAT does not directly become involved in platanos. They recommended contacting INIBAP. INIBAP is part of the international organization that CIAT belongs to, CGIAR.

There is an organization on the domestic level that established a strategic alliance is CORPOICA. This group is doing significant work in technical aspects of platano. Projected growing costs of platano are in the annex, Table XI, and can be referred to.

Palmitos

Plamito (Bactris Gasipas) is another horticultural commodity that can be produced in the Putumayo region. Palmito requires weather that has temperatures of 26-28 degrees centigrade. Furthermore, precipitation that is from 2,500 to 5,000 millimeters per year. Palmito is good for the environment, in that it takes in a great deal of CO2 and releases a significant amount of oxygen. The testing requirements will be in the rollout section of this report. The harvest time for planting of seedlings varieties is 18 to 20 months. Therefore, the testing and rollout will be longer than other horticultural crops.

This consultant was not able to discover the various cultivars that would be used for palmitos. It is the recommendation of this consultant that CORPOICA and UMATA be contacted to discover which cultivars the organizations think would be applicable to the specific regions of Putumayo.

In order to grow palmito, there are two important factors that must initially be taken: 1) Soil section is extremely important. Soil must be able to drain well so that the palmito plant can grow. 2) Soil preparation the soil must loosed for at least ½ meter in depth. This is in order to allow the root structure of the palmito to penetrate. If the soil is not loose to that depth, the size of the plant will be stunted and therefore the yield and quality of the palmito that will be harvested will be lessened. Palmito likes a Ph level in the soil of 4.5 to 6.5. As

heretofore mentioned, the average Ph level in Putumayo region is 3.5. Therefore amendments such has lime will be necessary to be applied to the soil in order to increase the Ph in the soil and reduce the acidity of the soil.

Palmito has a high degree of need of the major and major and minor nutritional elements. Nitrogen, phosphorous, and potash along with magnesium and calcium need to be applied prior to planting of the palmito. It is extremely important to choose the distance of the seedlings to be planted. That should be approximately 2 x 1 meters or approximately 5,000 plants per hectare. It is best to use seedlings that will be germinated at the nursery and then brought to the farm.

The first six-months are extremely important for palmito. This is where diseases and/or insects can damage the palmitos severely. Careful attention needs to be made to the palmito in order to assure proper growth.

Instruments and equipment can be utilized in the production of palmitos. Weed maintenance can be done through cultivation and utilization of equipment in order to save the usage of hand labor and/or the utilization of herbicides. Once the plant has begun to grow, official management of both soil and plant is extremely important. During the first year, the plant will continue to need nitrogen, phosphorous, and potash; additionally magnesium and calcium will need to be applied through the first year. This can be applied through various methods, foliar or soil injection.

Disease identification, management, and application of fungicides are critical in the maintenance of the plant. Diseases such as Erinia Crysantemis or Phythoptora Palmivora, are two of the diseases that can cause damage to the foliage of the palmito plant.

Insect identification, management, and application of insecticides or a good IPM program is also essential. The main insects that are dangerous to palmito are Rinchophorus palmarum and Metamasius hemipterus. These two insects can cause economic damage to the palmito plant. Traps can also be used to catch these insects in the fields.

When harvesting the palmito the most important factor is to move the product once harvested and the bark is cleaned from the heart of the palm is to transport the product quickly to the facility to be packaged. Oxidation happens very quickly. If oxidation occurs, denigration of color happens, the product quality will be lessened. Therefore, it is essential that the transportation of the product from harvest to facility occur quickly.

It is the opinion of the consultant, that a consolidator is essential to the success of harvesting, transporting, and packaging of palmito for the market. The consolidator would oversee the production and manage the timing of planting the various varieties that will be grown for processing. The consolidator will also have control over the harvesting and manage the timing and quality of the harvesting for processing at the facility.

The consolidator can provide technical assistance and information to the producers to grow the crop. This would be planting dates, varieties, fertilization applications, irrigation management, and soil preparation. This type of TA would be essential in the successful processing production of palmitos. The facility that is utilized to process the palmito will need to be one that is technologically advanced and meets the HACCP regulations in order export to the EU and the US. HACCP is a program of food safety that will be required by buyers in both the US and the EU.

Collateral materials such as packaging material will be important to meet the standards and quality requirements of both the US and the EU. Since this is packaged and processed product, knowledge of the packaging, labeling, and nutritional requirements will be necessary in order to export to these two target markets. They will need to pack various types of packages for projected customer's, the majority of them are packed in glass with tin tops.

It is essential that the consolidator have a production plan that will enable the facility to have a constant supply of palmito raw material in order to maintain efficiency and customer supply.

Preventative maintenance will be essential to the efficiency of the operation. There will be a need of several sophisticated types of equipment in order process and package the palmito. There will be a need to have thorough training of the consolidator's staff in order to understand the operation of the processing facility. Processing and production efficiency techniques are essential in order for the operation to be efficient.

The recording keeping of pertinent facts and figures for future reference and utilization is critical. An example the recording keeping would include the dates that the varieties are planted, harvested, various applications of fertilizer and/or insecticides in order to determine what occurred during the growth period. This information can be evaluated at the end of the crop grown and then utilized by the consolidator to improve upon future plantings.

Training of costing of production, harvesting, and processing is essential in order to determine profitability of the operation.

A good QA program is essential for the operation. A QA program will enable the processing facility to package according to the customer needs and select the different sizes and quality according to those specific needs of the customers.

Product storage and an inventory system are essential in order to maintain the integrity and quality of the product. All products will have a pull date and therefore it is essential production rotation and identification be maintained.

A business plan will need to be written and executed by the consolidator's management staff. This business plan would include the strategic plan, production plan, and marketing plan. There will need to be business training of the management staff of the facility in regards to employee satisfaction, accounting for in-house costing, marketing, and other functions that will need to be performed. This training would include technical training that would be needed in a laboratory within the facility to ensure that there is no contamination of the product in order to ensure to the customer food safety.

There needs to be implemented a methodology on the evaluation techniques of cultivars that are being harvested. This would be the responsibility of the QA department.

The marketing of palmito (hearts of palm) for domestic import substitution and export to US and the EU as can be seen in the Tables 23 and 24, the target market would be France, United States, Spain, Belgium, Canada, and Italy. The largest market for palmito is France. This should be the major target market, for the consolidator's marketing team. Palmitos are

13% of all horticultural exports from Colombia. Palmitos represent 27% of all processed fruits and vegetables.

The principal competitors for the consolidator would be Brazil, Costa Rica, Ecuador, Venezuela, Peru, and Bolivia. These countries all have efficient and established reputations for palmito.

The production of palmito in the Putumayo region is important due to the fact that it will employ numerous people, not only in the production but also in the processing of the palmito.

The sales staff, production staff, and QNA staff must all understand the labeling and nutritional requirements for the various target markets that have been as heretofore mentioned. Furthermore, the type of packaging that will be needed in order to assure quality product arrival will have to be investigated and utilized.

Product storage and accurate inventory systems will need to be established in order to maintain quality and product rotation. The sales staff will need to have an inventory system of real time in order to match inventory with sales to customers.

In developing the marketing plan, there will be the methods that will be utilized to penetrate the French, US, and other target markets. The development of an excellent collateral package is essential. This collateral package must consist of a brochure that enunciates the history of the company and pertinent information in respects to the palmito that is being produced by the company. The brochure must be professionally made because it will need to be distributed to the various targeted companies.

The strategies will be to attend international trade shows or ones that are specific to the targeted countries. An example is ANUGA, international trade show held in Europe, or the food specialty trade shows that are held three times in the US. In attending such trade shows as these, contact will be made with various importers and/or buyers of palmito in these target markets. Follow-up is essential such as phone calls to prospective customers, visits to prospective customers in these target markets.

It is essential that training of the sales staff occur. Areas to be covered would be cold call techniques, utilization of the internet, customer profiling, customer manual, methodologies utilized in order to obtain pertinent market information, and other essential factors that create an efficient marketing and sales staff.

As a part of the market plan, an export market plan would to be developed that would delineate the methodologies to be utilized to penetrate, secure, and maintain a customer. The export market plan would also delineate the marketing channels to be utilized. It would be the opinion of this consultant, that in targeting the US, that importers be utilized as opposed to going directly to retail customers. In targeting France, importers would be channels of distribution plus Carrefour, since there could be established a strategic linkage in the country of Colombia with Carrefour.

Presently there is a significant amount of palmitos (hearts of palm) that are being exported by the competitive countries to the world. The market over the last several years has declined to $18.00 per carton. This has declined from a $25.00 price two-years ago to $18.00 at this present time.

The production and processing costs are listed in the annex of this report in Tables XII & XIII. It will be noted, that the production costs are approximately $14.00 per carton. Therefore leaving an approximate price at world market today of $4.00 per carton. This consultant could not determine what the return was per hectare for the harvested palmito. The average yield per hectare is approximately 2.5 to 2.75 tons per hectare. Further research will need to be done to determine if this is a feasible return for the producer in a profitable sense.

Technical assistance will be delineated in the annex of this report. It will be delineated into pre-commencement of the project and post-commencement of the project to be involved with the beneficiaries of the Putumayo area.

Rollout

Foliage/Orchids

1st year

1. Select areas to grow test plot, this would be in one of the four cities with airports. Airports will be needed as the mode of transportation of the foliage and the orchids to Bogota and the US.
2. Negotiate strategic alliances with UMATA, Dr. Murguetio CIPAV, and Dr. Alberto Roldan for technical assistance and training. Furthermore, to manage the test plots and determine the location of the test plots. This would be a renewable yearly contract.
3. Negotiate linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides. This would be a renewable yearly contract.
4. Negotiate strategic alliance with Almacigos for seedling production in their nursery facility in Bogota. Have them start seedling program as soon as agreement is signed. This would be a renewable yearly contract. Must obtain orchid root tissue culture from either Asia or Australia and plant into the plastic liners so it can be ready to be transplanted to the test plot.
5. Bid small irrigation system and mesh for facility for test plots and install in the designated test plot. Bid and purchase the materials for the mesh screening and structure to support the meshing.
6. Plant cultivars that are recommended by Dr. Enrique Murguetio of CIPAV and Dr. Roldan. Plant the cultivars in the test plots on the “targeted soil” that is the choice of Dr. Murguetio and Dr. Roldan, this would be what is going to be like soil and conditions that will be utilized if the testing is successful. Test plots to be no more than ½ hectare. There should be two sights for substantiation of microclimates in the area. Orchids and foliage are usually planted from liners, which are rooted tissue culture explants. A tissue culture laboratory can provide the material; still in it’s plastic bad without rooting into a loner. A growing facility would need to have a nursery with mist/for propagation in order to finish of the plantlet into a more mature size, ready for planting.
7. Soil preparation and add amendments as specified by Drs. Murguetio and Roldan, and receive input from CIAT. Soil must be very loose deep for water penetration.
8. Research building a facility and cold storage in the city of the test plot. This should be a building that contains a cold storage and a covered area to package the products when

they arrive from the various locations. Facility should be near the airport to avoid extensive travel to the airport for transshipment. Ice making equipment and storage will need to be part of the facility.

9. Establish planting dates for orchids to have year around supply. It is critical to determine this, due to the need to have a supply to the customers.
10. Do market research to determine customer base in Bogota and customer demands of quality, variety etc. on both the orchids and the foliage. Contact the carnation and rose growers in Bogota for market opportunities and product. Contact needs to be made directly and personally with the various growers in the Bogota area. Have them assist in the type of foliage that they want to utilize in their bouquets, and the customer requirements on the orchids. Since the market strategy is to target those in Bogota to handle the orchids, international research would be in conjunction with the handler of the orchids in Bogota.
11. Through UMATA, PNDA, & CIPAV, determine individual or group for a consolidator in the area that is of the first testing. Begin TA for production, harvesting, post-harvest, processing, QA, packaging, and marketing on an individual basis
12. Have meetings with pact signers that want to participate with the program and start TA for them on foliage and orchids. This may be premature if the testing is a failure, but it will allow the project to get the jump on the next year and have the test plots to illustrate to the beneficiaries the actual product in all formats, such as ground preparation, planting and cultural practices, harvesting and post-harvest handling. TA to include all the areas that are defined in the above report for TA. Being there is worth a thousand photographs. Trainers should be part of this TA.
13. Review and the evaluate cultivars the test plots, those that mature in the 1st year, in conjunction with Drs. Roldan and Murguetio for future utilization in the area tested in and for new areas to be tested. If testing is successful, determine cultivars that will produce best quality for area and the potential buyers. This evaluation to be a written report from Drs. Roldan and Murguetio.
14. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from Drs. Roldan and Murguetio.
15. Determine funds available and budget accordingly for growth of the 2nd year.

2nd year

1. If market research substantiates market size, price and demand, look to other cities to do a test plot after first testing city. It would have to be in a city with the airport. Follow same procedures for sight selection of new test plot and soil preparation as in the first year. Make any corrections that are needed after evaluation of the 1st test plot.
2. Build a test plot facility in the second designated location. Utilize the same criteria that being utilized in the first test plot location. Utilize cultivars as designated by Dr. Enrique Murguetio of CIPAV and Dr. Alberto Roldan in the new test plot.
3. Negotiate and renew strategic alliances with UMATA, CIPAV, and Dr. Alberto Roldan for technical assistance and training. Furthermore, to manage the test plots and determine the location of the test plots
4. Negotiate and renew strategic linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides.
5. Negotiate and renew strategic alliance with Almacigos for seedling production in their nursery facility in Bogota. Have them continue seedling program.
6. Follow the same procedures of the 1st year in soil selection and soil preparation and analysis and amendments to the soil for balance.

7. Bid small irrigation system and mesh for facility for test plots and install in the designated test plot. Bid and purchase the materials for the mesh screening and structure to support the meshing.
8. Monitor the leather leaf, since it takes 18 months to mature. End of second quarter evaluate the leather leaf and determine those cultivars of the leatherleaf that are acceptable, if any, for future production. Monitor the orchids that mature in this period for future production. This should be done in a written report from Drs. Murguetio and Roldan.
9. Continue to do market research in Bogota and the US to create an accuracy of the price and demand and to gain a list of prospective customers.
10. If consolidator is an association, need some TA for those to be the Association, such as method to form an association, bylaws, membership requirements etc.
11. Continue to provide TA to the potential beneficiaries as per the TA in the first year. The TA may be altered due to the findings of the growing in the first year of the foliage and the orchids. Provide TA to the second area similar as to the 1st year TA to the first area.
12. Provide TA in the methods utilized to enlist pact signers to grow foliage and orchids for the consolidator under a contractual basis.
13. End of 3rd quarter, start planting in designated areas by Dr. Murguetio and Dr. Roldan for the first test plot for production of foliage and orchids.
14. Provide TA to the designated consolidator in terms of harvesting, post-harvesting, sizing, packaging, costing, QA, and shipping of the products.
15. If second location appears to be successful, in conjunction with CIPAV, UMATA, and Dr. Roldan select a candidate for the consolidator in the second area. Follow similar guidelines for the selection as in the first year.
16. Budget for 3rd year to determine what to be done.
17. Research building a facility and cold storage in 2nd area if testing and market research prove feasible.
18. Establish planting schedule for 2nd trial for supply continuity
19. Provide TA for engineering and design of 1st facility and cold storage. TA on what equipment is needed for new facility.
20. If testing in second city is successful, research expansion in that area as per the expansion done in the 1st.
21. Review and the evaluate cultivars the test plots, those that mature in the 2nd year, in conjunction with Drs. Roldan and Murguetio for future utilization in the area tested in and for new areas to be tested. If testing is successful, determine cultivars that will produce best quality for area and the potential buyers. This evaluation to be a written report from Drs. Roldan and Murguetio.
22. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from Drs. Roldan and Murguetio.
23. Budget for this to be determined for the 3rd year and this will determine the activities for the year.

3rd-5th Years

1. Review strategic alliances with Syngenta, CIPAV, UMATA, and Dr. Roldan to extend for another year each year.
2. Have seedlings grown in facility being built for vegetable seedlings.
3. Build new facility in 1st city for processing and packaging of product. This should be a building that contains a cold storage and a covered area to package the products when they arrive from the various locations. Facility should be near the airport to avoid

extensive travel to the airport for transshipment. Ice making equipment and storage will need to be part of the facility.

4. Purchase necessary equipment for transporting products to the airport and to the facility. Purchase the equipment that will be needed for the processing and packaging of the products in the facility.
5. Continue TA to the beneficiaries and to the consolidator
6. For the most part, follow the process of previous years if the market demand is good and growing is potential is good.
7. Expand only to size of the market demand.

Vegetable

1st Year

1. Negotiate strategic alliances with UMATA & CORPOICA for TA and training. Furthermore, they are to manage the test plots and determine the location of the test plots. This would be a renewable yearly agreement.
2. Negotiate strategic linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides. This would be a renewable yearly agreement
3. Negotiate a strategic linkage with Irridelco for irrigation system and greenhouse. This would be a renewable yearly agreement.
4. Negotiate a strategic linkage with Almacigos for seedlings. This would be a renewable yearly agreement.
5. CORPOICA, PNDA, and UMATA locate "target soils" that would be utilized for the test plot. Plant cultivars that are recommended in report and those that may be recommended by CORPOICA. Plant the cultivars in the test plots on the "targeted soil" that is the choice of CORPOICA, PNDA, and UMATA, this would be what is going to be like soil and conditions that will be utilized if the testing is successful. Test plot to be no more than ¼ hectare. There should be two sights for substantiation of microclimates in the area.
6. Do soil preparation and add amendments as specified by CORPOICA, and received input from CIAT. Soil must be very loose deep for water penetration.
7. Build proto-type greenhouse in Mocoa (higher elevation, milder climate, grow different vegetables) and Puerto Asis, largest population base, and plant the test plots. Determine the size to insure large enough for testing and ability to expand the greenhouse.
8. Research the areas with the highest consumption of vegetables, establish rollout list for the future. Do a thorough evaluation and research of dietary habits of the Putumayo inhabitants to determine areas of succession to build greenhouses.
9. Research building a facility and cold storage in the city of the test plot. This should be a building that contains a cold storage and a covered area to package the products when they arrive from the various locations.
10. Have meetings with pact signers that want to participate with the program and start TA program for them on the vegetables. Provide TA through CORPOICA and UMATA to the potential beneficiaries in the areas that the test plots are being organized. Determine key areas of needed for TA for the beneficiaries. Have the test plots accessible to the beneficiaries to illustrate to them the actual product in all formats, such as ground preparation, planting and cultural practices, harvesting and post-harvest handling. Being there is worth a thousand photographs. TA to include all the areas that are defined in the above report for TA. Essential that disease and greenhouse

temperature management is trained to the individuals. Trainers should be part of this TA.

11. In the 3rd quarter of the year determine and select cultivars since all of the cultivars will be harvested in the first six months, testing can be completed in this time frame. If testing is successful, determine cultivars that will produce best quality for area and the potential buyers. Establish planting dates in the Mocoa and the Puerto Asis cities, based on the information that is derived from the 1st test plots. This evaluation to be a written report. Expand utilization for year two into other areas based on evaluation submitted by CORPOICA in the 1st two areas.
12. If testing of vegetables is successful, determine other locations for greenhouses in the Putumayo region. If testing proves feasible for vegetables, research in building a facility and cold storage in Mocoa and Puerto Asis cities.
13. In conjunction with CORPOICA, PNDA, and UMATA, determine an individual or group for a consolidator in the areas that are of the first testing. Begin TA for production, harvesting, post-harvest, processing, QA, packaging, and marketing on an individual basis with the consolidator.
14. The size of the greenhouses to be utilized to be determined on the needs in that area and the region based on the projections of the market studies and dietary habits being done.
15. Review test plots to evaluate cultivars to used in the future
16. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from Mr. Carlos Escobar from CORPOICA.
17. Determine funds available and budget accordingly for the growth of the 2nd year.

2nd Year

1. Look to other cities to do a test plot after first tests, based on the budgetary amount as to the number of sights. Follow same procedures for sight selection of new test plot and soil preparation as in the first year. Make any corrections that are needed after evaluation of the 1st test plot.
2. Negotiate and renew strategic alliances with UMATA, and CORPOICA for technical assistance and training. Furthermore, to manage the test plots and determine the location of the test plots.
3. Negotiate and renew strategic linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides.
4. Negotiate and renew a strategic linkage with Irridelco for irrigation system and greenhouse. This would be a renewable yearly agreement.
5. Negotiate and renew strategic alliance with Almacigos for seedling production in their nursery facility in Bogota. Have them continue seedling program.
6. Build a test plot facility, irrigation system, and greenhouse in the next designated location(s). Utilize the same criteria that being utilized in the first year's test plot locations. Utilize cultivars as designated by CORPOICA & UMATA and approved by Chemonics.
7. Build greenhouses for personal usage and not test plots in Puerto Asis and Mocoa as budgetary funds are available from first year. Greenhouses to include complete irrigation systems and the cultivars that have proved successful in the original testing. The size of the greenhouses to be utilized to be determined on the needs in that area and the region based on the projections of the market studies and dietary habits being done.

8. Follow the same procedures of the 1st year in soil selection, "target soils", and soil preparation and analysis and amendments to the soil for balance.
9. Continue to provide TA to the potential beneficiaries as per the TA in the first year areas. The TA may be altered due to the findings of the growing in the first year of the vegetable cultivars. Provide TA to the second area similar as to the 1st year TA to the first area.
10. Based on consumer needs and dietary habits, and if testing proves feasible for vegetables, research in building a facility and cold storage in Mocoa and/or Puerto Asis if the consumer needs are there, and other areas within Putumayo.
11. In conjunction with CORPOICA, PNDA, and UMATA, determine a consolidator in new areas that are being developed. Provide TA to the designated consolidator in terms of production, harvesting, post-harvesting, sizing, packaging, costing, QA, and shipping of the products.
12. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from Mr. Carlos Escobar from CORPOICA.
13. Start to build interregional marketing based on research results from the first year based on the projections of the market studies and dietary habits of the Putumayo population.
14. If consolidator is an association, need some TA for those to be the Association, such as method to form an association, bylaws, membership requirements etc.
15. If market to other areas not feasible, then TA to be still focused on consumption for area of greenhouse, yet cultural practices still need to be utilized and TA given.
16. Review and the evaluate cultivars the test plots, those that mature in the 2nd year, in conjunction with Mr. Carlos Escobar and for future utilization in the area tested in and for new areas to be tested. If testing is successful, determine cultivars that will produce best quality for area and the potential buyers. This evaluation to be a written report from Mr. Carlos Escobar.
17. Determine funds available and budget accordingly for the growth of the 3rd year.

3rd-5th Year

1. Continue strategic alliances and linkages with CIAT, Syngenta, UMATA, and CORPOICA.
2. Continue strategic linkage with Irridelco.
3. Build a seedling facility in year three in Mocoa, higher altitude and cooler temperatures.
4. Build greenhouses according to year two budgets in selected areas.
5. Continue TA as post project with consolidators and produces from year 1 & 2.
6. Follow the same rollout as for expansion to other areas and expansion of the greenhouses in the areas built.
7. End of year determine select cultivars and expand in utilization of r the next year. The evaluation will be submitted by CORPOICA.
8. Research "target soils" for test plots through CORPOICA.
9. CORPOICA assistance to develop soil texture and nutritional levels in conjunction with CIAT for the most positive responses by the designated planted cultivars.
10. Establish planting dates in the Mocoa and the Puerto Asis cities.
11. If testing of vegetables is successful, determine other locations for greenhouses in the Putumayo region.
12. In conjunction with CORPOICA, PNDA, and UMATA, determine a consolidator.
13. Provide TA on harvesting, post harvesting, processing, packaging, and marketing to the consolidator.
14. If testing proves feasible for vegetables, research in building a facility and cold storage in Mocoa and Puerto Asis cities.

Yuca

1st Year

1. Select areas to grow test plot, this could be in several cities, depending on the funds to be allocated. Cultivars test planting in major cities areas.
2. Negotiate strategic alliances with UMATA, CORPOICA, CLAYUCA & CIAT for technical assistance and training. TA should be for both high cyanide and low cyanide cultivars, in case there is any difference in the cultural practices. Emphasis of the low cyanide varieties should be placed on the post-harvest handling, such as covering with paraffin wax to prevent physiological damage by not allowing the oxygen to attack any damaged tissue portion of the yuca or to have storage that is constructed such that it yuca is cured during the storage time. Environment of the storage is 30 degrees centigrade and 85% relative humidity and the roots are treated with an antimicrobial agent to prevent microbial growth. Another method is packing the roots in a plastic bag and treating them immediately with a fungicide. Furthermore, to manage the test plots and determine the location of the test plots. This would be a renewable yearly contract.
3. Negotiate linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides. This would be a renewable yearly contract.
4. Plant cultivars that are recommended by Dr. Hernan Ceballos of CIAT. Sample "target soils" and have analysis done and chose those soils which are closest to the soils that are needed. Fine tune the "target sols" for test plots. Plant the cultivars in the test plots on the "targeted soil" that is the choice of Dr. Ceballos and Mr. Carlos Escobar of CORPOICA, this would be what is going to be like soil and conditions that will be utilized if the testing is successful. Test plots to be no more than ½ hectare. There should be two sights for substantiation of microclimates in the area.
5. Study the weeds in the selected areas to determine approach to control the weeds for planting in test plot and future plantings.
6. Do soil preparation and add amendments as specified by Dr. Ceballos, and receive input from CIAT. Soil must be very loose deep for water penetration and root growth.
7. Determine best planting time for sticklings of yuca for harvest. This will have to be a continuous effort. Research on climatology data in areas so can have a continuous supply for processing plant.
8. Due diligence on processing facilities on yuca flour for animal feed and glucose verify that the costing provided by CLAYUCA is accurate. Investigate the other facilities that are built in Asia and Brazil for authenticity. Include negotiations with the manufacturers of the facilities and the machinery.
9. Have meetings with pact signers that want to participate with the program and start TA for them. Provide workshops for TA to the pact signers, this should be provided no matter what the outcome of the due diligence is for the facilities, there is a significant need for yield amelioration by the pact signers of Putumayo. There should be TA such as ground preparation, planting and cultural practices, harvesting and post-harvest handling. TA to include all the areas that are defined in the above report for TA. Train the trainers from UMATA and CORPOICA through CIAT.
10. In concert with PNDA, CORPOICA, CLAYUCA, and CIAT, determine individual or group for a consolidator in the area that is of the first testing. Provide TA individually to the consolidator in soil selection, soil preparation, soil amending, plant selection, planting, cultural practices for the growing the yuca, harvesting, post-harvest, and processing.

11. If consolidator is an association, need some TA for those to be the Association, such as method to form an association, bylaws, membership requirements etc.
12. Rigorous research on market import substitution with importers or animal feed manufacturers for yuca flour as a substitute for animal feed. Determine their requirements and establish a customer and product profile for the flour. Create a customer base to provide to the various beneficiaries.
13. Rigorous research with glucose importers for the purchase of yuca for glucose in their markets or utilization. Determine their requirements and establish a customer and product profile for the glucose. Create a customer base to provide to the various beneficiaries.
14. Review and the evaluate cultivars the test plots, those that mature in the 1st year, in conjunction with Dr. Ceballos and Mr. Escobar for future utilization in the area tested in and for new areas to be tested. If testing is successful, varieties must have a minimum yield of 30 tons per hectare and costs to be what is determined to be feasible, determine cultivars that will produce best quality for area and the potential buyers. This evaluation to be a written report from
15. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from Dr. Ceballos and Mr. Escobar.
16. Determine funds available and budget for growth of the 2nd year.

2nd Year

1. If due diligence proves positive on the marketing, processing, and production of the yuca for glucose and flour, engineer and design a proto-type facilities for the processing of the yuca in the initial areas of production. Increase the acreage of yuca so can supply the production of yuca and the market demand. These would be experimental facilities in order to determine the true nature of the market, commercial production from the farm level of the yuca, method of TA that will be needed for the beneficiaries for yuca in the future, and the TA for the consolidator in the processing of yuca in the two facilities.
2. Negotiate and renew agreements with CORPOICA and CIAT to continue the testing of the yuca and TA of the beneficiaries in the designated areas of Putumayo. TA should be for both high cyanide and low cyanide cultivars, in case there is any difference in the cultural practices. Emphasis of the low cyanide varieties should be placed on the post-harvest handling, such as covering with paraffin wax to prevent physiological damage by not allowing the oxygen to attack any damaged tissue portion of the yuca or to have storage that is constructed such that it yuca is cured during the storage time. Environment of the storage is 30 degrees centigrade and 85% relative humidity and the roots are treated with an antimicrobial agent to prevent microbial growth. Another method is packing the roots in a plastic bag and treating them immediately with a fungicide.
3. Negotiate and renew strategic linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides.
4. Follow the same procedures of the 1st year in soil selection, “target soil” and soil preparation and analysis and amendments to the soil for balance.
5. Start doing due diligence on glue industry for a possible market potential in this arena and the type of facility that will be needed to be built for the production of glue.
6. Plant varieties per area as per yield results in acreage large enough to supply the proposed plant.
7. Contact potential buyers for glucose and animal feed and investigate signing contracts with them for the future.

8. Plant test plots in other areas as deemed feasible by CORPOICA and CIAT. Establish guidelines for them to determine the feasible locations for the test plots for appropriate controls. Cultivars that are tested should be both high cyanide cultivars and low cyanide varieties, in order to determine the potential of both varieties.
9. Continue to identify and analyze the "target soils" through CORPOICA & CIAT.
10. Research the mechanization of yuca planting and harvesting through CLAYUCA of CIAT.
11. Provide TA to of beneficiaries to produce yuca for the proposed facilities. Even if the processing proves to be unfeasible, the beneficiaries for the production of yuca for individual consumption will need the TA.
12. If consolidator is an association, need some TA for those to be the Association, such as method to form an association, bylaws, membership requirements etc.
13. Provide TA in the methods utilized to enlist pact signers to grow yuca for the consolidator under a contractual basis.
14. Thorough training of consolidator and staff in the understanding and operations of the processing facility as devised by CLAYUCA.
15. Provide TA to the designated consolidator in terms of harvesting, post-harvesting, sizing, packaging, costing, QA, and shipping of the products.
16. Provide TA for engineering and design of facilities. TA on what equipment is needed for new facility. This to be done in conjunction with CLAYUCA. If research is positive, then build the facility that has the most potential first. The facility should be located logistically to have yuca transported to it with relative ease from the prospective producers of yuca.
17. Review and the evaluate cultivars the test plots, those that mature in the 1st year, in conjunction with Dr. Ceballos and Mr. Escobar for future utilization in the area tested in and for new areas to be tested. If testing is successful, determine cultivars that will produce best quality for area and the potential buyers. This evaluation to be a written report from
18. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from Dr. Ceballos and Mr. Escobar.
19. Budget for this to be determined for the 3rd year and this will determine the activities for the year.

3rd-5th Years

1. Continue strategic alliances and linkages with CIAT, Syngenta, UMATA, and CORPOICA.
2. Continue TA as post project with consolidators and produces from years 1 & 2.
3. Follow the same rollout as for expansion to other areas and expansion of the processing facilities for glucose and animal feed.
4. End of year determine select cultivars and expand in utilization for the next year. Dr. Ceballos and Mr. Escobar in will submit the written evaluations to Chemonics.
5. Research "target soils" for test plots through CIAT.
6. CORPOICA assistance to develop soil texture and nutritional levels in conjunction with CIAT for the most positive responses by the designated planted cultivars.
7. Establish planting dates in the in all new areas.
8. If testing of yuca is successful, determine other locations for test plots and facilities can be built in the Putumayo region.
9. In conjunction with CORPOICA, PNDA, and UMATA, determine a consolidator. Provide TA on harvesting, post harvesting, processing, packaging, and marketing to the consolidator.

Corn (Maize)

1st Year

1. Sign strategic alliances with CORPOICA & CIAT technical assistance and training. Furthermore, to manage the test plots and determine the location of the test plots. Test plots designed to determine what cultivars in respective areas are adaptable to that environment and possess the highest yields. This would be a renewable yearly contract.
2. Negotiate linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides. This would be a renewable yearly contract.
3. Plant cultivars that are recommended by CIAT & CORPOICA. Plant the cultivars in the test plots on the "targeted soil" that is the choice of CIAT & CORPOICA, this would be what is going to be like soil and conditions that will be utilized if the testing is successful. Test plots to be no more than ¼ hectare. There should be two sights for substantiation of microclimates in the area.
4. Do soil preparation and add amendments as specified by CIAT & CORPOICA, and receive input from CIAT. Soil after soil analysis, soil amendments, and preparation are completed, utilize the appropriate cultivars that are recommended.
5. Workshops and seminars provided by CORPOICA & CIAT in the areas throughout the year to cover the TA that is delineated in the report and that which CORPOICA & CIAT ascertain is necessary with the pact signers. Have meetings with pact signers that want to participate with the program and start TA for them on corn production. This illustrate to the beneficiaries the actual product in all formats, such as ground preparation, planting and cultural practices, harvesting and post-harvest handling. TA to include all the areas that are defined in the above report for TA. Being there is worth a thousand photographs. Trainers should be part of this TA. The TA to include focus on post harvesting and drying in order to prevent quality deterioration. Train the trainers.
6. Study the feasibility of what can be mechanized in farming of corn.
7. Establish planting dates for corn to have year around supply.
8. Chemonics in conjunction with CORPOICA & CIAT perform due diligence to ascertain if processing of the rice can be done.
9. If research is positive for a central processing facility, through CIAT & CORPOICA, determine individual or group for a consolidator in one area. Commence TA for production, harvesting, post-harvest, processing, packaging, and QA, on an individual basis
10. Review and the evaluate cultivars the test plots, those that mature in the 1st year, in conjunction with CIAT & CORPOICA for future utilization in the area tested in and for new areas to be tested. If testing is successful, determine cultivars that will produce best quality for area. The evaluation to be a written report from CIAT & CORPOICA.
11. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from CIAT & CORPOICA.
12. Determine funds available and budget accordingly for growth of the 2nd year.

2nd Year

1. Investigate building a dryer for corn in specific areas in order to produce less expensive corn with higher quality.
2. Negotiate and renew strategic alliances with CIAT & CORPOICA for TA and training. Furthermore, to manage the test plots and determine the location of the test plots. Plant

those cultivars that are determined to be the highest in yields with the superior quality. To continue to have new test plots and test any new cultivars that are developed.
3. Negotiate and renew strategic linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides.
4. Provide TA to of beneficiaries to produce corn for the proposed facilities. Even if the processing proves to be unfeasible, the beneficiaries for the production of corn for individual consumption will need the TA. Trainers should be part of this TA.
5. If determine to build a drying facility, review with CIAT.
6. Continue to approach mechanization of the rice industry in Putumayo.
7. If consolidator is an association, need some TA for those to be the Association, such as method to form an association, bylaws, membership requirements etc.
8. Review and the evaluate cultivars the test plots, those that mature in the 1st year, in conjunction with CIAT & CORPOICA for future utilization in the area tested in and for new areas to be tested. If testing is successful, determine cultivars that will produce best quality for area and the potential buyers. This evaluation to be a written report from
9. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from CIAT & CORPOICA.
10. Budget for this to be determined for the 3rd year and this will determine the activities for the year.

3rd-5th Years

1. Negotiate and renew strategic alliances with CIAT & CORPOICA for TA and training. Furthermore, to manage the test plots and determine the location of the test plots. Plant those cultivars that are determined to be the highest in yields with the superior quality. To continue to have new test plots and test any new cultivars that are developed.
2. Negotiate and renew strategic linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides.
3. If research proves feasible for a facility, engineer and design a facility in conjunction with CIAT.
4. CIAT & CORPOICA to provide TA to develop soil texture and nutritional levels for the most positive responses by the designated planted cultivars.
5. Continue TA as post project with consolidators and produces from years 1 & 2.
6. Trainers should be part of this TA.

Rice

1st Year

1. Sign strategic alliances with CORPOICA, FEDEARROZ, & CIAT technical assistance and training. Furthermore, to manage the test plots and determine the location of the test plots. Test plots designed to determine what cultivars in respective areas are adaptable to that environment and possess the highest yields. This would be a renewable yearly contract.
2. Negotiate linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides. This would be a renewable yearly contract.
3. Plant cultivars that are recommended by CIAT, FEDEARROZ, & CORPOICA. Plant the cultivars in the test plots on the “targeted soil” that is the choice of CIAT, FEDEARROZ, & CORPOICA, this would be what is going to be like soil and conditions that will be

utilized if the testing is successful. Test plots to be no more than ¼ hectare. There should be two sights for substantiation of microclimates in the area.

4. Do soil preparation and add amendments as specified by CIAT, FEDEARROZ, & CORPOICA, and receive input from CIAT. Soil after soil analysis, soil amendments, and preparation are completed, utilize the appropriate cultivars that are recommended.
5. Do market research on imported rice to Putumayo region to determine the amount and the prices paid by the residents of the Putumayo region. Determine where the largest consumption and the largest amount imported is so that the TA and the test plots can focus more assiduously in these areas.
6. Workshops and seminars provided by CORPOICA & FEDEARROZ in the areas throughout the year to cover the TA that is delineated in the report and that which CORPOICA & FEDEARROZ ascertain is necessary with the pact signers. Have meetings with pact signers that want to participate with the program and start TA for them on rice production. This illustrate to the beneficiaries the actual product in all formats, such as ground preparation, planting and cultural practices, harvesting and post-harvest handling. TA to include all the areas that are defined in the above report for TA. Being there is worth a thousand photographs. The TA to include focus on post harvesting and drying in order to prevent quality deterioration. Train the trainers. Trainers should be part of this TA.
7. Chemonics in conjunction with FEDEARROZ & CIAT perform due diligence to ascertain if processing of the rice can be done regionally as an import substitute.
8. Investigate growing irrigated rice with CIAT in the Putumayo region and where. If so, identify program to with CIAT to grow rice as an irrigated crop in Putumayo for the future.
9. Study the feasibility of what can be mechanized in dry land farming of rice.
10. Establish planting dates for rice to have year around supply.
11. If research is positive for a central processing facility, through CIAT, FEDEARROZ, & CORPOICA, determine individual or group for a consolidator in one area. Commence TA for production, harvesting, post-harvest, processing, packaging, and QA, on an individual basis
12. Review and the evaluate cultivars the test plots, those that mature in the 1st year, in conjunction with CIAT, FEDEARROZ, & CORPOICA for future utilization in the area tested in and for new areas to be tested. If testing is successful, determine cultivars that will produce best quality for area and the potential buyers. This evaluation to be a written report from CIAT, FEDEARROZ, & CORPOICA.
13. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from CIAT, FEDEARROZ, & CORPOICA.
14. Determine funds available and budget accordingly for growth of the 2nd year.

2nd Year

1. Investigate building a dryer for rice in specific areas in order to produce less expensive rice with higher quality.
2. Negotiate and renew strategic alliances with CIAT, FEDEARROZ, & CORPOICA for TA and training. Furthermore, to manage the test plots and determine the location of the test plots. Plant those cultivars that are determined to be the highest in yields with the superior quality. To continue to have new test plots and test any new cultivars that are developed.
3. Negotiate and renew strategic linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides.

4. Provide TA to of beneficiaries to produce rice for the proposed facilities. Even if the processing proves to be unfeasible, the beneficiaries for the production of rice for individual consumption will need the TA. Trainers should be part of this TA.
5. If it is determined that it is feasible to grow irrigated rice, implement a program to do this.
6. If determine to build a drying facility, review with FEDARROZ. They have several dryers that could be tested with them.
7. Continue to approach mechanization of the rice industry in Putumayo.
8. If consolidator is an association, need some TA for those to be the Association, such as method to form an association, bylaws, membership requirements etc.
9. Review and the evaluate cultivars the test plots, those that mature in the 1st year, in conjunction with CIAT, FEDEARROZ, & CORPOICA for future utilization in the area tested in and for new areas to be tested. If testing is successful, determine cultivars that will produce best quality for area and the potential buyers. This evaluation to be a written report from
10. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from CIAT, FEDEARROZ, & CORPOICA.
11. Budget for this to be determined for the 3rd year and this will determine the activities for the year.

3rd-5th Years

1. Negotiate and renew strategic alliances with CIAT, FEDEARROZ, & CORPOICA for TA and training. Furthermore, to manage the test plots and determine the location of the test plots. Plant those cultivars that are determined to be the highest in yields with the superior quality. To continue to have new test plots and test any new cultivars that are developed.
2. Negotiate and renew strategic linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides.
3. If research proves feasible for a facility, engineer and design a facility in conjunction with FEDEARROZ.
4. CIAT, FEDEARROZ, & CORPOICA to provide TA to develop soil texture and nutritional levels for the most positive responses by the designated planted cultivars.
5. Continue TA as post project with consolidators and produces from years 1 & 2. Trainers to be included in the TA.

Platanos

1st Year

1. Sign strategic alliances with CORPOICA & INIBAP technical assistance and training. Furthermore, to manage the test plots and determine the location of the test plots. Test plots designed to determine what cultivars in respective areas are adaptable to that environment and possess the highest yields. This would be a renewable yearly contract.
2. Negotiate linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides. This would be a renewable yearly contract.
3. Plant cultivars that are recommended by CORPOICA & INIBAP. Plant the cultivars in the test plots on the “targeted soil” that is the choice of CORPOICA, CIAT & INIBAP, this would be what is going to be like soil and conditions that will be utilized if the testing is

successful. Test plots to be no more than ¼ hectare. There should be two sights for substantiation of microclimates in the area.

4. Do soil preparation and add amendments as specified by CORPOICA, CIAT & INIBAP, and receive input from CIAT. Soil after soil analysis, soil amendments, and preparation are completed, utilize the appropriate cultivars that are recommended.
5. Establish planting dates for platanos to have year around supply.
6. Have meetings with pact signers that want to participate with the program and start TA for them on platano production. This illustrate to the beneficiaries the actual product in all formats, such as ground preparation, planting and cultural practices, harvesting and post-harvest handling. TA to include all the areas that are defined in the above report for TA. Workshops and seminars provided by CORPOICA & INIBAP in the areas throughout the year to cover the TA that is delineated in the report and that which CORPOICA & INIBAP ascertain is necessary with the pact signers. Being there is worth a thousand photographs. Trainers should be part of this TA.
7. Review and the evaluate cultivars the test plots, those that mature in the 1st year, in conjunction with CORPOICA & INIBAP for future utilization in the area tested in and for new areas to be tested. If testing is successful, determine cultivars that will produce best quality for area. This evaluation to be a written report from CORPOICA & INIBAP.
8. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from CORPOICA & INIBAP.
9. Determine funds available and budget accordingly for growth of the 2nd year.

2nd Year

1. Negotiate and renew agreements with CORPOICA & INIBAP to continue the testing of the platanos and TA of the beneficiaries in the designated areas of Putumayo.
2. Negotiate and renew strategic linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides.
3. Follow the same procedures of the 1st year in soil selection, “target soil” and soil preparation and analysis and amendments to the soil for balance.
4. Plant varieties per area as per yield results in acreage large enough to supply the proposed plant.
5. Plant test plots in other areas as deemed feasible by CORPOICA & INIBAP. Establish guidelines for them to determine the feasible locations for the test plots for appropriate controls.
6. Continue to identify and analyze the “target soils” through CORPOICA & INIBAP.
7. Review and the evaluate cultivars the test plots, those that mature in the 1st year, in conjunction with CORPOICA & INIBAP for future utilization in the area tested in and for new areas to be tested. If testing is successful, determine cultivars that will produce best quality for area and the potential buyers. This evaluation to be a written report from
8. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from CORPOICA & INIBAP.
9. Budget for this to be determined for the 3rd year and this will determine the activities for the year.

3rd-5th Years

1. Continue strategic alliances and linkages with Syngenta, CORPOICA & INIBAP.
2. Continue TA as post project with consolidators and produces from years 1 & 2.

3. End of year determine select cultivars and expand in utilization for the next year. CORPOICA & INIBAP in will submit the written evaluations to Chemonics.
4. Research "target soils" for test plots through CIAT.
5. CORPOICA & INIBAP assistance to develop soil texture and nutritional levels in conjunction with CIAT for the most positive responses by the designated planted cultivars.
6. Establish planting dates in the in all new areas.
7. If testing of platano is successful, determine other locations for test plots and facilities can be built in the Putumayo region.

Palmito

1st Year

1. Select areas to grow test plot, this could be in several cities, depending on the funds to be allocated. .
2. Negotiate strategic alliances with UMATA, local NGOs, and CORPOICA for technical assistance and training. Furthermore, to manage the test plots and determine the location of the test plots. This would be a renewable yearly contract.
3. Negotiate linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides. This would be a renewable yearly contract.
4. Negotiate strategic alliance with Almacigos for seedling production in their nursery facility in Bogota. Have them start seedling program as soon as agreement is signed. This would be a renewable yearly contract.
5. Plant cultivars that are recommended by CORPOICA. Plant the cultivars in the test plots on the "targeted soil" that is the choice of CORPOICA this would be what is going to be like soil and conditions that will be utilized if the testing is successful. Test plots to be no more than ½ hectare. There should be two sights for substantiation of microclimates in the area.
6. Thorough market research, domestic and international markets to determine the feasibility of marketing palmito from Putumayo. Do market research to determine customer base in Bogota and customer demands of quality and purchase potential. Do market research to determine customer base in the EU and the US and customer demands of quality and purchase potential.
7. Thorough due diligence of the production and processing of palmito in Putumayo to determine the feasibility of processing palmito there.
8. Establish planting dates for palmitos to have year around supply. It is critical to determine this, due to the need to have a supply to the customers and to maintain efficiency in the facility.
9. Have meetings with pact signers that want to participate with the program and start TA program for them on the vegetables. Provide TA through CORPOICA and UMATA to the potential beneficiaries in the areas that the test plots are being organized. Determine key areas of needed for TA for the beneficiaries. Have the test plots accessible to the beneficiaries to illustrate to them the actual product in all formats, such as ground preparation, planting and cultural practices, harvesting and post-harvest handling. Being there is worth a thousand photographs. TA to include all the areas that are defined in the above report for TA. Trainers should be part of this TA.
10. Due diligence on feasibility of Agroamazonia and provide TA with them and their producers on areas such as soil preparation, soil management, disease control, weed control, harvesting, post-harvesting etc.

11. If market research and due diligence on Agro and cost are positive, in 3rd quarter assist Agroamazonia In engineering and designing a facility for the processing of palmitos.
12. Review and the evaluate cultivars the test plots, those that mature in the 1st year, in conjunction with CORPOICA, determine for future utilization in the area tested in and for new areas to be tested. If testing is successful, determine cultivars that will produce best quality for area and the potential buyers. This evaluation to be a written report from CORPOICA.
13. Evaluate cultural practices to improve the products for the actual planting. This evaluation to be a written report from CORPOICA and UMATA.
14. Determine funds available and budget accordingly for growth of the 2nd year.

2nd Year

1. Negotiate and renew strategic alliances with UMATA, local NGOs, and CORPOICA for technical assistance and training. Furthermore, to manage the test plots and determine the location of the test plots.
2. Middle of the year determine cultivars that are most productive for processing and begin planting in the "targeted soils" in the Puerto Asis area.
3. Negotiate and renew strategic linkages with Syngenta for inputs such as the herbicides, fungicides, fertilizers, and the insecticides.
4. Follow the same procedures of the 1st year in soil selection, "target soils", and soil preparation and analysis and amendments to the soil for balance.
5. Continue TA as per program with Agroamazonia And producers in the cultural practices of growing, harvesting, post-harvesting of palmito.
6. Continue with test plots in order to determine the correct cultivars and locations for the palmitos.
7. Plant varieties per area as per yield results in acreage large enough to supply the proposed plant.
8. Provide TA to Agro on harvesting, QA, HACCP, post-harvesting, costing etc.
9. Travel to the EU and US to make contacts with potential customers in order to build a customer base.
10. Continue to provide TA to the potential beneficiaries as per the TA in the first year areas. The TA may be altered due to the findings of the growing in the first year palmito cultivars.
11. Establish strategic linkages with manufacturers of collateral material, such as boxes, glass containers, labels, lids, brochure etc.
12. Start construction in the 4th quarter and have equipment companies being contacted for the necessary equipment. Provide TA in the construction of palmito facility. The construction is based on positive from due diligence from market research, research on Agroamazonia and the positive test results of the varieties.

3rd-5th Years

1. Continue the testing of cultivars through CORPOICA in test plots throughout the Puerto Asis area.
2. Provide TA to the producers in the cultural practices and harvesting, cultivars selection, of Palmito.
3. Provide limited TA with Agroamazonia in processing and marketing.
4. Negotiate and sign an agreement with Negotiate and renew the agreements with CORPOICA, UMATA, and local NGOs to continue to provide TA and oversee test plots that are determined to be needed.

Conclusion

The first area of focus would be to perform the testing of vegetables in various areas of the Putumayo region. Testing would be done in cities such as Puerto Asis, Mocoa, and the other major population cites. Smaller greenhouses should be constructed in these areas and various cultivars that have been listed for the vegetables be tested in these various areas.

This would enable the different beneficiaries and pact signers in the Putumayo region that are being tested to have food security and a short period of time. The investment would not be that would not significant, for a smaller greenhouse and irrigation system would not be that expensive. The concept of a consolidator with a facility would be deferred until the production of the vegetables proved to be feasible and there were markets available for the produce.

Foliage/orchids would be an opportune product to be raised in the Putumayo region. With the weather that is so conducive, and an expanding market of utilization in Bogota, all the parts are ostensibly situated for market penetration. It is critical to do the testing in this to determine the Leatherleaf and the Treefern and the other foliage can be grown with quality in the Putumayo region. This testing would not take a long period of time, therefore allowing a quick appraisal to determine the feasibility of producing foliage/orchids on a profitable basis in the Putumayo region.

The facility would need to be in the major cities that have an airport, such as Puerto Asis. If feasible, this could add significantly to the economy of that city or those cities that are determined to have the facilities. The inflow of cash would be significant for the area and revitalize the economy of the city and the area that the facilities were located.

Testing on yuca for production should be immediately initiated. Agreements should be negotiated and signed with CIAT and CORPOICA in order to do plant test plots throughout the Putumayo region. For the production facilities for value added to be feasible, the tonnage must be in excess of thirty ton. This will be a significant increase of yield that is being accomplished at this time. CIAT would be involved not only in cultivars testing, but also in IPM of yuca and the soil management of the yuca. The entire package is a necessity to be negotiated and signed with CIAT and CORPOICA in order to determine the feasibility of producing yuca to attain the tonnage that is necessary for the profitability in the processing of the product.

In the meantime, research is necessary on the facilities that have been reviewed with Mr. Bernardo Ospina from CLAYUCA, similar to those that are being utilized in Thailand. This would be to determine the plant feasibility application in the Putumayo region. If the due diligence proves to be positive, this could be a mainstay for the Putumayo region producing yuca. With the significant of acreage that could be produced, coca could be replaced with a profitable crop that could be available to the beneficiaries and the pact signers of Putumayo. Furthermore, market research must be commenced in order to determine if the value added products can be marketed as market import substitutes in Colombia. If the market or the

processing of the glucose or flour are ascertained not to be feasible; it is essential to increase the yields of yuca in the Putumayo region and TA should be given to the pact signers to augment their yields through improved cultural practices.

Palmito is one product that due diligence is commenced in the manner of funding for processing. Albeit, there is a domestic import substitute, that market is becoming is declining and not large enough for a significant expansion in the Puerto Asis area. With the over production or hearts of palm in the international market, furher market research in order to determne if the Puerto Asis area can be competitive with processors from other countries.

Concerning the balance of the horticultural crops, rice, corn and platanos, it is essential strategic alliances be negotiated with responsible organizations in order to determine the feasibility of augmented yields in the Putumayo region. This research should entail what the requirements to accomplish these augmented yields. Test plots should be planted throughout the region in order to determine if there is in fact feasibility to create that. If that is in fact true, TA should be provided to the pact signers in order to augment the yields of these horticultural crops throughout the Putumayo region.

For the processing of rice and corn, further due diligence is required to be executed to ascertain if the consolidator would be a feasible concept to be implemented and utilized in Putumayo. If the results of the due diligence are positive, facilities can be constructed in strategic locations in Putumayo in order to provide rice and corn for the Putumayo pact signers and the other residents of the Putumayo region. This could assist the inception of a inter-regional market for the Putumayo region.

No one concept is going to concept is going to eradicate coca and replace the income the pact signers of the Putumayo region. Several aspects of the project will need to be implemented together will enable an increase of income and lifestyle of Putumayo.

ANNEX

Technical Assistance Recommended to the Beneficiaries

Foliage/orchids

Technical assistance-prior to project beginning to the beneficiaries foliage/orchids:

1. Type of mesh covers for the foliage/orchids
2. Training on utilization of irrigation/misting system and how and when to use
3. Soil preparation and soil amendments for suitable soil nutritional levels to reduce acid, aluminum and iron toxicities, and to increase Ph and phosphorous and potash and other microelements
4. Instruments to be used for growing, cultivating etc of flowers and/or foliage
5. Seedling spacing
6. Do’s and Don’ts of raising foliage/orchids
7. Nutritional management of soil and plant after seedlings are planted

8. How to gain and maintain excellent soil drainage during growing cycle of plants
9. Insect identification, management and application of insecticides and the utilization of natural predators- nematode and thrip-IPM
10. Disease identification, management and utilization of fungicides
11. Weed identification, management, and utilization of herbicides to control weeds
12. Soil amendments to be utilized pre & post planting of seedlings
13. Harvesting techniques to harvest product when optimally ready and not damage the harvested product
14. Post harvest regimen to include the cold chain and product handling to not damage product for shipment
15. Training of trainers

Technical assistance-post project starting to the beneficiaries foliage/orchids:

1. Utilization of shaded areas-see notes
2. Soil structure and tolerant levels of Ph, acid, and amendments to utilize to correct soil levels
3. Methodologies of maintaining excellent drainage of the soil
4. Plant spacing – 50,000 to 60,000 to the hectare
5. H20 management to avoid root rot of plants
6. Insect identification, management and application of insecticides and the utilization of natural predators-nematode and thrip-IPM
7. Weed identification, management and application of herbicide to control weeds
8. Disease identification, management and application of fungicides to control diseases
9. Nutritional management of the plant and soil after planting of the seedling
10. Harvesting-appropriate sizing and handling of the plant as to not injure for future harvesting
11. Post harvest handling and maintaining the cold chain and handling of the foliage through shipping
12. Packaging- type of container and methodologies to package for quality shipment to markets
13. Maintenance of processing and refrigeration equipment
14. Grading for quality
15. Leatherleaf - color, length, width of leaves, no insect damage, no disease damage,
16. Treefern – thickness of stem, small foliage, dark green, no thrip damage, length
17. Shipping-type of container and how to maintain freshness and quality in container of product to reach the customer
18. Transporting of product to facility and to airport
19. Training on costing categorization of production, harvesting, and processing of production leaders and consolidator
20. Facility maintenance with a preventive maintenance program and efficient operation of production of product
21. Record keeping of pertinent facts and figures for future reference
22. Export market plan
23. Market training of sales staff for cold calls, customer profiles, introductory letters to customers, pricing etc.
24. Business plan, to include strategic plan and production plan
25. Business training to the consolidator-i.e. strategic planning, employee satisfaction, an accounting of in-house procedures, QA plan, marketing principals
26. Methodologies on evaluation techniques of cultivars
27. Train the trainers from local organizations, UMATA if it is the one

Vegetables

Technical assistance-prior to project beginning to the beneficiaries vegetables:

1. Soil preparation- methodologies to eliminate compaction to allow good root growth
2. Type of greenhouse to construct and where
3. Soil composition nutritionally and how to achieve nutritional and ingredient levels of soil for products to be produced, i.e. amending with compost to build up organic matter, lime to reduce acidic levels and increase Ph, phosphate etc.
4. Irrigation-understand usage of drip system and different crops use different water tube spacing and water amounts
5. Do's and Don'ts of raising crops
6. Crop rotation of various vegetables that are being planted
7. Optimum planting dates for varieties to gain best yields and quality
8. Seedling and seed plant spacing
9. Germination moisture for seeded and seedlings, correct and acceptable to avoid root dampening if too much water or die due to lack of water
10. Vegetable varieties that can be planted together without contamination of the others
11. Insect identification, management and application of insecticides and the utilization of natural predators- IPM
12. Weed identification, management and application of herbicide to control weeds
13. Disease identification, management and application of fungicides to control diseases
14. How to manage the humidity and temperature of the greenhouse
15. Soil amendments to be utilized pre & post planting of seed and seedlings
16. Tying tomatoes and cucumbers to the poles
17. Pollination
18. Harvesting techniques to avoid product damage and reduce of yields and correct size of products, the handling of the product so as not to damage the product and reduce yields
19. Post harvest handling, to maintain the cold chain and the correct temperatures for individual products
20. Processing and packaging to meet the local standards of quality
21. Train the trainers

Technical assistance-post project starting to the beneficiaries vegetables:

1. Soil preparation and nutritional amendment of soil for soil structure and acceptable tolerant levels of Ph, acid, and other soil makeup
2. Appropriate management of greenhouse and comprehension of greenhouse maintenance
3. Seed and seedling spacing
4. Water management to avoid root rot
5. Insect identification, management and application of insecticides and the utilization of natural predators- IPM
6. Weed identification, management and application of herbicide to control weeds
7. Nutritional management of the plants and fertilizer applications after planting of seed and seedlings
8. Diseases-probably single largest problem when growing crops in this environment, identification, management, and application of fungicides
9. Water and moisture management at germination and post germination

10. Pollination techniques
11. Temperature & humidity management of greenhouse
12. Harvesting-size, color, quality etc of each product that is being grown
13. Post harvesting, when, quality, care of plants, container to use, timing of moving harvesting product to facility through market distribution
14. Transportation of products from field to processing and to market
15. Training on costing categorization of production, harvesting, and processing of the individual products
16. Individual product cold chain requirements
17. Record keeping of pertinent facts and figures for future reference
18. Facility maintenance, to include a preventive maintenance program, and efficient operation from arrival of product through refrigeration and distribution of product
19. Inventory keeping and management and handling of harvested products
20. Packaging of products with quality and sizing
21. Storage of products in correct environment i.e. humidity, temperature, odor transference
22. How to obtain pertinent market information
23. Business plan, to include strategic plan and production plan
24. Business training to the consolidator-i.e. strategic planning, employee satisfaction, an accounting of in-house procedures, QA plan, marketing principals
25. Methodologies on evaluation techniques of cultivars
26. Train the trainers from local organizations, UMATA if it is the one Organizations to have alliances with

Yuca

Technical assistance-prior to project beginning to the beneficiaries yuca:

1. Soil preparation- methodologies to eliminate compaction to allow good root growth
2. Soil composition nutritionally and how to achieve nutritional and ingredient levels of soil for yuca to achieve maximum growth, i.e. amending with compost to build up organic matter, lime to reduce acidic levels and increase Ph, phosphate etc.
3. How to identify of “target soils” and obtain analysis to determine which soil to utilize to produce crops on
4. Plant selection to prevent indigenous diseases of the area is one of the most critical factors. Should be through workshops, field days and other forms of instruction to the producers to ensure that the plant lines are kept clean
5. Plant planting timing to guarantee continuous supply to the facility on a year around basis and plant spacing
6. Instruments and equipment to be used for growing, cultivating etc
7. Nutritional management of plant and soil after planting
8. Disease identification, management and application of fungicides– cassava bacterial blight,(used disease free cuttings and tolerant cultivars); brown leaf spot, cassava mosaic disease, cassava, anthracrose disease
9. Weed identification, management, and application of herbicides and/or cultivation
10. Insect identification, management and application of insecticide or utilization of predators to control insects (IPM)- green mites, thrips, (use tolerant and resistant cultivars), cassava hornworm, ants, termites, and mealy bugs

11. Soil amendments to be utilized post planting of cuttings to maintain plant nutritional level
12. Harvesting techniques and the handling to avoid product damage and therefore the reduction of yields; establish the correct size of root;
13. Post harvest – susceptible to damage, highly perishable and poor in storage, this to include the timing from harvest location to the facility
14. Train the trainers from local organizations, UMATA if it is the one Organizations to have alliances with

Technical assistance-post project starting to the beneficiaries yuca:

1. Soil preparation for maintaining drainage of the soil and H2O management to avoid root rot
2. Soil composition nutritionally and how to achieve nutritional and ingredient levels of soil for yuca to achieve maximum growth, i.e. amending with compost to build up organic matter, lime to reduce acidic levels and increase Ph, phosphate etc.
3. Cultivars selection for specific area, soil and weather conditions
4. Planting techniques and plant spacing
5. Plant planting timing to guarantee continuous supply to the facility on a year around basis
6. Plant selection to prevent indigenous diseases of the area is one of the most critical factors. Should be through workshops, filed days and other forms of instruction to the producers to ensure that the plant lines are kept clean
7. Disease identification, management and application of fungicides– cassava bacterial blight,(used disease free cuttings and tolerant cultivars); brown leaf spot, cassava mosaic disease, cassava, anthracrose disease
8. Weed identification, management, and application of herbicides and/or cultivation
9. Insect identification, management and application of insecticide or utilization of predators to control insects (IPM)- green mites, thrips, (use tolerant and resistant cultivars), cassava hornworm, ants, termites, and mealy bugs
10. Harvesting techniques and the handling to avoid product damage and therefore the reduction of yields; establish the correct size of root;
11. Post harvest – susceptible to damage, highly perishable and poor in storage, this to include the timing from harvest location to the facility
12. Facility maintenance, to include a preventive maintenance program, and efficient operation from arrival of product through bagging and distribution of the product
13. Thorough training to consolidator and staff in the understanding and operation of the processing facility as devised by CLAYUCA
14. Processing production efficiency techniques
15. Record keeping of pertinent facts and figures for future reference and utilization
16. Training on costing categorization of production, harvesting and processing
17. Packaging and shipping- what type of collateral material to utilize
18. Product storage and inventory to maintain quality and product rotation
19. Methods of contacting and securing prospective customers-cold calls, introductory letters, customer profiles, buyer profiles etc.
20. Business plan, to include strategic plan and production plan
21. Business training to the consolidator- i.e. strategic planning, employee satisfaction, an accounting of in-house procedures, QA plan
22. Methodologies on evaluation techniques of cultivars

23. Train the trainers from local organizations, UMATA if it is the one Organizations to have alliances with

Corn

Technical assistance-prior to project beginning to the beneficiaries corn:

1. Soil preparation- methodologies to eliminate compaction to allow good root growth
2. Soil composition nutritionally and how to achieve nutritional and ingredient levels of soil for corn to achieve maximum growth, i.e. amending with compost to build up organic matter, lime to reduce acidic levels and increase Ph, phosphate etc.
3. How to identify of "target soils" and obtain analysis to determine which soil to utilize to produce crops on
4. Seed spacing at planting time to gain maximum yield
5. Instruments and equipment to be used for growing, cultivating etc
6. Nutritional management of plant and soil after planting
7. Nutritional management of plant and soil
8. Disease identification, management and application of fungicides to control diseases– leaf spot rust, maize stredivirus, downy mildew, fusarium verticlliods
9. Weed identification, management, and application of herbicides and/or cultivation to control weeds
10. Insect identification, management and application of insecticide or utilization of predators to control insects (IPM)- carpophilus dimidiatus, sitophilus zea mais, cutworm, army worm, aphid, freen moth
11. Soil amendments to be utilized post planting of seed
12. Harvesting techniques and the handling to avoid product damage and therefore the reduction of yields; establish the correct size of ear
13. Post harvest –Maintaining dryness for product to avoid storage fungi and insect infestation
14. Train the trainers from local organizations, UMATA if it is the one Organizations to have alliances with

Technical assistance-post project starting to the beneficiaries corn:

1. Maintaining drainage of the soil and H2O management to avoid root rot
2. Soil preparation- methodologies to eliminate compaction to allow good root growth
3. Soil composition nutritionally and how to achieve nutritional and ingredient levels of soil for corn to achieve maximum growth, i.e. amending with compost to build up organic matter, lime to reduce acidic levels and increase Ph, phosphate etc.
4. How to identify of "target soils" and obtain analysis to determine which soil to utilize to produce crops on
5. Seed spacing and depths, and techniques planting time to gain maximum yield
6. Cultivars selection for specific area, soil and weather conditions to minimize diseases and maximize yields
7. Disease identification, management and application of fungicides to control diseases– leaf spot rust, maize stredivirus, downy mildew, fusarium verticlliods
8. Weed identification, management, and application of herbicides and/or cultivation to control weeds
9. Insect identification, management and application of insecticide or utilization of predators to control insects (IPM)- carpophilus dimidiatus, sitophilus zea mais, cutworm, army worm, aphid, freen moth

10. Soil amendments to be utilized post planting of seed
11. Harvesting techniques and the handling to avoid product damage and therefore the reduction of yields; establish the correct size of ear
12. Post harvest –Maintaining dryness for product to avoid storage fungi and insect infestation
13. Facility maintenance, to include a preventive maintenance program, and efficient operation from arrival of product through bagging and distribution of the product
14. Record keeping of pertinent facts and figures for future reference and utilization
15. Product storage to maintain quality and product rotation
16. Methodologies on evaluation techniques of cultivars
17. Training of cost accounting and management of production
18. Train the trainers from local organizations, UMATA if it is the one Organizations to have alliances with
19. How the producer can produce their own seed
20. Cultivars selection for specific area, soil and weather conditions

Rice

Technical assistance-prior to project beginning to the beneficiaries rice:

1. Soil preparation- methodologies to eliminate compaction to allow good root growth
2. Soil composition nutritionally and how to achieve nutritional and ingredient levels of soil for corn to achieve maximum growth, i.e. amending with compost to build up organic matter, lime to reduce acidic levels and increase Ph, phosphate etc.
3. How to identify of “target soils” and obtain analysis to determine which soil to utilize to produce crops on
4. Seedling spacing
5. Instruments to be used for growing
6. Insect identification, management and application of insecticides and the utilization of natural predators- IPM
7. Weed identification, management and application of herbicide to control weeds
8. Nutritional management of the plants and fertilizer applications after planting of seedlings post planting
9. Diseases-probably single largest problem when growing crops in this environment, identification, management, and application of fungicides
10. Harvesting techniques to avoid product damage and reduction of yields and correct size of grain the handling of the grain so as not to damage and reduce yields
11. Post harvest –Maintaining dryness, 14%, for product to avoid storage fungi infestation
12. Train the trainers from local organizations, UMATA if it is the one Organizations to have alliances with

Technical assistance-post project starting to the beneficiaries rice:

1. Soil preparation- methodologies to eliminate compaction to allow good root growth
2. Soil composition nutritionally and how to achieve nutritional and ingredient levels of soil for corn to achieve maximum growth, i.e. amending with compost to build up organic matter, lime to reduce acidic levels and increase Ph, phosphate etc.
3. Cultivars selection for specific area, soil and weather conditions and testing that has been performed
4. Planting depths, techniques and plant spacing

5. Insect identification, management and application of insecticides and the utilization of natural predators- IPM
6. Weed identification, management and application of herbicide to control weeds
7. Nutritional management of the plants and fertilizer applications after planting of seedlings post planting
8. Diseases-probably single largest problem when growing crops in this environment, identification, management, and application of fungicides
9. Harvesting techniques and timing concerning size and quality, 23%-26% moisture at time of harvesting and need to move to drying quickly to avoid kernel damage from bacterial and fungal disease
10. Post harvest handling and movement quickly and efficiently to processing in order to attain dryness of 14%
11. Record keeping of pertinent facts and figures for future reference and utilization
12. Product storage to maintain dryness, 14%, and quality and product rotation
13. Methodologies on evaluation techniques of cultivars
14. Training of cost accounting of production
15. How the producer can produce their own seed]
16. Train the trainers from local organizations, UMATA if it is the one Organizations to have alliances with

Platano

Technical assistance-prior to project beginning to the beneficiaries platanos:

1. Soil preparation- methodologies to eliminate compaction to allow good root growth
2. Soil composition nutritionally and how to achieve nutritional and ingredient levels of soil for corn to achieve maximum growth, i.e. amending with compost to build up organic matter, lime to reduce acidic levels and increase Ph, phosphate etc.
3. How to identify of “target soils” and obtain analysis to determine which soil to utilize to produce crops on
4. Seedling spacing
5. Cultivars selection to prevent indigenous diseases of the area
6. Instruments and equipment to be used for growing
7. Nutritional management of plant and soil post planting
8. Disease identification, management and application of fungicides to control diseases- Black Signatoka, Fungal leaf spot, Banana Strechtura, Cosnopolits Sordidus, Cestnioner Humbolti,
9. Insect identification, management and application of insecticides and the utilization of natural predators- IPM
10. Weed identification, management and application of herbicide to control weeds
11. Harvesting techniques to avoid product damage and reduction of yields, correct size of product, and the handling of the product so as not to damage and reduce yields
12. Post harvest –Maintaining careful handling not injure the product which will cause bruising and decay and spoilage
13. Train the trainers from local organizations, UMATA if it is the one Organizations to have alliances with

Technical assistance-post project starting to the beneficiaries platano:

1. Maintaining drainage of the soil and H2O through proper pre planting soil preparation and post planting soil handling
2. Soil preparation- methodologies to eliminate compaction to allow good root growth
3. Soil composition nutritionally and how to achieve nutritional and ingredient levels of soil for corn to achieve maximum growth, i.e. amending with compost to build up organic matter, lime to reduce acidic levels and increase Ph, phosphate etc.
4. How to identify of “target soils” and obtain analysis to determine which soil to utilize to produce crops on
5. Cultivars selection for specific area, soil and weather conditions
6. Planting depths, techniques and plant spacing
7. Insect identification, management and application of insecticides and the utilization of natural predators- IPM
8. Weed identification, management and application of herbicide to control weeds
9. Disease identification, management and application of fungicides to control diseases- Black Signatoka, Fungal leaf spot, Banana Strechtura, Cosnopolits Sordidus, Cestnioner Humbolti,
10. Harvesting techniques to avoid product damage and reduction of yields, correct size of product, and the handling of the product so as not to damage and reduce yields
11. Post harvest –Maintaining careful handling not injure the product which will cause bruising and decay and spoilage
12. Train the trainers from local organizations, UMATA if it is the one Organizations to have alliances with
13. Record keeping of pertinent facts and figures for future reference and utilization
14. Methodologies on evaluation techniques of cultivars
15. Training of cost accounting and management of production
16. Cost accounting and management of production and harvesting

Palmito

Technical assistance-prior to project beginning to the beneficiaries

1. Maintaining drainage of the soil and H2O through proper pre planting soil preparation and post planting soil handling
2. Soil preparation- methodologies to eliminate compaction to allow good root growth
3. Soil composition nutritionally and how to achieve nutritional and ingredient levels of soil for corn to achieve maximum growth, i.e. amending with compost to build up organic matter, lime to reduce acidic levels and increase Ph, phosphate etc.,
4. How to identify of “target soils” and obtain analysis to determine which soil to utilize to produce crops on
5. Plant selection to prevent indigenous diseases of the area as from the testing that is being done
6. Seedling spacing and depth
7. Instruments and equipment to be used for growing, cultivating etc
8. Nutritional management of the plants and fertilizer applications after planting of seedlings post planting
9. Insect identification, management and application of insecticides and the utilization of natural predators- IPM
10. Weed identification, management and application of herbicide to control weeds
11. Diseases-probably single largest problem when growing crops in this environment, identification, management, and application of fungicides

12. Harvesting techniques to avoid product damage and reduction of yields and correct size of product the handling of the product so as not to damage the product and reduce yields
13. Post harvesting-oxidation happens very quickly, must be immediately taken to facility to package to avoid oxidation of the harvested stalk

Technical assistance-post project starting to the beneficiaries palmito:

1. Maintaining drainage of the soil and H2O through proper pre planting soil preparation and post planting soil handling
2. Soil preparation- methodologies to eliminate compaction to allow good root growth
3. Soil composition nutritionally and how to achieve nutritional and ingredient levels of soil for corn to achieve maximum growth, i.e. amending with compost to build up organic matter, lime to reduce acidic levels and increase Ph, phosphate etc.,
4. How to identify of "target soils" and obtain analysis to determine which soil to utilize to produce crops on
5. Cultivars selection for specific area, soil and weather conditions
6. Plant selection to prevent indigenous diseases of the area as from the testing that is being done
7. Seedling spacing, planting techniques, and depth
8. Instruments and equipment to be used for growing, cultivating etc
9. Nutritional management of soil and plant to maximize yields
10. Insect identification, management and application of insecticides and the utilization of natural predators- IPM
11. Weed identification, management and application of herbicide to control weeds
12. Diseases-probably single largest problem when growing crops in this environment, identification, management, and application of fungicides
13. Harvesting techniques to avoid product damage and reduction of yields and correct size of product the handling of the product so as not to damage the product and reduce yields
14. Post harvesting-oxidation happens very quickly, must be immediately taken to facility to package to avoid oxidation of the harvested stalk
15. Preventive maintenance, to include a preventive maintenance program, of processing facility
16. Thorough training to consolidator and staff in the understanding and operation of the processing facility
17. Processing production efficiency techniques
18. Record keeping of pertinent facts and figures for future reference and utilization
19. Training on costing categorization of production, harvesting and processing
20. Shipping-type of container and how to maintain freshness and quality
21. Packaging and shipping- what type of collateral material to utilize
22. Processing and packaging to meet the local standards of quality
23. Training on the nutritional and labeling requirements of the EU and US
24. Packaging- type of container and methodologies to package for quality shipment to markets
25. Product storage and inventory system to maintain quality and product rotation
26. Methods of contacting and securing prospective customers
27. Business plan, to include strategic plan, market plan, and production plan
28. Export market plan as part of the market plan
29. Market training of sales staff i.e. cold call techniques, how to use the internet, customer profiling, customer manual etc.

30. How to obtain pertinent market information
31. Development and design of collateral material
32. How to use the internet to find customers, pricing for exporting, etc.
33. Methodologies on evaluation techniques of cultivars
34. Business training to the consolidator- i.e. strategic planning, employee satisfaction, an accounting of in-house procedures, QA plan
35. Train the trainers from local organizations, UMATA if it is the one Organizations to have alliances with HACCP training for production

Names and Telephone Numbers and/or Emails of People Contacted			
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Skip Bastanzi	Gemini		Miami, Florida USA
Zeb Jones	Consultant	zebbe@aol.com	Honolulu, Hawaii

Table I- Leatherleaf and Treefern for sizes

Product	**Sizes**		
	Short	Medium	Long
Leatherleaf	25-35 cm	40-52 cm	54+ cm
Treefern	25-35 cm	40-59 cm	60+ cm

Source: Dr. Alberto Roldan

Table II- Variety and Seed Companies on Vegetable Seed

Product	**Variety**
Onions-Yellow	Sun Seeds-Nikita F1, Rio Bravo F1, Don Victor F1, Henry's Speca F1 Tropical Seeds-Tropic Ace F1, Early Texas, Grano 502, Yellow Bermuda, Awahia Syngenta- Testing several varieties and be available for 2002
Onions – Red	Sun Seeds-Hibrido Jojo F1, Gegal PVP, Rosa Linda F1 (1530) Tropical Seeds - Red Creole Syngenta- Testing several varieties and be available for 2002
Pumpkins	Tropical Seeds-howden, Jack Pot, Wizzard, Oz, Happy Jack, Jumpin Jack, Pankow's Filed, Big Autumn, Aspen, Buckskin, Bushkin, Howden Biggie
Tomatoes	Tropical Seeds - Leila, Santa Fe, Rocio, Zuley, Fortaleza from Tropical seeds Sun Seeds-Gloria F1, Vickar F1, Tempra LSL F1, Mangate F1, Daisy, Don Jose F1 Syngenta- Santa Fe, Rocio, Diva, Zulley
Green Onions	Sun Seeds- Cebolla Kiyotaki;
Cucumber	Sun Seeds - Pepino H. Slice Nice F1 Tropical Seeds - Lehua, Gemini-7, Triumph, Challenger, and Burpee, and Patio Pik Syngenta- Centurion
Bell Peppers	Sun Seeds Marte - F1 SXP-1031 Syngenta- Commandant, Pep 1216, Nathalie, Reinger
Carrots	Sun Seeds – Musica F1 SXC-278, Mark II, Condor, Chantenay Royal Syngenta- Testing several varieties and be available for 2002
String Beans	Syngenta- Kentucky Blue Sun Seeds- Arvena Santa Cecilia
Sweet Corn	Syngenta- Testing in Colombia and Brazil and be available in 2002

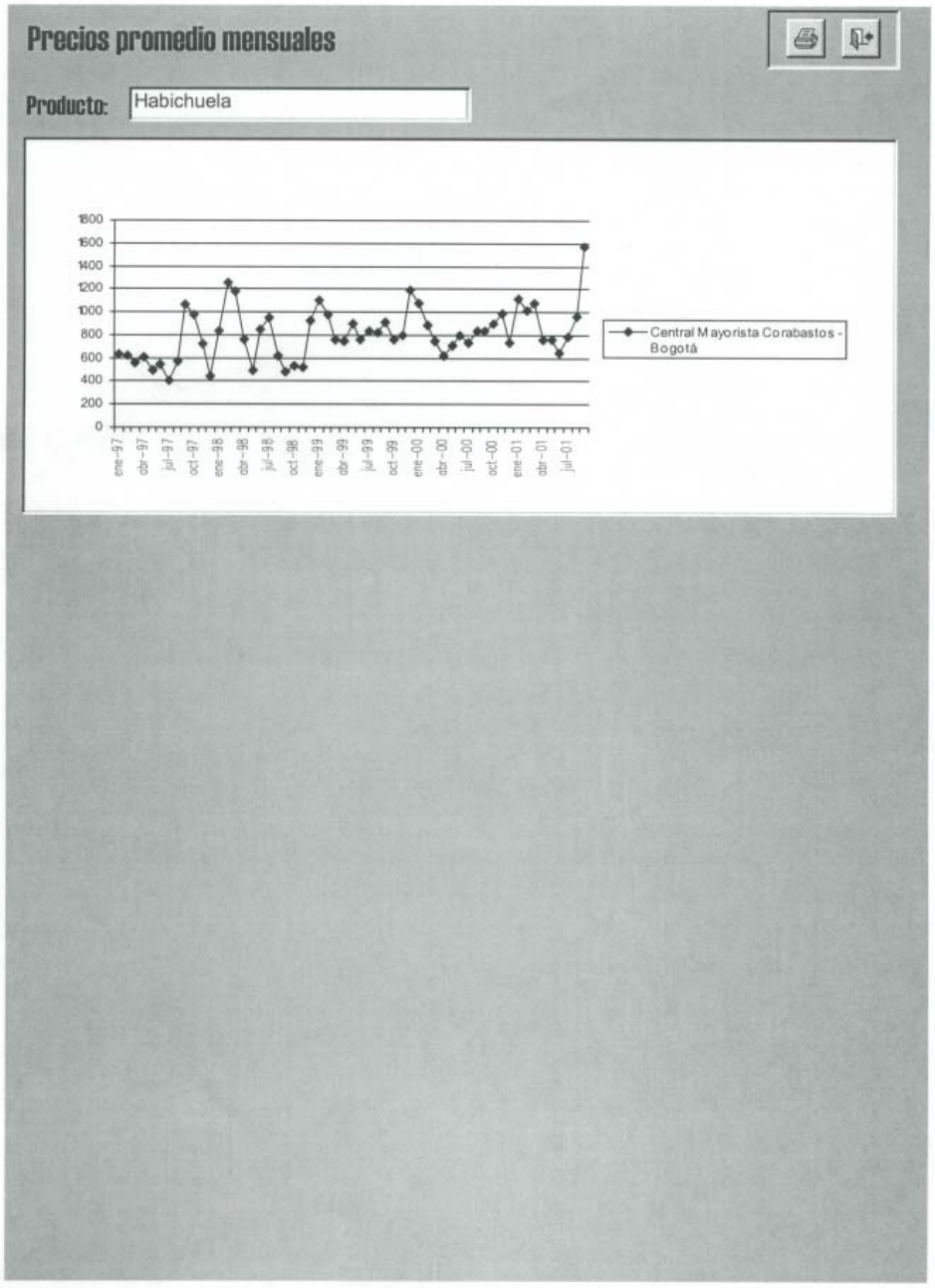


Table III
Source: CCI

Precios promedio mensuales

Mercado: Galería Santa Helena - Cali

Producto: Habichuela

Mes	Unidad	Pr. Promedio
28-ene-98	Kilogramo	799,51
28-feb-98	Kilogramo	760,61
28-mar-98	Kilogramo	676,67
28-abr-98	Kilogramo	278,26
28-may-98	Kilogramo	276,13
28-jun-98	Kilogramo	546,89
28-jul-98	Kilogramo	437,44
28-ago-98	Kilogramo	318,15
28-sep-98	Kilogramo	363,54
28-oct-98	Kilogramo	475,56
28-nov-98	Kilogramo	537,08
28-dic-98	Kilogramo	536,11
28-ene-99	Kilogramo	745,63
28-feb-99	Kilogramo	635,83
28-mar-99	Kilogramo	665,93
28-abr-99	Kilogramo	663,33
28-may-99	Kilogramo	576,88
28-jun-99	Kilogramo	520,19
28-jul-99	Kilogramo	453,33
28-ago-99	Kilogramo	541,21
28-sep-99	Kilogramo	418,54
28-oct-99	Kilogramo	409,74
28-nov-99	Kilogramo	458,52
28-dic-99	Kilogramo	757,41
28-ene-00	Kilogramo	729,38
28-feb-00	Kilogramo	912,22
28-mar-00	Kilogramo	658,89
28-abr-00	Kilogramo	415,71
28-may-00	Kilogramo	567,78
28-jun-00	Kilogramo	931,85
28-jul-00	Kilogramo	602,92
28-ago-00	Kilogramo	482,78
28-sep-00	Kilogramo	512,71
28-oct-00	Kilogramo	433,33
28-nov-00	Kilogramo	638,33
28-dic-00	Kilogramo	585,21
28-ene-01	Kilogramo	696,67
28-feb-01	Kilogramo	637,08
28-mar-01	Kilogramo	899,63
28-abr-01	Kilogramo	540,00
28-may-01	Kilogramo	554,00
28-jun-01	Kilogramo	362,96
28-jul-01	Kilogramo	588,75
28-ago-01	Kilogramo	743,00
28-sep-01	Kilogramo	1.030,00

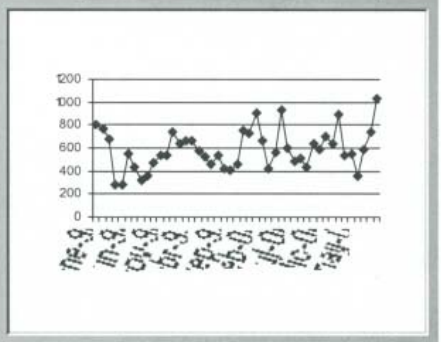


Table IV
Source: CCI

Precios promedio mensuales

Mercado: Galería Santa Helena - Cali

Producto: Pepino cohombro

Mes	Unidad	Pr. Promedio
28-sep-96	Kilogramo	200,00
28-oct-96	Kilogramo	202,78
28-nov-96	Kilogramo	220,37
28-dic-96	Kilogramo	241,98
28-ene-97	Kilogramo	394,44
28-feb-97	Kilogramo	509,72
28-mar-97	Kilogramo	338,89
28-abr-97	Kilogramo	133,93
28-may-97	Kilogramo	167,78
28-jun-97	Kilogramo	234,38
28-jul-97	Kilogramo	245,14
28-ago-97	Kilogramo	391,67
28-sep-97	Kilogramo	321,60
28-oct-97	Kilogramo	193,40
28-nov-97	Kilogramo	112,04
28-dic-97	Kilogramo	143,83
28-ene-98	Kilogramo	441,67
28-feb-98	Kilogramo	272,92
28-mar-98	Kilogramo	181,39
28-abr-98	Kilogramo	191,67
28-may-98	Kilogramo	216,05
28-jun-98	Kilogramo	304,32
28-jul-98	Kilogramo	175,93
28-ago-98	Kilogramo	202,78
28-sep-98	Kilogramo	124,07
28-oct-98	Kilogramo	250,00
28-nov-98	Kilogramo	382,29
28-dic-98	Kilogramo	263,89
28-ene-99	Kilogramo	188,54
28-feb-99	Kilogramo	213,54
28-mar-99	Kilogramo	173,33
28-abr-99	Kilogramo	241,67
28-may-99	Kilogramo	357,29
28-jun-99	Kilogramo	375,93
28-jul-99	Kilogramo	388,52
28-ago-99	Kilogramo	270,20
28-sep-99	Kilogramo	236,46
28-oct-99	Kilogramo	259,62
28-nov-99	Kilogramo	227,47
28-dic-99	Kilogramo	187,96
28-ene-00	Kilogramo	363,54
28-feb-00	Kilogramo	345,37
28-mar-00	Kilogramo	192,59
28-abr-00	Kilogramo	169,05
28-may-00	Kilogramo	222,22

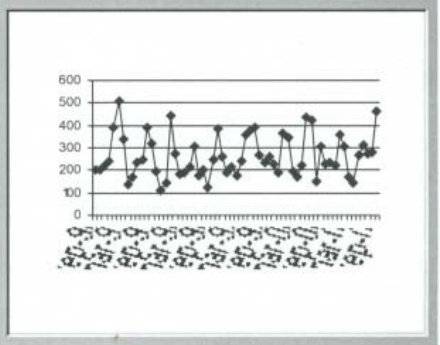


Table V

Source: CCI

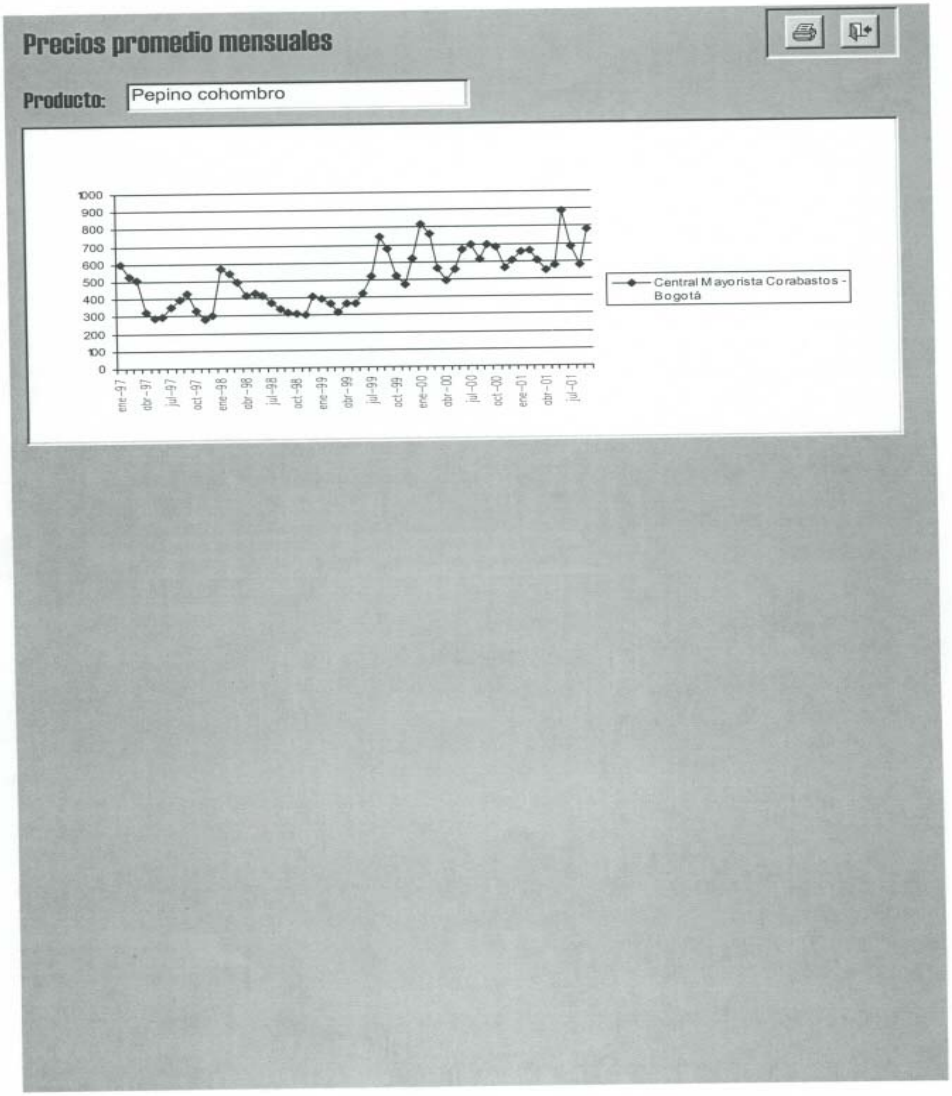


Table VI
Source: CCI

Table VIII- Yuca Growing and Harvesting Costs

Function of Cost	Cost Per Hectare
Direct-Seed, Labor, and Insecticides	$583.40
Indirect	$340.27
Total Costs	$923.67

Source: CD from CORPOICA

Table IX- Corn growing costs

Function of Cost	Cost Per Hectare
Direct-Seed, Labor, and Insecticides	$188.53
Indirect – Equipment, Inputs, Freight, and Packaging	$45.53
Total Costs	$234.11

Source: CD from CORPOICA

Table X- Rice costs for growing

Function of Costs	Cost Per Hectare
Direct Costs-Hand Labor, herbicides, Insecticides, Pesticides	$159.89
Indirect Costs- Tools & Freight	$93.21
Total Costs	$253.10

Source: PNDA in Puerto Asis

Table- XI- Platano Costs for growing

Function of Costs	Cost Per Hectare 1st Year	Cost Per Hectare 2nd Year	Cost Per Hectare 3rd Year
Seedling	$189.00	0	0
Direct Costs- Hand Labor, herbicides, Insecticides, Pesticides and Fungicides for Seedling	$545.71	$335.11	$374.98
Indirect Costs- Tools & Freight	$12.83	$103.67	$154.91

Total Costs	$748.15	$443.25	$534.78

Source: PNDA in Puerto Asis

Table XII- Growing Costs of Palmito

Function of Cost	**Cost Per Hectare**
Direct-Seed, Labor, and Insecticides	$758.42
Indirect	$451.45
Total Costs	$1,209.87

Source: Jorge Yorbia Rubio of Agroamzonia SA & Ruben Dario Pinzan of PNDA

Table XIII- Cost of Processing Carton of Palmito

Description of Cost	**Cost**
Raw Material	$3.33
Direct	$6.85
Indirect	$4.74
Administrative	$2.21
Total	$14.13

Source: Jorge Yorbia Rubio of Agroamzonia SA

CLAYUCA

Latin American and Caribbean Consortium to Support Cassava Research and Development

Cassava pos-harvest
Cassava flour for animal feeding

CLAYUCA is working in the development of a technology for the production of cassava flour that can be used in animal feeding. This technology has been developed to meet criteria related to competitiveness, efficiency and profitability.

General view of the processing plant

Stages of the process

Cleaning of fresh roots

Chipping and disintegration

Pre drying

Drying, acclimatization and packing

Product

Cassava integal flour

Processing costs

Item	Consumption per flour ton		Unitary value $Col	Cost $Col	
Plant factory model [1]	**1**	**2**		**1**	**2**
Raw material					
Fresh roots (ton)	2,5	2,5	[2] 80.000	200.000	200.000
Processing costs					
Electric power (kwh)	130	85	150	19.500	12.750
Natural gas m^3	70	60	250	17.500	15.000
Maintenance [3]				6.200	2.970
Depreciation [4]				15.350	7.410
Manual labor	7	17		24.300	10.630
			Subtotal	**82.250**	**48.760**
			Total production costs [5]	**282.250**	**248.760**

[1] Model 1: 500 kg/h, 1450 ton flour/year
Model 2: 5 ton/h, 14500 ton flour/year
Both models working 300 days per year, three shifts per day
[2] Price of roots at up processing plant gate
[3] 4% per year of investment costs
[4] Calculated over 10 years
[5] Price of cassava flour at up processing plant gate

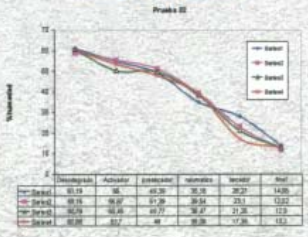
Technical data

Variation of the cyanide content during the process

Proximal analysis of the cassava integral flour

Description	% H b.h	Protein (%)	FC (%)	Ashes (%)	E.E.T. (%)	CN total (ppm)	CN free (ppm)
CM 340-30		2.67	3.98	3.31	0.92		
CM 340-30		2.72	4.01	3.26	0.90		
CM 340-30		2.54	3.82	3.39	0.50		
AVERAGE	**11**	**2.64**	**3.93**	**3.32**	**0.77**	**62**	**57**
MVEN 2		2.66	3.76	3.41	0.68		
MVEN 35		2.50	4.28	3.31	0.72		
MVEN 25		2.74	3.80	3.47	0.80		
AVERAGE	**13**	**2.64**	**3.95**	**3.40**	**0.73**	**60**	**49**

Variation of the moisture content during the process



Use of cassava forage in animal feeding

CLAYUCA is seeking to contribute to the development of the poultry, swine and dairy sectors of the country members through the development, adaptation and evaluation of agricultural systems for intensive production of cassava forage as a source of vegetal protein for use in animal feeding. This option helps to improve the efficiency, profitability and sustainability of the cassava production systems.

Goals

To identify promising cassava varieties using different planting densities and harvesting periods for each variety to evaluate their nutritional value, quality and quantity of biomass produce.

To use the cassava forage as a source of protein in animal feeding (pigs, poultry and cattle).

Mechanical harvest of cassava forage

Best varieties

Caicedonia (Valle del Cauca)

Variety	3 months	6 months	9 months
MCOL 2737	16.74	22.96	12.65

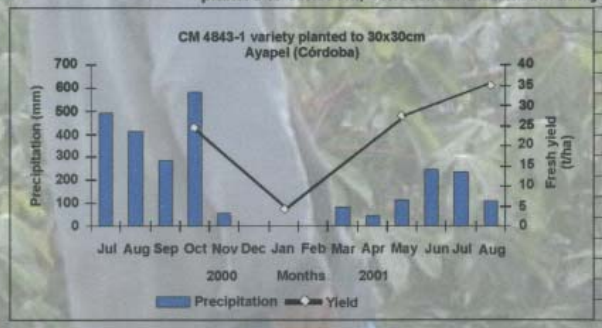
Ayapel (Córdoba)

Variety	3 months	6 months	9 months	12 months
CM4843-1	24.5	4.43	27.29	34.96

Buga (Valle del Cauca)

Variety	3 months	6 months	9 months
MCOL 2738	8.87	25.6	12.99

Interaction Precipitation vs Yield in fresh cassava forage (t/ha) planted to 30x30cm, 40x40cm and 50x50cm in Ayapel, Cordoba (Colombia)



Month	Precipitation (mm)	Yield 30x30 (t/ha)	Yield 40x40 (t/ha)	Yield 50x50 (t/ha)
Jul	486			
Aug	409			
Sep	282			
Oct	578	24.40	12.20	7.20
Nov	55			
Dec				
Jan		4.80	1.82	1.26
Feb				
Mar	81			
Apr	45			
May	111	27.20	19.81	14.76
Jun	243			
July	232			
Aug	108	34.96	15.86	7.08

CLAYUCA

Latin American and Caribbean Consortium to Support Cassava Research and Development

Mechanized systems for cassava planting and harvesting

Development of mechanized systems for cassava planting and harvesting is a must for reducing production costs, improve competitiveness of cassava in relation to others crops and increase incomes for farmers. Mechanization of cassava production is one of principal needs of the countries in which the crop is considered an option for agroindustrial development. The adoption of mechanization practices could reduce production costs between 15-20% in relation with manual planting and harvesting.

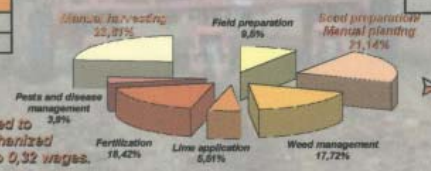
PLANTING

Roots costs per ton in Valle del Cauca

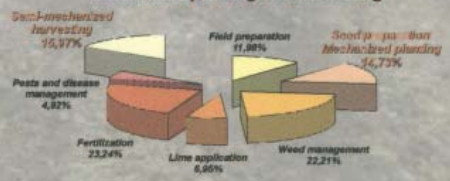
Manual planting			
Yield	20 ton/ha	25 ton/ha	30 ton/ha
Col $	61,680	49,344	41,120
Two rows			
Yield	20 ton/ha	25 ton/ha	30 ton/ha
Col $	52,022	41,618	34,681
Three rows			
Yield	20 ton/ha	25 ton/ha	30 ton/ha
Col $	51,493	41,195	34,329

Percentage of participation in direct costs of production per hectare Valle del Cauca (2000)

Manual planting and harvesting



Mechanized planting and harvesting



In Colombia 6 man days are needed to plant a hectare per day. Whit mechanized planting this amount is reduced to 0,32 wages.

Recovery of the initial investment in one year requires to plant at least 31,5 ha

HARVESTING

Roots costs per ton in Valle del Cauca

Manual harvesting			
Yield	20 ton/ha	25 ton/ha	30 ton/ha
Col $	66,681	53,344	44,454
Semi-mechanized harvesting			
Yield	20 ton/ha	25 ton/ha	30 ton/ha
Col $	54,318	43,454	36,212

Recovery of the initial investment in one year requires to plant at least 18 ha.

Use of cassava flour in animal feeding

CLAYUCA

Latin American and Caribbean Consortium to Support Cassava Research and Development

Cassava crop

Integral soja

Forage flour

Roots flour

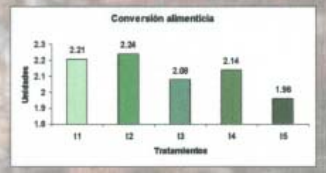
Balanced feeding

Excellent quality

Parameter	Diet 1	Diet 2	Diet 3	Diet 4	Diet 5
Period of time (days)	42	42	42	42	42
Initial weight(g)	39.80	39.73	39.37	39.52	39.56
Final weight(g)	2139.47	2113.00	2237.50	2279.54	2387.50
Increment of weight (g)	2099.67	2073.27	2198.13	2240.02	2347.94
Average comsuption per fowl (kg)	4.64	4.65	4.58	4.78	4.60
Nutritional value	2.21	2.24	2.08	2.14	1.96
European Efficiency Factor (EEF)	199.00	194.00	221.00	220.00	240.00
Weight increase per day (g) (ADP)	50.00	49.36	52.33	53.30	55.90

	Diet 1		Diet 2		Diet 3,4 y 5	
Ingredients	Start	Final	Start	Final	Start	Final
Yellow corn	55.925	51.072				
Roots cassava flour			40.454	43.513	45.752	48.813
Cassava forage flour			6.000	6.000		
Soja toast	27.200	18.000	30.000	30.000	30.000	30.000
Soja torte 48%	13.800	14.900	16.400	13.300	18.700	15.300
Rice flour		7.000				
Palm oil		3.000	4.500	4.800	2.900	3.300
Vitamins, minerals and additive	3.075	5.028	2.646	2.387	2.648	2.587

Nutritional value



European Efficiency Factor