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Value Chain market Assessment

for each priority Area identified in the Resilient Rural Belize (RRB) Program

Product 3.2 Value Chain and Market Assessment of Pineapple Production in Belize

May 2022

VALUE CHAIN AND MARKET ASSESSMENT OF PINEAPPLE PRODUCTION IN BELIZE

Conduct Value Chain and Market Assessments for Resilient Rural Belize

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List of Acronyms and Abbreviations

BAHA	Belize Agricultural Health Authority
BBS	Belize Bureau of Standards
CATIE	Tropical Agriculture Research and Higher Education Center
CPBL	Citrus Products of Belize Limited
CVA	Climate Vulnerability Assessment
DFC	Development Finance Corporation
FAO	Food and Agriculture Organization of the United Nations
GOB	Government of Belize
IFAD	International Fund for Agriculture Development
MAFSE	Ministry of Agriculture, Food Security and Enterprises
PCB	Pesticide Control Board
RRB	Resilient Rural Belize
SIB	Statistical Institute of Belize
VCMA	Value Chain and Market Assessment

Executive Summary

Belize is a small tropical country with relative abundance in natural resources such as land and water. It is classified as a Small Island Developing State (SIDS) because it is threatened by many impacts of Climate Change especially to its rural areas which accommodates 54.3% of the country's population. Also impacted by Climate Change is the agricultural sector, a major pillar of Belize's economy, particularly small-scale farmers focused on producing vegetables and other non-traditional crops. These challenges, poor market access, poor infrastructure (such as roads), and underdeveloped production systems have rendered small-scale farmers unproductive or with sub-standard produce.

To alleviate the climate induced and productivity limitations faced by small scale farmers, strengthen food security, economic development and reduce poverty, the Government of Belize (GOB) sought assistance from the International Fund for Agricultural Development (IFAD) to develop a program entitled "Resilient Rural Belize" (RRB) Program. The RRB Program contracted the Tropical Agriculture Research and Higher Education Center (CATIE) to conduct the value chain analysis and market assessment, focusing on eight preselected commodities: sweet pepper, tomato, pineapple, and hot pepper, cabbage, carrot, onion and honey products. The analysis will guide interventions across and within the various value chains.

This study focuses on the structure and function of the Pineapple Value Chain in Belize at the national level, examining all linkages between the actors. It identifies opportunities for strengthening horizontal and vertical linkages within the value chain, identifies end markets and make recommendations for value chain upgrading strategies including improved production and quality of pineapple.

The fresh fruit pineapple market in Belize is estimated at 7,248,151 pounds valued at BZ $5,291,150 (based on 2020 data). The processing pineapple market is at a 1,191,000 pounds valued at BZ $249,900 (based on 2020 data). The main consumers of fresh fruit pineapples in Belize are households, restaurants, hotels and fast-food establishments while the Citrus Products of Belize Limited (CPBL) processes MD2 pineapples for concentrate.

Pineapple is grown in all the districts of the country. The Toledo District is the leading producer of pineapple followed by the Cayo and Orange Walk Districts. One of the largest producers of pineapples in the country is the "Los Buenos Amigos Cooperative Society Ltd".

The Ministry of Agriculture, Food Security and Enterprises plans to support and prioritize fruit production as part of the larger agricultural strategy to conduct import substitution. Supporters and service providers provide technical and financial services along the value chain. Most farmers do not use financial institutions for financial assistance because they don't have sufficient collateral such as land as these financial institutions require.

The strengthening of the Pineapple Value Chain requires strengthening the cooperatives who are the main pineapple producers. All farmers require knowledge of good agricultural practices such as certified seed varieties, good land preparation, integrated pest management, rational use of agrochemicals, efficient use of irrigation systems to conserve water, post-harvest technology, processing and others. Important also, farmers need the knowledge to farm as a business in most cases during the study most farmers do not have records of cost of production or knowledge if they are operating at a profit or loss.

1. Introduction

Belize is a coastal tropical country which lies on the north-eastern coast of Central America, making it suitable for the cultivation of various horticultural crops. The United Nations has designated Belize as a Small Island Developing State (SIDS) because it has been greatly affected from vulnerabilities and threats similar to those of Small Island Developing State (SIDS). Impacts from threats such as Climate Change to Belize's agricultural sectors have prompted the adoption of many strategies such as Climate Smart Agriculture (CSA) to the population based in the rural areas and whose livelihoods are based mainly in the agriculture sector.

Agriculture is extremely important to Belize's development, providing employment, foreign exchange earnings and is key to food and nutrition security. Approximately, 172,000 hectares or 7.48 percent of Belize's total land area is suitable for agricultural use. An estimated 122,000 hectares or 5.31% of Belize's total land area is cultivated land (FAOSTAT, 2019). The agricultural sector employs an estimated 12.24% of the total population of Belize and an estimated 5.2% are females (FAOSTAT 2019). Primary industries in Belize include Sugar, Banana, and Citrus Products, normally the highest agricultural income earner. In 2020, the highest contributors to the economic output in agriculture in Belize was the non-traditional sector with grains and legumes being the highest contributor (MAFSE, 2021). The Gross Domestic Product per capita (constant) in 2019 was US$ 5,078.81 with the agriculture sector accounting for 8.2 percent (SIB, 2021).

The Agriculture Output Value (at Producer's price) for fruits and vegetables in Belize has been on a fluctuating downward trend; notably, the decrease from 2016 to 2020 is 27 percent (SIB, 2021). In 2019, the dominant commodities in the tuber and vegetables category based on economic value were onion, potato, carrot and sweet pepper ranking from first to fourth places, respectively (MAFSE, 2020). The Toledo District is the leading producer of pineapple followed by the Cayo and Orange Walk Districts. Despite this, there is no previous study recorded on pineapple's value chain analysis and market assessment. Recognizing this gap, the Ministry of Agriculture, Food Security and Enterprises has sought the assistance of local and international partners to strengthen the value chain of pineapple in Belize and, by extension, improve the social and economic situation of small-scale local farmers and improve food security in Belize.

This Value Chain Analysis and Market Assessment (VCMA) for Pineapple (*Ananas comosus*) in Belize is conducted by the Tropical Agriculture Research and Higher Education Center (CATIE)

with funding from collaboration with the International Fund for Agriculture Development (IFAD), the Green Climate Fund (GCF), and the GOB through the Resilient Rural Belize (RRB) Project. The objectives of this VCMA are to (i) map and describe the pineapple value chain including the role and relationships between the different actors (producers, transporters, packers, processors, traders, retailers and consumers) in the value chain; (ii) market potential; (iii) identify challenges and opportunities for the pineapple value chain; and (iii) identify and recommend adequate policy interventions based on findings to strengthen the pineapple value chain in Belize. Although the value chain was focused at a national level, the priority area of the assessment is the Toledo District which encompasses the village of Trio.

2. Methodology

The Value Chain Market Assessment (VCMA) for pineapple is presented in four phases described by CATIE (CATIE, 2020). The details of the methods used are as follows:

2.1 Description of the Study Area

The area for this VCMA was preselected by the Resilient Rural Belize (Belize) Project when the consultancy was initiated. The target areas in the Toledo District are home to the main pineapple producers. This includes the village of Trio (Table 1).

Table 1. Population of the Target Village in the Toledo District, 2021

Belize Population by Number of Households and Average Household Size, 2010					
Village	Total	Males	Females	No. of HH	Avg. HH Size
Trio	1243	665	578	305	4

2.2 Data Collection

Collection of current and relevant data was done in three steps: Collecting secondary data through desk research; Collection of primary data using targeted interviews.

Collection of secondary data through desk research

There is no pre-existing value chain analysis for pineapple in the Toledo District or the country. Raw data and information about supplies, production, transformation, and marketing were accessed from various government departments such as the Ministry of Agriculture, Food Security and Enterprises (MAFSE), the Belize Agricultural Health Authority (BAHA), the Statistical Institute of Belize (SIB), Belize Bureau of Standards (BBS), Resilient Rural Belize (RRB) Project personnel, Citrus Products of Belize Ltd. (CPBL) and the online portal of the Food and Agricultural Organization (FAOSTAT). Research and studies published on pineapple production within the last five years in other countries were targeted to identify innovations and technologies that could strengthen the pineapple value chain in Belize. The market trends of pineapple and cultivation of pineapple across Belize, quality standards, restrictions on the production and/or the marketing of the products were also sought. The main actors in the value chain and relationships between the actors were also identified. The output of the desk research was an initial value chain map.

Collection of Data through Primary Research

Major players in and outside the value chain were identified based on the preliminary value chain map developed from findings from the desk research. Personal interviews were carried out, being mindful of the Covid-19 regulations. Electronic and telephone communications were also carried out.

- Personal Interviews: Face-to-face interviews were conducted with leader farmers of cooperatives and field visits to understand the farming operations. Extension Officers from the Department of Agriculture, the Cooperative Department and Resilient Rural Belize were interviewed. A visit to the town/city market also allowed to interview vendors/retailers. These interviews allowed the consultant to better understand how pineapple is grown, processed and marketed, labour requirements, sources of supply of raw materials, market prices, fluctuations in demand throughout the year, sources of financing, and contractual relationships with clients.
- Telephone Interviews: Telephone interviews were carried out with persons that could not accommodate a personal interview. Three intermediaries collect fruit from the Trio village, only one was available for an interview and provided information on how they conduct business with the farmer. They supply retailers at the markets in Belmopan and Belize City.
- Electronic Interviews: Electronic interviews were done with persons that could not accommodate a personal interview. Via Email three of the major Agrochemical suppliers were contacted and they provided information on mainly agrochemicals they supply to the pineapple growers. They requested that their information remain confidential.

2.3 Limitations of the Study

While farmers were willing to cooperate in the study, they generally had limited records of their production costs and yields, therefore they could not verify if they operated at a profit or loss. Hence the study depended mainly on the national statistics provided by the Ministry of Agriculture to the Statistical Institute of Belize and the processor.

2.4 Validation of Value Chain Map by Stakeholders

To validate the data and information collected during the desk and primary research, a workshop was carried out in Trio Village with actors from different levels of the value chain. These actors included input suppliers, producers, intermediaries and technical officers from the government departments and NGO's. List of participants and some pictures of the event as

shown in *Annex 4. List of participant and pictures of participants in the pineapple value chain workshop.*

The Objectives of the workshop were:

- Present the results of the Value Chain and Market Analysis for Pineapple to stakeholders.
- Validate the results.
- Identify and prioritize potential value chain production, processing, and marketing efficiency improvements benefiting smallholders, women, and other actors along the value chain.

Figure 1. Working groups during the validation workshop

Table 2. Pineapple VCMA double entry matrix with priorities derived by workshop participants

Problems	**Finances**	**Input purchase**	**Training and TA**	**Improved seed**	**Road Infrastructure**	**Marketing**
Finances		Finances	Training	Finances	Finances	Marketing
Input purchase			Training	Imp seeds	Road Infra	Marketing
Training and TA				Imp Seeds	Training	Training
Improved Seed					Imp Seeds	Marketing
Road Infrastructure						Road Infra
Marketing						

At the VCMA workshop, a presentation of the Pineapple VCMA was conducted using historical data collected by the Ministry of Agriculture and from information gathered from farmers, input suppliers and other focus groups. Participants were invited to validate the findings and the VC map as presented by the consultants through a group activity which allowed them to identify and prioritize needs that will help to improve or strengthen the value chain.

As shown in Figure 1, as many as 6 major challenges/problems were identified and prioritized. Participants prioritized training and technical assistance, finances, marketing, and seeds, giving road construction and input purchasing capacity a lower priority.

2.5 Finalization of the Report

After every validation workshop, meetings were held with the Lead Value Chain Consultant from CATIE, Local Consultants and the Agriculture Marketing Officer from the RRB Program. During these meetings, further recommendations were made to improve the final document and meet its objectives.

2.6 Value Chain and Climate Vulnerability Assessment Synchronization

The validation workshop of the VCMA was carried out together with the CVA, with the idea to catch any comment or question about changes of climate that members of the value-chain of pineapple may have. During the CVA workshop in terms of climate change most farmers expressed major concern on unexpected droughts during the year. Their concern comes from their perception that droughts have affected the fruit size and intense sunlight causes fruit burn. None of the pineapple fields are irrigated, but farmers expressed interest in learning about irrigation which they believe will contribute to better production throughout the year. Floods was not ranked as a major concern as their occurrence is not frequent.

Synchronization of the CVA and VCMA consultations produced a new section in this report that it is not traditionally included in VCMA studies. Section 8 on this report shows the findings concerning the suitability and climate adequacy changes projected in two scenarios.

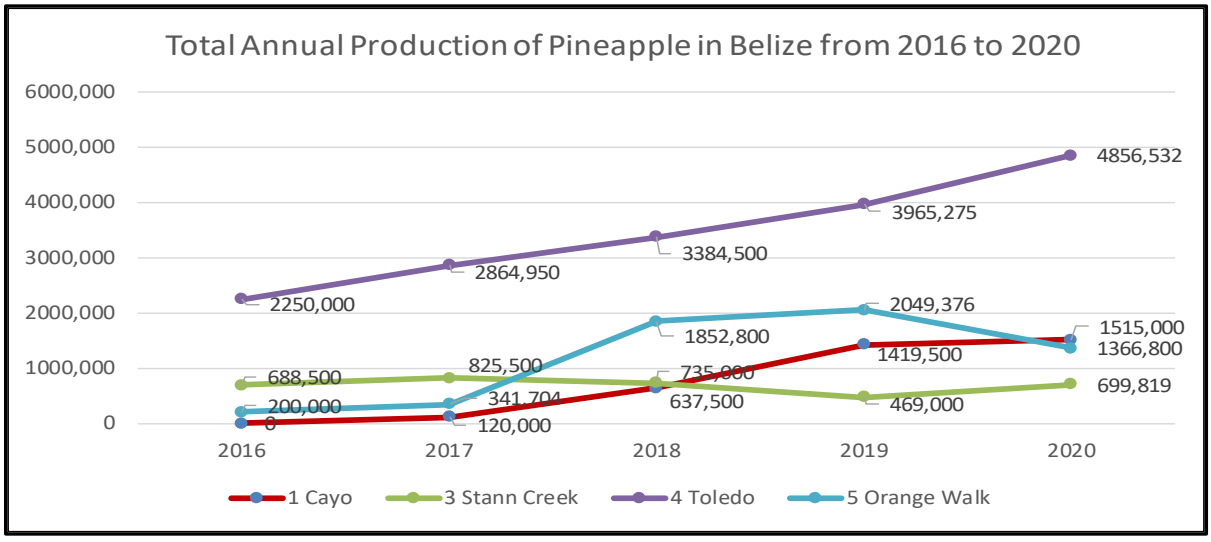
3. History of Pineapple Value Chain in Belize

Pineapple is produced in all the districts in Belize with the Toledo District being the largest producer (figure 2), followed by the Orange Walk and the Cayo Districts (MAFSE, 2021). In figure 2, the production trend for the Toledo District has been on a constant upward trend; this is due to the increased demand of pineapples for processing by the Citrus Products of Belize Limited (CPBL) which can process 80,000 lbs per day. The minimum quantity of pineapples accepted per day by CPBL is 20,000 pounds The preferred variety by CPBL is MD2 due to its intense juice colour, brix, and taste qualities. According to farmers, this pineapple is more challenging to grow than other varieties such as Sugar Loaf. Nonetheless, these farmers have taken the challenge to grow MD2 but need technical assistance to improve their techniques and practices to increase production. Varieties like Sugar Loaf and Smooth Cayenne are more tolerant to some pests and environmental conditions with good brix; however, the juice colour is pale and does not meet the requirement of the processor.

3.1 Pineapple Production in Belize

The production trend in the districts shows a gradual increase except for the Orange Walk District which registered a decrease in 2020. The dominant varieties in the fresh fruit market are Sugar Loaf and Smooth Cayenne varieties which supply the local markets, restaurants, and tourist resorts.

Figure 2. Total Annual Production of Pineapple in Belize from 2016 to 2020



During the latter part of 2020, border entries, maritime ports and the airport were closed. Immediately the tourism industry was affected; tourist resorts, major restaurants and

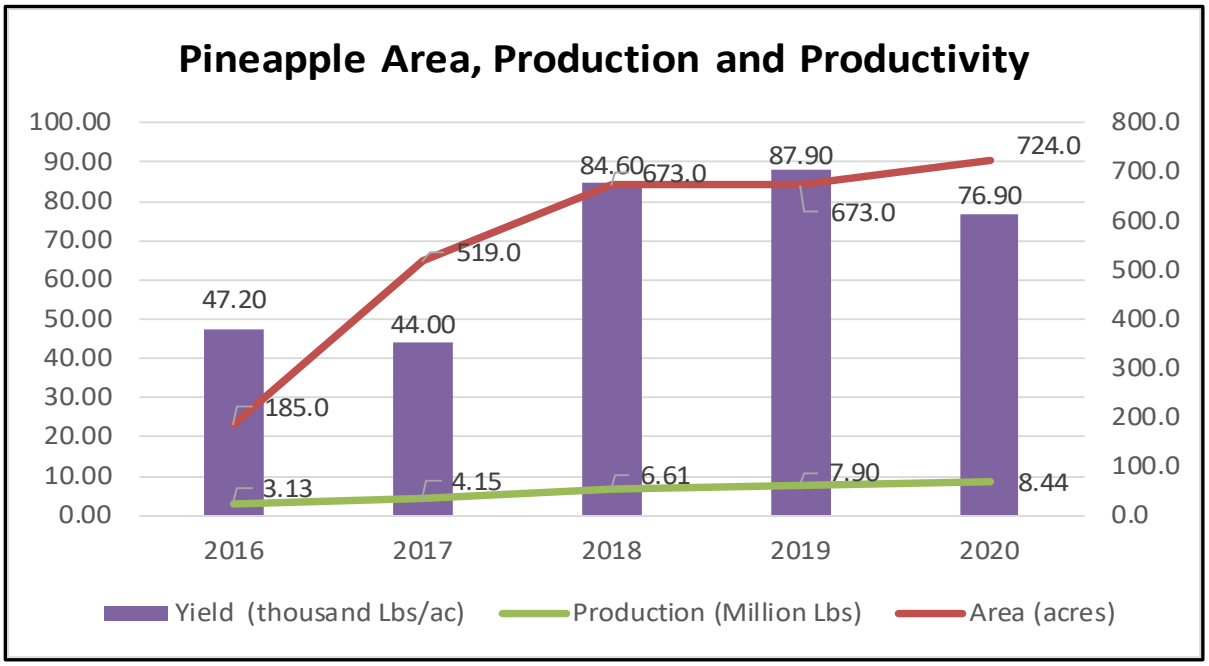
supermarkets were closed. This affected the consumption of many local produce including pineapples. Households became the major consumers of pineapples.

In Figure 3, the national average yield per acre from 2016 to 2020 is 68,000 lbs/acre. In communication with farmers the current estimated yield per acre for pineapple is 52,500 lbs/acre, at a density of 15,000 plants per acre. This would be considered a medium density planting and this is what most farmers do. A high-density planting is 28,000 plants per acre with an estimated 98,000 lbs/acre yield. Interviews with farmers expressed that they prefer to manage a medium planting density, as higher densities require intensive management.

Pineapple production in Belize is for both the domestic market (as fresh fruit) and processing into juice. Fresh fruits are mainly for households and the tourism industry, primarily the food suppliers in local restaurants and hotels. Farmer sells the majority of their fresh produce by dozens to an intermediary supplier (Collector) who resells/distributes it to retailers such as market vendors. Contractual arrangements between Farmer and Collector are informal. Some farmers sell directly to retailers or consumers such as large upscale restaurants.

For those farmers producing for sale into the processing market, they are almost exclusively for that market; 98% of their harvest is sold to the processing plant and about 2% goes to the local market as fresh fruit. Farmers that produce for processing send the pineapples in bulk, in trucks that can transport up to 30,000 lbs of fruit in one shipment to the processing plant.

Figure 3. Total Pineapple area harvested, production and yield in Belize (2016 to 2020)



Pineapples take between 12 to 14 months to come into production and are available year-round in the fresh fruit market, the planting season is between June to September during the main rainy season since no irrigation systems are used. Farmers that produce for processing aim to have their production in April, June, August, and October. However, the processor would prefer a yearly supply of pineapples, however, in order to do this, farmers need technical assistance on how to organize and calendar their production to meet this demand.

3.2 Pineapple Demand in Belize

In Belize between 2016 and 2020 a total of 30,241,756 pounds of Pineapple was produced. Table 3 shows the yearly total consumption of fresh pineapple in Belize for the past 5 years. The estimated weekly consumption of pineapples in Belize is 109,156 pounds per week. Fresh pineapple is not imported into Belize, except for processed pineapple in cans. Between 2019 and 2020 CPBL processed 1,874,000 pounds of pineapple (Table 3) for concentrate for export to CARICOM countries and a small percentage for local juices in country.

Table 3. Yearly consumption of fresh Pineapple in Belize (2016 to 2020)

Pineapple Fresh Fruit Consumption (Lbs) in Belize 2016 to 2020				
2016	**2017**	**2018**	**2019**	**2020**
3,139,316	4,163,233	6,610,950	7,219,151	7,248,151

Table 4. Processed Pineapple in Belize (2019 to 2020)

Processed Pineapple by Citrus Products of Belize Ltd (CPBL) Pounds/Year				
Year	**Fresh Fruit**	**Processed**	**Imports**	**Ilegal Entry**
2019	7,219,151	*684,000	0	0
2020	7,248,151	*1,190,000	0	0

**Source: CPBL*

3.3 Quality Standards of Pineapple Production in Belize

The Belize Bureau of Standards is tasked with developing quality standards for agricultural commodities in Belize. To date, there are only three quality standards drafted for agricultural commodities. The BBS will use the Pineapple quality standards that exist in:

CARICOM Regional Organization for Standards and Quality (CROSQ), 2nd Floor Nicholas House 29 & 30 Broad Street Bridgetown, St Michael Barbados T: 246.622.7670 | F: 246.622.7678. Website: http://www.crosq.org © CROSQ 2010 – All rights reserved Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission.

CARICOM REGIONAL STANDARD: Specification for grades of fresh agricultural produce. Part 7: Pineapples CRS 24: Part 7: 2010

The Processor, Citrus Products of Belize Limited has its own quality standards for the procurement and processing of pineapples these can be seen in Annex 1.

The Belize Bureau of Standards is tasked with developing, establishing, harmonizing, and promoting the use of relevant quality standards for key economic sectors/national development. By extension, developing standards for the agricultural sector pertinent to the 8-value chains identified under the IFAD RRB Programme is an opportunity to revise and introduce standards for the agricultural sector.

To date, there are no established national standards for pineapples in Belize. In an effort to establish a level playing field, it will be useful to ensure that standards and other elements for Quality Systems[1] are introduced and applied in all aspects of the pineapple value chain.

[1]Quality Systems are made up of high-level institutions providing services in standardization, metrology (such as calibration), conformity assessment (such as inspection, testing and certification) and accreditation to ensure that products and services meet the requirements of customers as well as

Notwithstanding the absence of national standards for pineapples, the CARICOM Regional Standard Specification for Grades of Fresh Agricultural Produce for Pineapples (CRS 24: Part 7: 2010) can serve as the basis from which to draw national requirements to meet the needs of the Belizean market, namely those requirements relating to the MD2 variety inclusive of requirements of other relevant export markets of interest. The regional standard requirements include but not limited to the following:

- Whole complete with the crown or as specified by the particular market
- Fresh in appearance with the crown free of wilted, dry, loose or damaged leaves
- Free from internal browning; damage caused by pests; blemishes in particular unhealed cuts, bruising, scorching, holes, or cracks; damage caused by temperatures; any foreign smell or taste
- Maturity with at least 12 Brix
- Size classification across three classes I, II and III;
- Colour requirements across classes
- Tolerance levels across size and colour classifications
- Packaging and labelling
- Contaminants in relation to heavy metals and pesticide residues; and
- Hygiene and sanitation requirements

Currently there exists the challenge where, individual farmers apply their own company/farmer requirements to ensure quality which does not necessarily mirror that of the processors such as the Citrus Products of Belize Limited (CPBL) where the procurement and processing of MD2 pineapples (see Annex 1) is governed by the industry's own standards and quality requirements. Product from farmers not meeting CPBL's requirements are not accepted. This underpins the need to ensure that standards and quality systems are embedded in the value chain at all levels thereby not only improving efficiencies and competitiveness but ensuring that the buyers and sellers needs are fulfilled. Aside from serving national needs, the application of national standards for pineapple will also create export opportunities for fresh produce.

pursuing other objectives such as industrial development, trade competitiveness in markets of interest, food safety, health, the environment, climate change, among others.

4. Value Chain Mapping

The Pineapple Value Chain in Belize consists of input suppliers, producers, intermediaries (Collectors), processor, retailers, and consumers. Other actors are classified as supporter and enablers, and they provide financial and technical services or provide support to in developing policies to strengthen the value chain. Presented below in Figure 4 is the map of the pineapple value chain in Belize.

4.1 Value Chain Map

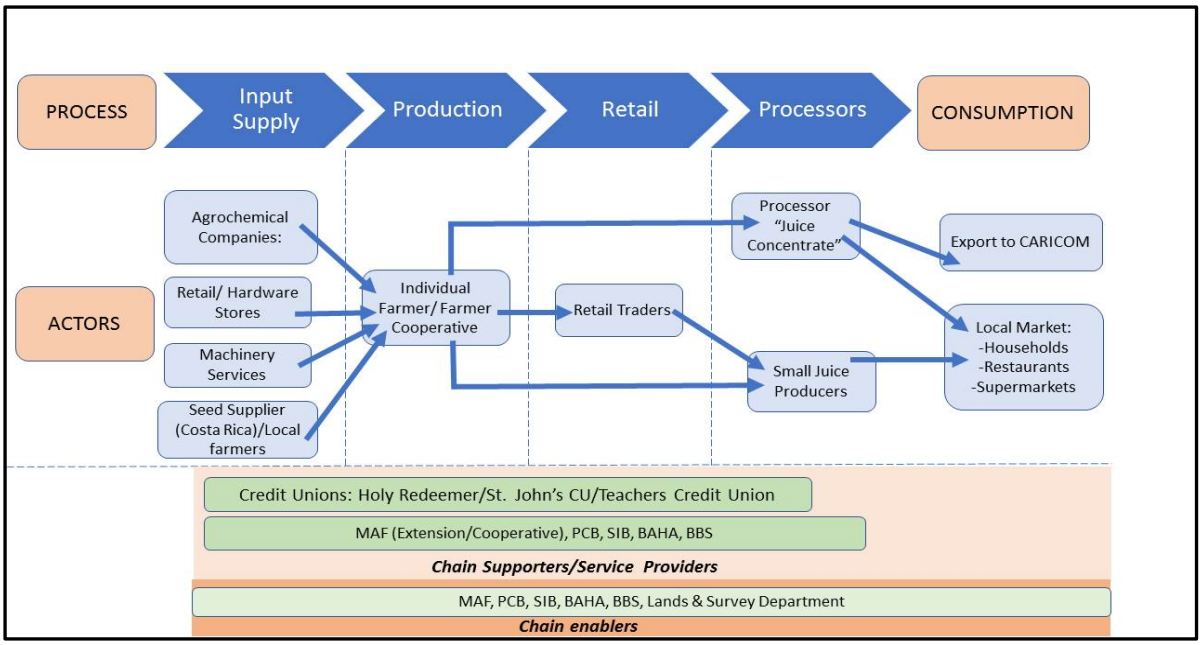


Figure 4. Value Chain Map for Pineapple in Belize

4.2 Description of the Pineapple Value Chain Actors and their roles

Input Suppliers

The first actors in the chain are the input suppliers. These consist mainly of the agrochemical and seeds suppliers, machinery services providers, farm equipment companies, fuel service stations, and hardware stores. The main agrochemical suppliers in the Toledo District for pineapples are Bel-Agro Enterprise, Prosser Fertilizer and Agrotec Company Ltd. and Circle R Limited. In terms of seeds or pineapple slips farmers collect their own from existing fields. Additionally, the Belize Citrus Growers Association accessed, and the Citrus Products of Belize Ltd. Imported, slips from Costa Rica in 2018 and in 2020 sold slips from these established field, albeit in quantity, to other farmers.

Producers/Farmers

In the Pineapple value chain in Belize, the main producers are in the Toledo District for processing and in Orange Walk, Cayo and Stann Creek District for the fresh fruit market and some for processing. There are individual farmers and farmer Cooperatives. In Trio Village, majority of the pineapple farmers belong to the Cooperativa de Los Buenos Amigos Cooperative Society Limited (LBACSL) formed officially in 2005 (RRB, 2019). Currently, this cooperative has 17 active members, two of which are females. Information from the Toledo District Agriculture Department estimate that there are about 35 farmers that produce pineapples.

In the Cayo District, the farmers are part of a cooperative named Cooperativa de Productores de Frutas Tradicionales, Bromelia Sociedad Ltd. (Bromelia) was originally registered in the year 2002 by the Department of Co-operatives (DOC), (RRB, 2019). They have 16 active members, which includes 4 women, and 1 male and female youth. They produce pineapples for the fresh fruit market.

In the Orange Walk District there are about 25 individual farmers that produce pineapples mainly in the San Felipe and Santa Martha Villages, they cultivate an average of 2 acres of pineapples for the fresh fruit market. For many of these farmers, profit obtained from pineapple production is not their only source of income as many of them do other crops and livestock.

Many of the farmers use family labour and other members of the cooperatives for harvesting, but also use hired labor at the peak of production. Small, medium, and large-scale producers in average cultivate 1, 2.5, and 10 acres.

Importers

There is no importation of fresh fruit pineapples; importation of pineapple products is in cans or juices mainly from Mexico or the USA.

Data requested from BAHA on the illegal importation/confiscation of pineapples is non-existent. No confiscations have been documented between 2016 to 2020 (BAHA, 2021).

Intermediaries (Collectors)

Intermediaries are middlemen who collect and purchase Pineapple locally and who sometimes develop long term relationships with farmers. In the case of Trio Village three intermediaries collect fruit every Wednesday and Sunday and each collect an average of 15 dozens of pineapples. The average price of a dozen is BZ$16.50, average weight of a pineapple is 3.5

pounds, a dozen will total 42 pounds. So the unit price per pound is BZ$0.39 farm gate price. The three intermediaries collect 3780 lbs of pineapple on a weekly basis, it was mentioned that certain times they may not always get the amount of pineapples they require. The pineapple is distributed to retailers at the market in Belmopan and Belize City.

For processing, the Trio cooperative sends the fruit in bulk by trucks that carry 30,000 pounds of pineapples. They have two transporters and pay between Bz. $400 to $450 per trip depending on fuel prices.

Retailers

Retailers include market vendors, grocery stores and supermarkets in the major towns and city.

Consumers

The most significant users of pineapples are household users. Other main users include the tourist resorts, restaurants, hotel restaurants and fast-food establishments.

Processor

The Citrus Products of Belize is the major processor that has the capacity to process 80,000 lbs of pineapples per day and accepts a minimum of 20,000 lbs per day to process.

4.3 Profit Margins and Share Benefits along the value chain

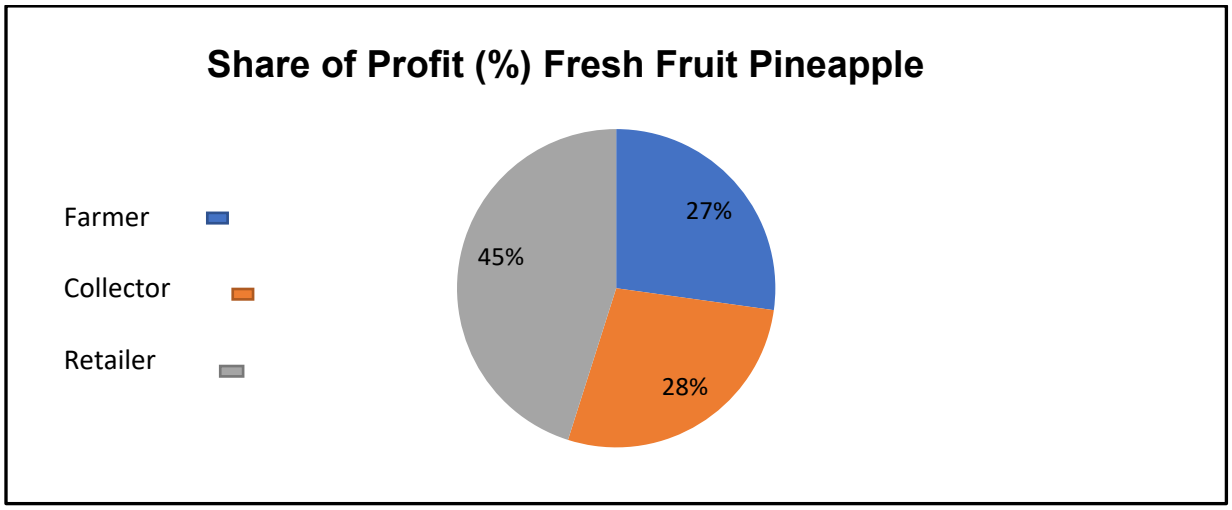
Cost of production and prices across the value chain were obtained by interview with a farmer in St. Margret Village, Cayo District. Table 5 shows an analysis of the profit margins and share benefits along the value chain.

Table 5. Profit Margins and Share Benefits along the value chain for Fresh Fruit Pineapple

Description	Actors			
	Farmers	Collectors	Retailers	Horizontal Sum
Purchase Price (Bz$)	0.00	0.50	0.66	1.16
Total Input Cost (Bz$)	0.14	0.16	0.22	0.52
Sale Price (Bz$)	0.72	0.75	1.18	2.65
Market Margin (Bz$)	0.72	0.25	0.52	1.49
% share of margin	48.3	16.8	34.9	100.0
Profit Margin (Bz$)	0.58	0.59	0.96	2.13
% of share of profit	**27.2**	**27.7**	**45.1**	**100.0**

The data shows that for the farmer the cost of inputs is the lowest, given that the pineapple varieties for fresh fruit are hardy plants. The second is the collector and is very likely due to transportation of the product given that fuel prices are high here in Belize compared to other countries in the region. The retailer is the highest and can be due to the rental cost for space at the market since the fruit is bigger and is kept longer on the shelf. Together, the collectors and retailers take 72.8% out of the total profit margin. The retailer's profit margin constitutes the highest share (45.1%) followed by the collector (27.7%). The farmer share profit in this analysis is 27.2% (Figure 5).

Figure 5. Share of profit of actors for the Pineapple Value Chain in Belize



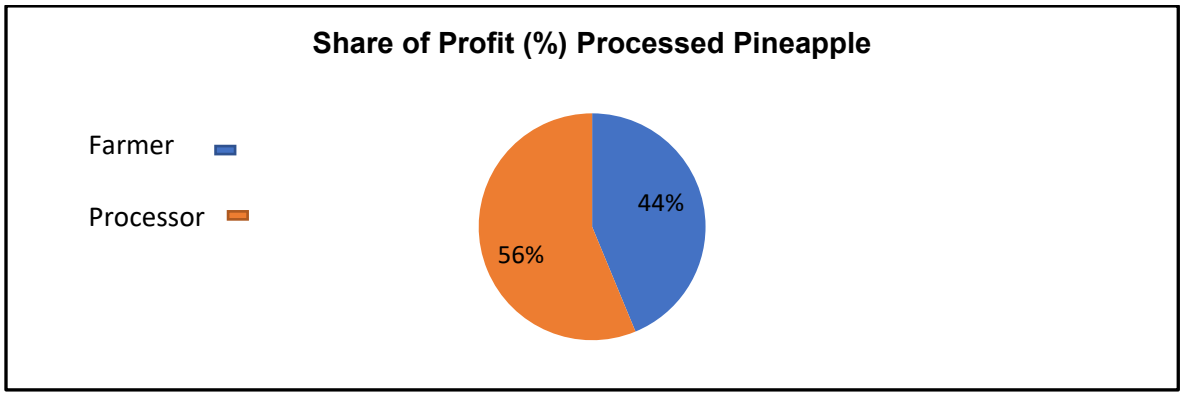
Cost of production and prices across the value chain for pineapples for processing were obtained by interviews with key persons in the cooperative from Trio Village in the Toledo District. Table 6 shows an analysis of the profit margins and share benefits along the value chain.

Table 6. Profit Margins and Share Benefits along the value chain for Processed Pineapple.

Description	Actors		
	Farmers	Processors	Horizontal Sum
Purchase Price (Bz$)	0.00	0.21	0.21
Total Input Cost (Bz$)	0.14	0.14	0.28
Sale Price (Bz$)	0.21	0.23	0.44
Market Margin (Bz$)	0.21	0.02	0.23
% share of margin	91.3	8.7	100.0
Profit Margin (Bz$)	0.07	0.09	0.16
% of share of profit	**43.8**	**56.3**	**100.0**

The data shows that for the farmer the cost of inputs is the same as the processor. Although the processing pineapple variety is much delicate to grow and the farmer has to transport the fruit to the processing plant, transporting in bulk may curtail the costs. For the processor it would be the cost of running the processing operation. The processor takes 56.3% out of the total profit margin and the farmer share profit in this analysis is 43.8 (Figure 6). This shows a great potential for farmers to grow pineapples for processing and given the advantage of a secure market.

Figure 6. Share of profit of actors for the pineapple value chain in Belize.



5. Market Analysis

Pineapple can be cultivated in any district of Belize and is available year-round. The main pineapple varieties for the fresh fruit market are Sugar Loaf and Smooth Cayenne. For processing, the MD2 variety is preferred.

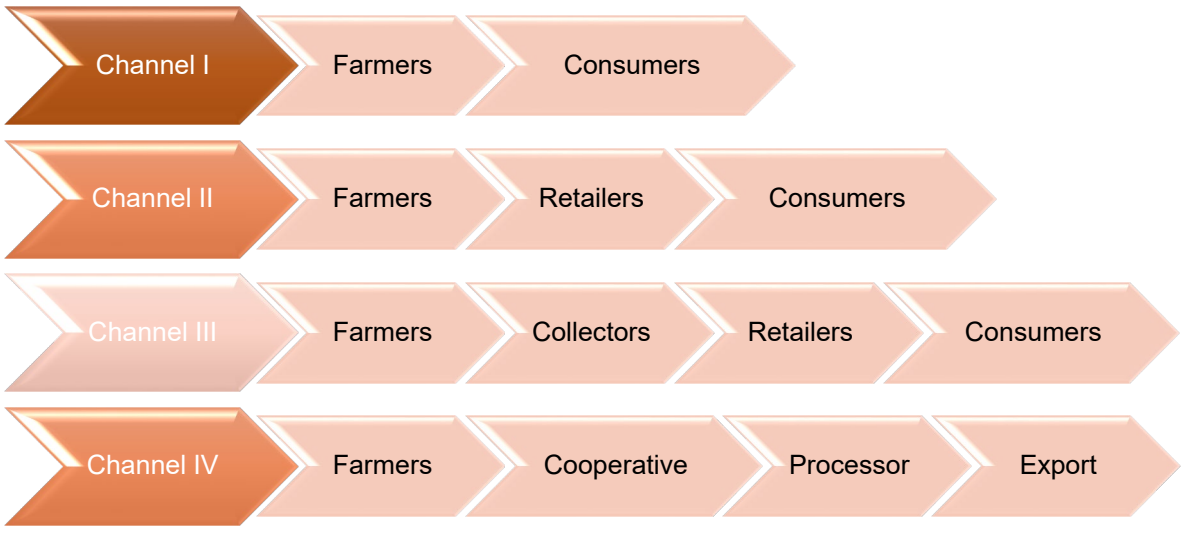
5.1 Market Size

The estimated weekly consumption of pineapples in Belize is 109,156 pounds per week. Between 2019 and 2020 CPBL processed 1,874,000 pounds of pineapple for concentrate for export to CARICOM countries and a small percentage for local juices in country. For the local consumption the amount produced may be sustainable to maintain a reasonable market price, but for processing there is a great opportunity for farmers to invest as the CARICOM market and others are available for pineapple juice concentrate. Also, the importation of the by-products into Belize includes products such as pineapple essence, pineapple juices, pineapple flavourings, pineapple jam and pineapple yogurt importations as shown in Annex 2.

5.1 Market Channel

A significant amount of the Pineapple produced by the Cooperative in the case of Trio Village is sold to the processor, individual producers sell to collectors, then to retailers and finally to consumers. The main marketing channels identified from the point of production to consumers through intermediaries for Pineapples in the Belize are as follows:

Figure 7. Main Marketing Pineapple Channels



5.2 Price trend of Pineapple in Belize

The average price for fresh fruit pineapple in Belize is BZ $0.73/lb. (Figure 8) and for processing is stable at BZ $0.21/lb.

Figure 8. Price trend for Pineapple production in Belize (2016 to 2020) at Producer's Price (SIB)

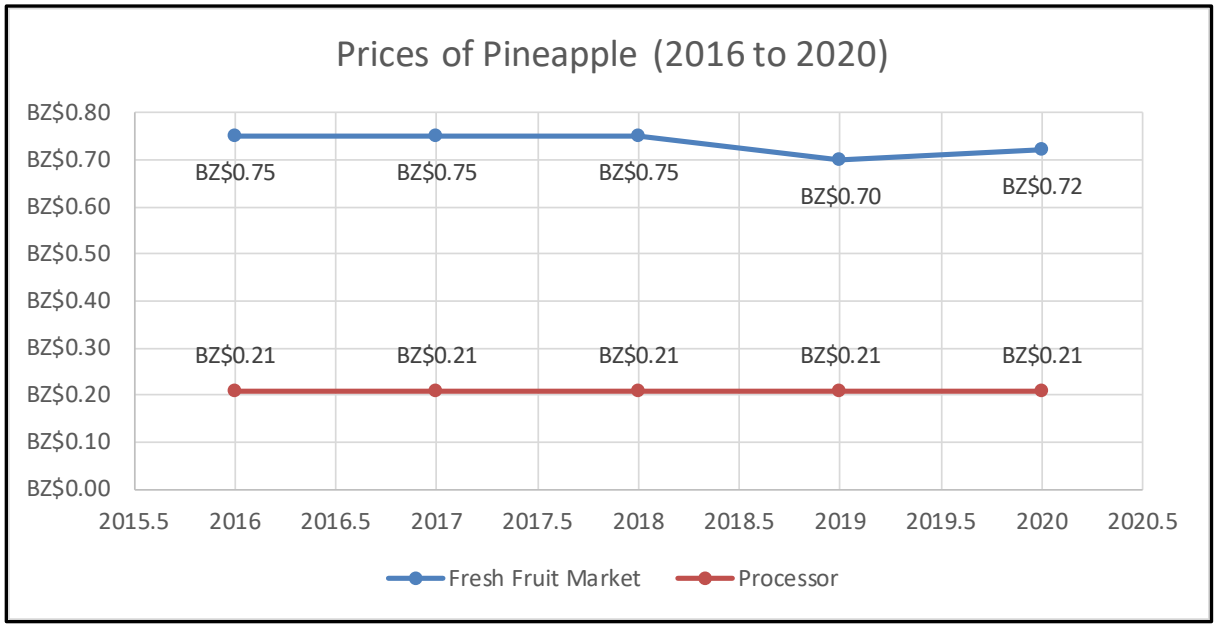


Table 7. Prices of pineapple for the local market

Year	Fresh Fruit Market	Processor
2016	BZ$0.75	BZ$0.21
2017	BZ$0.75	BZ$0.21
2018	BZ$0.75	BZ$0.21
2019	BZ$0.70	BZ$0.21
2020	BZ$0.72	BZ$0.21

6. Supply Chain

The supply chain considers the production, importation, profitability, and cost of production across the value chain.

The total production of Pineapple in 2020 in the country was an estimated 2,910,663 pounds valued at BZ $5,745,297.28 (SIB, 2020). The main suppliers of Pineapple in Belize are farmers.

6.1 Amount Supplied

Table 8 shows the yearly supply of pineapples for fresh fruit consumption and processing for the last five years. There is no importation of fresh fruit pineapple in Belize. The main suppliers of pineapples in Belize are individual producers and those organized in co-operatives.

Table 8. Annual supply of Pineapple (lbs) (2016 to 2020)

District	Total Annual Production (Lbs)				
	2016	2017	2018	2019	2020
Cayo	0	120,000	637,500	1419,500	1515,000
Stann Creek	688,500	825,500	735,000	469,000	699,819
Toledo	2250,000	2864,950	3384,500	3965,275	4856,532
Orange Walk	200,000	341,704	1852,800	2049,376	1366,800
Total	**3138,500**	**4152,154**	**6609,800**	**7903,151**	**8438,151**

Table 9. Total area harvested

District	Total Area Harvested (Ac.)				
	2016	2017	2018	2019	2020
Cayo	0.00	15.00	17.00	40.00	51.00
Stann Creek	50.00	55.00	49.00	39.00	51.00
Toledo	75.00	425.00	535.00	584.00	761.00
Orange Walk	60.00	24.00	72.00	61.00	51.00
Total	**185.00**	**519.00**	**673.00**	**724.00**	**914.00**

Table 9 registers a stable growth in the cultivation of pineapples. The acreage data for the Toledo District is questionable when compared to the annual production. Although the acreage

planted farmers in Toledo is from the MAFSE, participants at the validation workshop for the VCMA voiced their doubts that the total pineapple acreage in existence is 761 acres for 2020. They voiced there are about 35 active pineapple farmers in Toledo concentrated in the Trio Village area with an average of 2.5 acres planted, at a density of 15,000 plants/acre and fruit produced at an average of 3.5 pounds/fruit. However, it must be pointed out that the largest growers in the calculations based on the production of 4.8 million pounds in the year 2020 would account for about 90 acres of pineapple.

6.2 Cost of Production

The Belize Citrus Growers Association estimates BZ$ 0.18 to produce a pound of Pineapple. Although this may seem accurate, more detailed study is needed in conducting proper feasibility studies for this crop. Using a farm's specific case, we were able to calculate the cost per pound with similar results: our estimate was BZ$ 0.14 /Pounds This based on 1 acre, 20,500 plants @ 3 lbs per fruit (average) or a total production of 61500 lbs/acre. The farm reported cost of production equals to BZ$8607/acre (Citrus Products of Belize Limited).

Table 10 shows the data for the budget of 1 acre of MD2 pineapple facilitated by the Belize Citrus Growers Association (CGA). Details on each of the components of the budget can be found in *Annex 3: Pineapple budget 2018 – Belize Citrus Growers Association*. The cost structure for year 1 shows planting (52%) as the major cost and harvesting as the second most important cost.

Second year budget shows harvesting (33%) followed by disease control (21%) as the activities contributing the most to cost of production of one acre of MD2. Here the cost of production per pound was calculated to be BZ$ 0.11. The budget recapped in Table 10 uses 29000 plants per acre while the calculation presented at the beginning of this section (from CPBL) uses 20,500 plants per acre. This alone explains the differences in production costs between the two calculations.

Table 10. Budget allocation for 1 acre of MD2 pineapple

		Year 1		Year 2	
	Description	Total cost	% of Total	Total cost	% of Total
	Land preparation	$3,639.00	12.76	$0.00	0.00
	Planting	$14,818.71	51.96	$0.00	0.00
	Weed control	$345.00	1.21	$351.90	3.64

		Year 1		Year 2	
	Description	Total cost	% of Total	Total cost	% of Total
	Fertilizer	$1,927.80	6.76	$1,425.08	14.76
	Pest control	$976.50	3.42	$996.03	10.31
	Disease control	$1,961.81	6.88	$2,001.05	20.72
	Flower induction	$261.83	0.92	$267.06	2.77
	Harvesting	$3,200.00	11.22	$3,200.00	33.14
	Equipment	$1,388.00	4.87	$1,415.76	14.66
	Total Cost	**$28,518.64**	**100.00**	**$9,656.88**	**100.00**

Source: Own elaboration using data from Citrus Growers Association

In Trio Village, where the value-chain workshop was held, the average density is less than 15000 plants per acre, sometimes far lower. Fruit sizes are a little bigger, but no farmer is able to give a true cost of production or production in pounds because they sell to the fresh fruit market, then the remainder goes to the processing. The fresh fruit market demand is not very high but does pay significantly more.

7. Climate Change Vulnerability of the Pineapple Value Chain

While value-chain dynamics is commonly analyzed and described in 3, 5 or 10 year periods, and most experts will avoid market prospects or projections beyond the 10 year mark, any climate analysis is described in longer periods. Climate dynamics is rarely described in short-periods of years as experts understand the limited predictable value of 3, 5, or 10 year forecasting. In addition, climate forecasting in general terms, will be useful for the decision-making process in the pineapple value-chain if it provides relevant information on how the future climate could affect production, productivity, accessibility of resources, or any other variable affecting the likelihood of pineapple business.

For this report, we bring in context of the pineapple value-chain findings produced by simulation, index, and modelling explained in detail on the CVA reports. Even with the explanation given here, those who want to understand methods and techniques used to obtain these findings should review the CVA reports.

Two major sections of findings are presented below. First, we report changes on climate adequacy for the pineapple production for the whole country of Belize. Using maps and a colour-code to understand those changes, a general futuristic perspective to produce pineapple can be described. Second, findings specifically for the 10 intervention areas of the RRB program are presented. Aiming to describe the uniqueness of each area and how this could bring similar or very different picture of the future for pineapple production, we identify losses and gains in suitability or adequacy in percentages of the adequacy from the base line data.

7.1 Pineapple value-chain and changes on climate adequacy for Belize

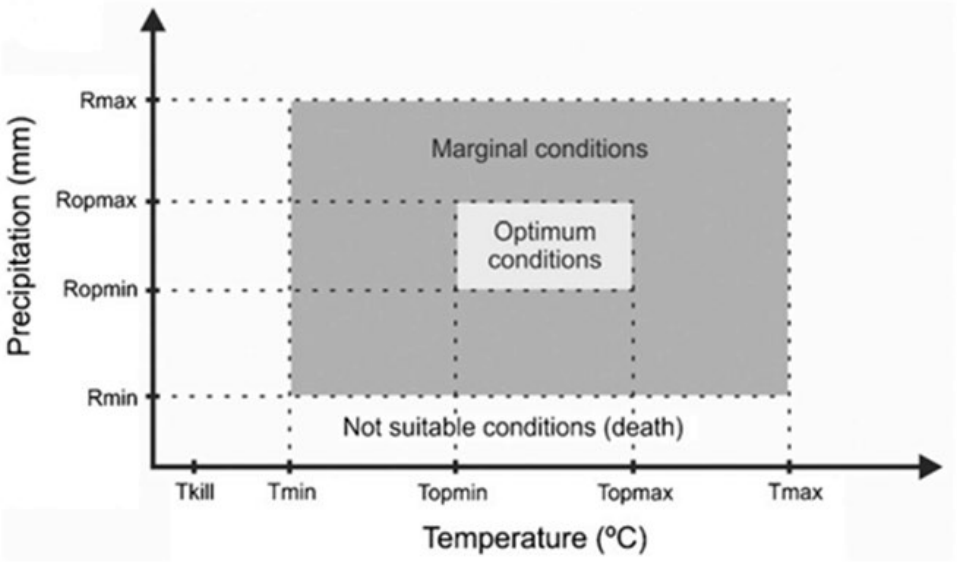
By comparing current climate conditions and future climate conditions, the climate vulnerability assessment team provides a first ever effort to understand possible changes in climate adequacy to produce pineapple in Belize. A brief description of the method used to develop the comparison is presented here. First, current climate conditions (1970 – 2000) were defined as those referring to the historical average total annual precipitation and temperature (WorldClim 2.1). Secondly, future climate conditions were represented as the average of the weather conditions over the 30-year period 2041 – 2070 (i.e. centered in the 2050's), consistent with the definition of climate by the World Meteorological Organization. Again, focusing on the projected changes in precipitation and temperature.

Third, the results (comparisons) are based on an assemble of climate projections from a 21 climate models (see Materials and methods) and two emission scenarios RCP2,6 and RCP8,5.

Both scenarios (RCP2,6 and RCP8,5) show increases in the average temperature towards 2050. RCP2.6 shows average temperature values that exceed the baseline between 0.7°C in Belize and Corozal up to 1.5°C in Toledo. On the other hand, the RCP8.5 scenario shows larger increases in temperature ranging between 1.6°C and 2.5°C above the baseline in Belize and Toledo, respectively.

Fourth, the R. EcoCrop package was used to construct an adequacy index based on the climatic requirements of the species; for this, the model uses two types of ranges, which are defined by a pair of parameters of each variable (temperature and precipitation). The first range is that defined by the minimum and maximum temperature, as well as the minimum and maximum precipitation, in which we can find the species (absolute range); that is, beyond those limits the conditions are not suitable for the development of the crop or the species. The second refers to the optimal ranges for both temperature and precipitation required by the species so that it can achieve its best performance. Figure 9 shows the interaction between precipitation and temperature parameters for absolute and optimal ranges.

Figure 9. Interaction between precipitation and temperature parameters for absolute and optimal ranges



Below are the climatic parameters considered in the climate adequacy analysis for the pineapple production, prioritized in the RRB project. The optimal range of precipitation for pineapple cultivation is between a minimum of 800 mm and a maximum of 2500 mm, and the temperature optimal range goes from a minimum of 21 and a maximum of 30 °C.

Table 11. Climate parameters considered in the climate adequacy analysis requested for the pineapple value chain prioritized in the RRB project

Description of parameter used in the model	Value used
Gmin: Minimum duration of the growing season	330
Gmax: Maximum duration of the growing season	365
Gused: Used duration of the growing season	348
Tkmp: Temperature (°C) below which the species cannot survive	0
Tmin: Lower limit of the absolute temperature range (°C)	10
Topmin: Lower limit of the optimum temperature range (°C)	21
Topmax: Upper limit of the optimum temperature range (°C)	30
Tmax: Upper limit of the absolute temperature range (°C)	36
Rmin: Lower precipitation limit (mm) of the absolute range	550
Ropmin: Lower precipitation limit (mm) of the optimal range	800
Ropmax: Upper limit of precipitation (mm) of the optimal range	2500
Rmax: Upper precipitation limit (mm) of the absolute range	3500

Fifth, a reclassification of modelling results with EcoCrop was carried out. To process the suitability data, the results were reclassified into quintiles; thus, the value of less than 20% of the suitability range corresponds to the very low class, while the very high adequacy range (dark green color) corresponds to a scale greater than 80% in the adequacy scale resulting from modelling with EcoCrop. On the other hand, the comparison between the results of the adaptation according to the current climatology and the future scenarios were also reclassified in such a way that the strong green colours correspond to the areas where gains would be experienced in climatic conditions for the crop analyzed (it implies for example areas that pass from a category of low suitability to a higher category of adequacy); in contrast, brown was used to identify areas where adequacy categories are low when comparing the future versus baseline scenario.

Below are the climate adequacy maps for pineapple (Ananas comosus) cultivation in Belize selected species at national level. Figure 10 maps the climate adequacy for cultivating pineapple in Belize for the baseline (current conditions, year 2000) and both future scenarios (centered in year 2050). The suitability for the crop is color-coded. Figure 11 maps the general losses and gains on adequacy comparing each scenario with the base-line climate adequacy for production of pineapple in the whole country.

Under both scenarios, climate adequacy to produce pineapple do not see major losses, however, the southern area of the country will increase the total area of unsuitable land.

Figure 10. Map for Climate Adequacy for cultivation of Pineapple (*A.comosus*) for Belize for the base line and two future scenarios 2050

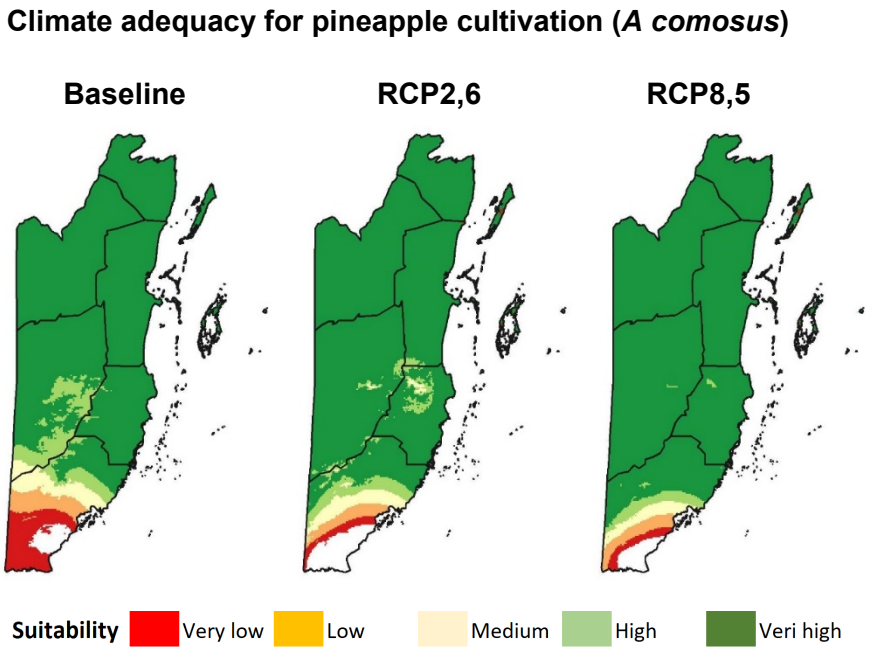
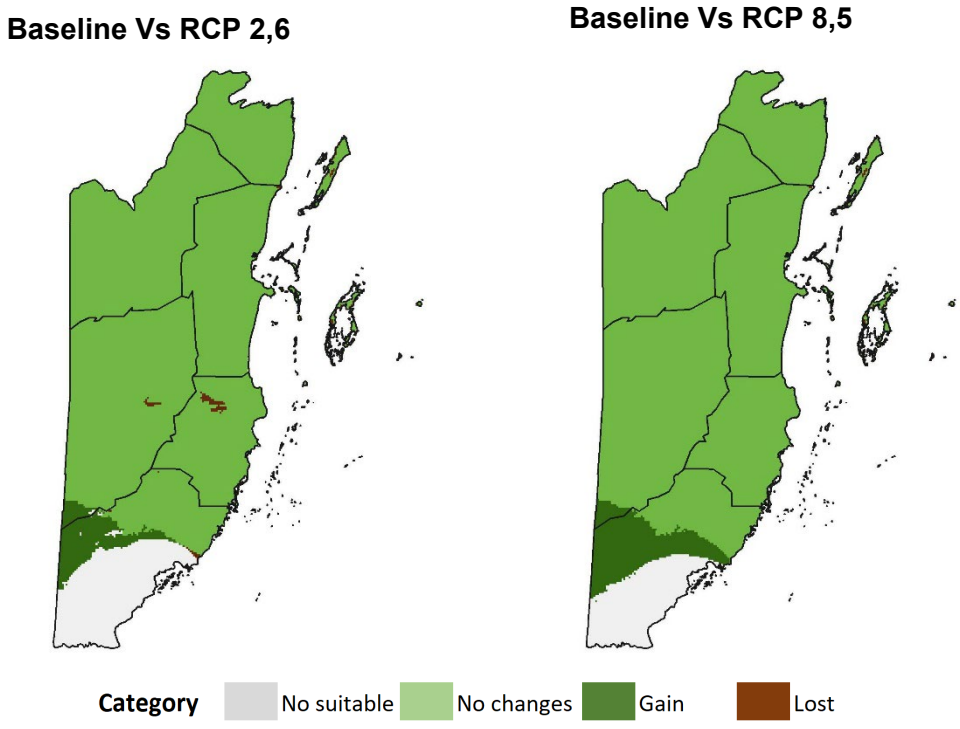


Figure 11. Changes in climate adequacy between baseline and future scenarios for pineapple cultivation in Belize



7.2 Pineapple Value-chain and changes in climate adequacy for RRB's intervention areas

As much as the data for the whole country could tell us the story on sensibility and vulnerability for our target crop, the RRB defined 10 intervention areas (Assessment Units of the Rural Resilience Programme in Belize (RRB) and it is on those areas where knowing how conditions will affect our value chain has been prioritized. We note for our value chain, the future may play significantly different at RRB's intervention areas than at the national level. Assessment Units of the Rural Resilience Program in Belize (RRB) are shown in Figure 12.

Figure 12. Mapping Intervention Areas-Assessment Units of the Resilience Rural Belize Program

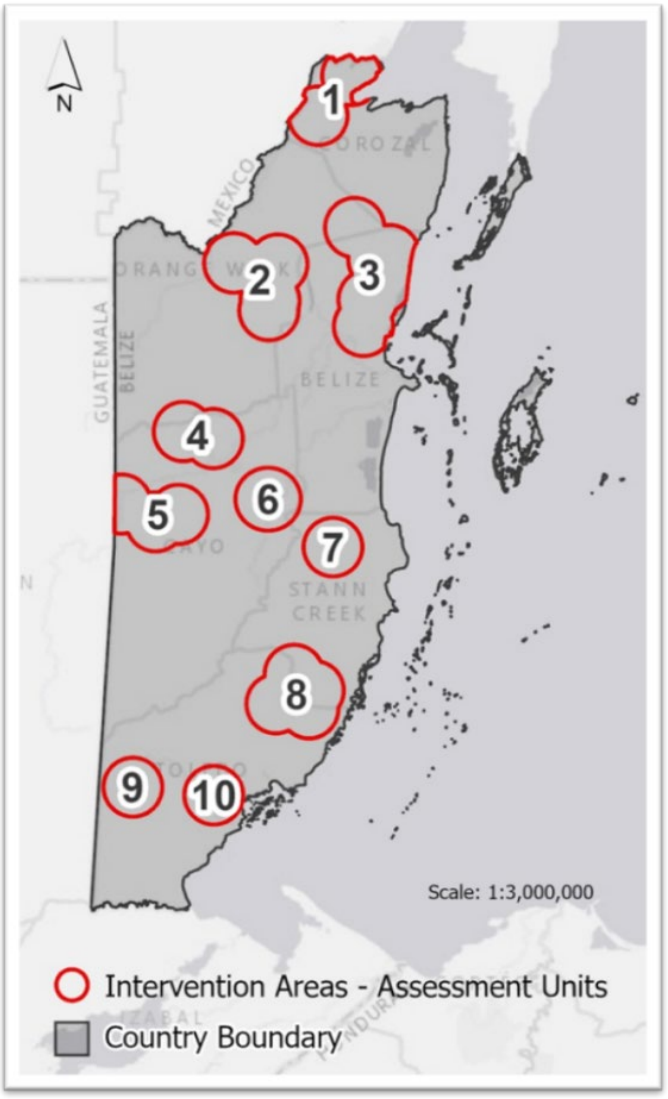


Table 12 shows changes in climate adequacy between baseline and future scenarios for pineapple (*A. comosus*) cultivation in Belize as a percentage of each RRB programme intervention area. Figure 12 shows such areas. When an intervention area is the focus of the comparison between scenarios, and not for the whole country of Belize, we are able to identify area of intervention 9 and 10 as the areas gaining suitability. However, note that those areas already are presenting unsuitable conditions for pineapple production which implies that their gains in suitability are marginal. If we consider that Toledo District has been increasing the production more than other districts, a warning sign should be put into the future of this sector in Toledo District. Although, areas of intervention 9 and 10 are already limited on the area suitable for pineapple, we should prepare and act accordingly to the climate change forecasts.

Table 12. Changes in climate adequacy between baseline and future scenarios for Pineapple (*Ananas comosus)* cultivation in Belize as a percentage of each RRB program intervention area

Change direction Percentage (%)	**Intervention Areas- Assessment Units**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
	RCP 2,6									
Gain									51	
Unsuitable									49	100
Loss			0.8				16			
No changes	100	100	99.9	100	100	100	84	100		
	RCP 8,5									
Gain									95	7.8
Unsuitable									5	92
Loss			0.8							
No changes	100	100	99.9	100	100	100	100	100		

*Fuente: CVA consultancy report *Draft with preliminary results.*

Toledo District will see increasing cost of production because weather conditions will become less suitable for the cultivation. Currently farmers are trying to depend less on rain patterns, in Toledo we see more interest in irrigation systems. This adaptation to climate change could contrast the projected losses in suitability.

Also, it is evident that most of the other areas will not see major changes in their situation with respect to baseline suitability. In general, future climate changes could be argued to have limited impact for the cultivation of pineapple on RRB target communities, and Belize will continue to sustain a great potential for growing pineapple.

Constraints and Opportunities

The production of Pineapple is being given priority by the Government of Belize through the Resilient Rural Belize (RRB) Program. This in itself is very positive for the fruit industry; therefore, all the challenges and opportunities need to be examined in detail to strengthen the value chain. Presented below are challenges and opportunities identified in the Pineapple Value Chain.

Table 13. Challenges and Opportunities for Pineapple Value Chain in Belize

	Constraints	Opportunities
Input Supplies	**High costs of inputs:** • Very high cost of fertilizers, seeds, and pesticides. • High cost of fuel	• Farmers´s organizations, like cooperatives, could be engaged in buying in volume and transferring cost savings to individual farmers. For pineapple, a potential reduction in fertilizers and insecticides could help significantly in reducing the cost of production. • Substituting organic fertilizers could be explored as a cheaper alternative to chemical fertilizers. This could be analyzed together with an evaluation on timing of applications as it is understood that organic fertilizers take longer to produce effects and the farmer will need to learn the new times for application. • Expenditure on fuel can be reduced if there is greater collaboration and planning for taking orders and delivery products between the actors. • The prices of inputs (i.e., fertilizer and pesticides) may not change rapidly enough, but efficiency in application could be tremendous. A training on the basics of efficient use could reduce the total bill paid by farmers.
	Seed Quality and Availability: • Seed variety for	• Facilitate importation of seeds and establish local seed banks to supply farmers together with technical assistance for those providers about good management of the seeds: Differentiated treatment for fresh market versus processing market.

	Constraints	Opportunities
	processing and fresh fruit, prices are very high	• It is recommended to support seed providers finding international reliable sources. Some providers may be so small that they will not be able to carry out the best seeds even if the farmer is willing to pay for it. •
Production	**Poor Knowledge on use of inputs** • Poor knowledge on use of pesticides application	• Opportunity for collaboration and strengthening of relationships between farmers, agronomists, and local input suppliers so the information that is provided to the farmer is the same as the one technical professional are recommending. The information given to the farmer must be calibrated/reviewed together with the input provider. • Training on the proper use of agrochemicals and equipment use adjusted to the scale of operation. Small scale operations should not follow the same recommendation that commercial, larger scale operations. It is important to work with integrated pest management when advising small-scale producers. • Information sharing on alternatives inputs (i.e., organic fertilizers) could be promoted by the local extension service.
	Farmer does not plan Production • Especially for fruit destined for processing is very important to meet supply and demand of the processor.	• Enhance among farmers and farmers' organization the habit of working with an Annual Production Plan (APP), for example, by providing easy and simple manuals and introducing this concept regularly in the training. • Explore with pineapple processors the possibility that cooperative will act as guarantee of contracts between the farmer and the processor. Processors may be willing to offer some kind of better price to security delivery of the fruit. Informal contracts are one step closer to formal (commercial) contracts. • Small scale producers of pineapple may not see immediate benefits of implementing an annual production plan because they may be using collectors to get to the processing plant.

	Constraints	Opportunities
		However, it is possible to think that those producers may benefit from coordinating their small-scale operations with a "group" annual production plan, which will bring the possibility to coordinate transportation and sell directly to the processor. This could be promoted by cooperatives to members.
	Climate Vulnerability • Farmers depend on the seasonal rainy season and not much emphasis on climate change.	• Share information on climate change and technical assistance on irrigation systems. • Use the concept of "Escuela de Campo" to invite producers to learn about production under irrigation and the importance of not depending on the rainy season for their crops.
Harvest and Post-Harvest	**Bad Road Conditions** • Poor road conditions between distribution and collection center.	• RRB could consult with government area representative to address this issue. What should be avoided is fast deterioration of road improvements due to lack of maintenance or poor monitoring. Here, communities should be mostly involved in providing monitoring. • Current issues of land titles for many farmers could limit the potential benefit of road infrastructure improvement to farmers, therefore, an active plan for land title formalization should be pursued. • Request to include in the farmer business plan the need for road infrastructure as well as the need for legalizing land ownership.
Processing	**Farmer does not adhere to quality standards** • In particular, processor already has quality standards farmers have to adhere to.	• Organized groups and/or cooperatives need to request development of standards and possible price control over quality of pineapple commercialized in the fresh market. • It should be explored why there is no quality premium paid for those farmers following the quality standards. If a farmer does not perceive the benefit, it will be difficult to adhere to standards. Either there is no quality premium possible to offer, or the standards are not clear to farmers.

	Constraints	Opportunities
	• Quality standards are not clear (fresh)	• If production increases the importance of the quality standard as a requirement for carrying out business with the processor, it will become even more relevant; production of a quality manual, adapted to farmers language and circumstances, should be useful for the future of the value chain. • Current cooperatives may be able to work much easier with the Belize Bureau of Standards, but they need coaching and technical support to discuss standards.
	Lack of diversification • Limited processing and development of derived products. • Rejected produce by the processor	• Promotion of processing among organized group. Belizean consumer is familiar with the offer of imported pineapple-based products such as jellies, jams. Replacing these imports by joint work between processors and cooperatives, should be promoted as a strategy of diversification of the value chain. • Carry out a study to verify the reasons for the rejection: poor knowledge of the standard, adverse conditions that prevent achieving quality, carelessness of the producer. We have to know the reasons for the rejection and from there, look for corrective measures to reduce it. • Use rejected produce into artisanal processing of pineapple-based products that are well received in the domestic market.
Marketing and Distribution	**Poor Business Practices** • Poor record keeping resulting in poor understanding of cost of production • Lack of formal contracts with intermediary resulting in late payment	• Farmers need the knowledge to farm as a business. In most cases, training on record keeping, cost of production estimation, and knowledge about contract and negotiation should be the basic content of the training on entrepreneurship for farmers. • Good business practices training should also be given to the cooperatives. It was argued that cooperatives need to improve their relevance to members who need to see clear examples of why belonging to a cooperative is important. Marketing of produce, collective negotiation, and saving on cost of inputs, should be obtainable with strengthening the cooperatives.

	Constraints	**Opportunities**
	to farmer for produce sold • No official medium to learn about price information on the market •	• Manuals and simple brochures easy to complete/read are necessary as well as make them available to pineapple producers. • Consistency of services that provide price information to the producer can be achieved using technologies such as cell phones. Here, it will first be necessary to launch a pilot program to define the ideal format that reaches the producer and that is easy for them to interpret and use.
	Poor access to financing Financial institutions require collateral such as land title, however, many of the farmers are squatters and do not have a land title to use as collateral to access finance.	• Poor access to financing is normally a result of limited collateral value to offer to banks, however, access can be improved if a farmer is able to demonstrate administrative skills: bookkeeping, inventories, etc. NGO´s and similar sources of financial support should be obtainable with better business practices. • Improving cooperative capitalization could translate into better financial access for the farmer. Undercapitalization at the cooperative level, limits capacity to provide advance payments or credit to members which is critical for planting and harvesting/collection. Training in financial management at the cooperative level could increase the capacity to provide those services to farmers. • Appropriate business training with emphasis in investment and financial management for cooperatives, should reduce the need to find often high-cost credit for the organization. Even if the cooperative has low capitalization, it should not mean that it needs to work with expensive capital: learning where to borrow, as well as, knowing how to manage the loans are essential to guarantee the cooperative is working with the cheapest capital possible. • Land ownership should be encouraged as much as possible knowing that it could grant farmers access to credit and work capital. The Lands Department officials may need to train

	Constraints	**Opportunities**
		and inform farmers on the process of acquiring land legally. It is recommended that a study be conducted encompassing the 10 intervention areas of the program seeking to explain why farmers do not formalize land ownership.

8. Conclusions

Pineapple Value Chain Ready for Upgrading. Pineapple is grown in all districts in the country. The Toledo District is the leading producer of Pineapple followed by the Cayo District. Main producers of Pineapple are part of a cooperative. The Toledo District at this moment is taking the challenge to produce pineapples for processing, which is quite a secure market. Other districts such as the Stann Creek and Cayo District should be doing the same.

The Ministry of Agriculture, Food Security and Enterprises has in its policy to support and prioritize fruit production as part of the larger agricultural strategy to conduct import substitution. Technical and financial services are provided by supporters and service providers along the value chain. Most farmers do not use financial institutions for financial assistance because they don't have sufficient collateral such as land as required by these financial institutions.

The strengthening of the Pineapple Value Chain requires strengthening the cooperatives who are the main producers of pineapple. All farmers require technical assistance and training in Good Agricultural Practices, training in basic farm business management. There is a need to development a national seed policy and certification and development of pineapple seed banks, so as to curtail importation from other countries.

Impact of Covid-19 and the business environment. The unforeseen impact of covid-19 on logistics for carrying out the studies was a great challenge. Carrying out interviews and workshops in pandemic required extra planning and most importantly the flexibility to adapt. Not surprisingly, our analysis shows unexpected consequences under the pandemic which began in 2020. Therefore, our findings need to be put in the context of an abnormal business environment which should serve as a warning on our end-market assessment. Consumers will need to learn again the market conditions after pandemic. Would consumers return to pre-pandemic taste and preferences? For now, what is safe to conclude is that Belize's end-market for fresh pineapple saw what the world without contraband looks like, and it is up to consumers to tell us what consequences, if any, this has for their preferences and habits of consumption.

Volume increase and processing opportunities. The pineapple value chain includes some cooperatives with weak managerial and productive skills. Given the need to coordinate with processors the supply of fruit to the processing plant, the role of cooperatives become essential. The productivity at the farm level was reported to be low, in some cases critically low, resulting from lack of improved genetic material, low use of fertilizers, inappropriate pest and disease management, and limited knowledge of good agriculture practices. This particularly is the case

for small scale producers who may not be selling to the processor directly and focus more on the fresh market. For a value chain with potential to aim for regional and international markets, relatively high and rigid sanitary and quality standards (traceability, cold chain, etc.) are prerequisites. Belize's pineapple processing investors seems on track of expanding demand of raw materials. RRB's value chain approach came at a very convenient time since expansion of the processing volume will only be obtainable if all stakeholders can visualize this opportunity and take action.

Weak organizational processes are the standard not the exception – Farmers' organizations have yet to consolidate their governance, management, and overall organizational structures. First-tier organizations may benefit of formal relations with their members specially with strong communication and coordination procedures for production and marketing. Systems for monitoring and evaluating performance are also needed. Finally, avoiding confusion on the division of responsibilities between the board of directors and community-based leaders or administrators could improve the decision making and increase accountability. These and other barriers must be eliminated with appropriate business training.

Managing expectations for small-scale producers. We argue that small-scale producers should be assisted technically in directing their production to the fresh market and/or explore craft processing for local markets. For small-scale producers, less than one acre, means they will be better served by collectors than try to move their product to the processing plant.

It is well understood the length of time it takes for value-chain approaches to become viable, if it doesn't break down before reaching its goal. It could take 4 or 5 years despite, or at times because of, intensive, albeit often disarticulated, interventions from government agencies, NGOs, development projects, and the like. The long duration of this process will increasingly become an obstacle for stakeholders, their organizations, and development agencies, given rapidly globalizing markets for agricultural products where these enterprises meet with both new opportunities and increased competition. It is imperative to identify viable shortcuts to value-chain development based on enabling political and legal frameworks, harmonized and aligned development interventions, and the delivery of effective and well-articulated technical, business development, and financial services. Nothing of these could be achieved without promoting regular dialogue between local processors, investors, and government agencies, and producers.

Priorities for the whole value chain. When thinking of a value chain as a system, all stakeholders are interlinked, and all are mutually dependent. RRB must recognize that some interventions

are prioritized differently for different actors/stakeholders. Interventions for the whole value chain requires extra effort to create consensus on priorities. Through workshops and interviews carried out with stakeholders of the pineapple value chain, constraints were prioritized and are shown in Table 13 of this report. Priority among value chains should also be understood as a necessary step toward the efficient use of resources. To maximize the impact of the RRB program, the pineapple value chain should be prioritized given the market potential, the suitability for cultivation (even under climate change scenarios), and the value-added opportunities that cooperatives could help to create.

9. Final comments on limitations of the study

In general, an argument can be made the following list includes major challenges for achieving the best pineapple value chain and market assessment.

1. It was observed that **women participating** as members, managers and leaders was limited during the workshops and in the interviews. Although suggested by some participants, covid restrictions do not seem to explain the gap in participation between men and women, noir between youth and adults. An explicit action plan for gender equity should be draft, discuss, shared, and put in place with all members working with the value chain approach.

2. **Short sight as the new norm.** Covid-19 had everyone focusing on the short-sight of event, losing the potential of the studies to reflect long-sight strategies. For example, having no tourism make people ignore the opportunities that linking farmers to tourism supply chain represent on the long run. Similarly, many people that lost their jobs, moved to micro farming affecting the normal agricultural supply in many of the products studied. Of course, this is just a logical attitude under crisis mode, but it could have serious limitations when a value chain approach is used to harness governmental intervention in the sector. Finally, Belize tourism sector meltdown under covid-19 pandemic works as a reminder of how important diversification is for Belize agriculture value chains targeted by the VCMAs studies. Among agriculture officers and extensionists, opportunities to connect farmers to the tourism supply chains were not at all present in discussions and workshops carried out for the VCMAs studies. Such inattentive situation, probably due to current emphasis on national consumers and effects of the pandemic, should not diminish the tourism sector as a source of diversification. It is expected that as the tourists return to Belize, opportunities to link farmers to the tourism supply chain will as well return. Here, challenges on quality and acceptance of standards that have been already identified in the VCMAs studies will be paramount

3. We found that **data inconsistency** of official sources is a serious limitation for any VCMA analysis. When data of production, yields and acre-harvested do not match, it is possible that Belize´s agencies in charge of collecting the data will need to revisit the way that they are producing the data. It is suggested that RRB brings this observation to SIB for further consideration.

4. Making sense of working with **value chain approaches**. During the process of carrying out the study, it was clear that not all agriculture extensionist and technicians understood what it is to work with a value chain approach. For some, the approach still works mostly to support farmers, which is a misunderstanding. The guiding principle is to support the whole chain by creating more options to create value. If the creation of value is under the scope of the farmer or with the processor, that is fine with the value chain approach. It was difficult to conduct value-chain workshops were farmers thought it was a space for them to present demands and discuss only issues concerning to them. RRB needs to consciously remind participants and partners the essential features of the value chain approach.

5. The major challenge for making sense while working with the value chain approach is exemplified by the **misrepresentation of what a middleman (collector) does** for the value chain. Ignored are the essential changes on space and time it brings to the value of products: relocating, holding them to times that are more convenient, assuming various risks by stocking inventories. Why is the bias against middleman so persistent? Part is explained by cultural perceptions as mere cheaters, part the misjudging of how difficult is to create value of space and time. Farmers having mastered the complexities of the production process have seldom also mastered the very different complexities of inventory management and numerous other services performed by middlemen in the process of relocating products in time and space. Value chain approaches demand integrating middlemen into the negotiation/concertation table where actions for the value-chain are being discussed; having the technical team understand this is paramount.

10. References

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11. Annexes

11.1 Annex 1. Citrus Products of Belize Limited fruit delivery systems & standards, fruit acceptance standards for pineapple.

FRUIT DELIVERY SYSTEMS & STANDARDS FRUIT ACCEPTANCE STANDARDS

PINEAPPLE

1. Fruit Variety/Maturity Ratio/Fruit Size

Criteria	Accepted	Not Accepted
Fruit Variety	MD 2	Smooth Cayenne, Sugar Loaf, Red Spanish, Queen, Pernambuco
Maturity: Fruit maturity is evaluated on the extent of fruit eye flatness and Color Stage or skin yellowing.	***Eye Color:*** 20-50% Eyes Yellow *Code: Color Stage (*CS) 2 ***Fruitlet Flatness*:** lower one-quarter to one-half of the fruitlets are flat. (skin color can be green, provided the minimum maturity requirements are met)	Any criteria less than those as set in the **ACCEPTED** column.
Maturity Ratio	22.0:1 or	Below 22.0:1
Minimum Brix (^{0})	12.0	Below 12.0
Fruit Size	3lbs (1.36 kg) or greater Six(6) inches in diameter or greater	Less Than 2 lbs (1.0 kg)

2. Sound and Wholesome Fruits

In addition to conforming to the specifications for variety, maturity, ratio, and fruit size, fruits delivered to the factories must be sound and wholesome, that is free of:

(a) Decays
(b) Splits/Bruises contamination
(c) Scale insects or Internal insect damage
(e) Mold presence
(f) Excessive soiling and
(g) Absence of Black rot

All fruits with the above defects will be rejected by the graders at the factories. A maximum of 10% rejects, which shall include no more than 2% decays, shall be the permitted level of rejects in a load.

3. Fruit Delivery Vehicle Standards

A vehicle delivering fruit is required to meet the following conditions:

(i) Have sufficient power to allow safe positioning on the off•loading ramp or bay, and, where necessary, exit the ramp/ bay with the load of fruit, under its own power.
(ii) Fruit holding compartment clean and free of contaminants such as oils, chemicals, fertilizers. etc.
(iii) No leaking of oils and fuels on to the off-loading ramp.
(iv) Fruit holding compartment with proper flooring to allow for proper off• loading.
(v) Provide one person to assist with off-loading.

EXPLANATORY NOTES

(i) Fruit Variety:

The commercial pineapple is the fleshy fruit produced by some varieties of the plant *Ananas comosus (L.) Merrill, which* is a tropical member of the plant family, Bromeliaceae. The exceptional hybrid selection named MD2, is also known by its trade names as "Golden Ripe", "Super Sweet", "Rompine" or "Gold". MD2 is better in several qualities. Among them are: uniform bright gold color, sweeter taste, higher Vitamin C content, lower fiber, lower acidity, thinner skin, smaller fruits at an average of 1.5 kg each, and longer shelf life.

(ii) Maturity

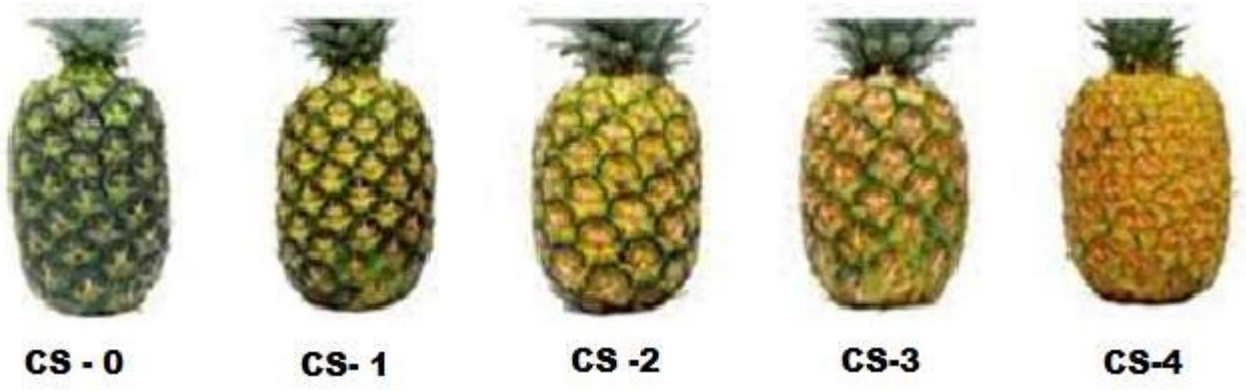
Harvesting and submitting a mature fruit is necessary to ensure the consistent production of quality juices. Deliveries of fruit below this minimum maturity grade will be treated in accordance with Part 1 to this document.

***Fruitlet Flatness*:** The pineapple has numerous individual fruitlets, which mature from the bottom part of the fruit to the top. As the fruitlets mature, they become flatter. A pineapple is typically mature and ready for harvest when the lower one-quarter to one-half of the fruitlets are flat.

***Fruit Surface Color**:* Pineapples change from green to yellow to reddish-brown as they mature. Pineapples are considered ripe and at their best eating quality when the fruit surface color is the one-quarter to one-half yellow.

The fruit will also bruise easily and is more vulnerable to damage. Pineapples are over-mature when the surface color of the fruit changes to reddish-brown. The following color classification, or peel-Color Stage (CS), is used:

C0 – Totally green exterior
C1 – Beginning to turn yellow/orange on one quarter of the fruit surface C2 – Yellow/orange on one half of the fruit surface
C3 – Yellow/orange on two thirds of the fruit surface C4 – Totally orange/yellow fruit.



4

(iii)Minimum Brix

CODEX GENERAL STANDARD FOR FRUIT JUICES AND NECTARS stipulates that the juice for pineapple be a minimum Brix of 12.8 degrees. Fruits with this Brix level or higher are likely to be well mature, with high solids, and give final products of good flavor and color. Such quality fruits enhance payments to growers.

(iv)Fruit Size

Fruit sizes less than 3 pounds are not handled efficiently by our fruit peeler(s). In addition to juice losses, will also result in low quality final product.

(v) Sound and Wholesome Fruits

Sound and wholesome fruits are essential for good quality juice products. On the other hand, a small amount of unsound and unwholesome fruits may present problems in the extraction system which may affect final product and could be rendered unsaleable because of off flavors and

excessively high quantities of immature and improperly processed fruits.

Fruit graders at the factories are therefore under instruction to reject all unsound and unwholesome fruits.

The following are some common examples of unwholesomeness:

(a) "Internal Insect Damage ": Damage by insects will greatlyn contribute to the resultant negative consequences described at iv(a) above.

(b) “Splits/Bruises". : Fruits may split or suffer severe bruising when allowed to fall from tall trees during reaping, especially in the dry months when the ground is hard. Fruits may also split or become severely bruised by rough handling during loading on to a vehicle and during transportation. The juice of such fruits will normally have high levels of spoilage organisms, which will have gained admittance through the splits or the breakdown of the bruised areas. These fruits must be rejected for the same reasons given at *iv(a)* above.

(c) "Decays": Conditions described at *iv(a)* and *iv(b)* above will quickly deteriorate to "Decays" under the moist and elevated temperature conditions. Contamination of other fruits with high levels of post•harvest spoilage organisms under such conditions can quickly occur, which could result in the spoilage and rejection of large quantities of fruit.

(d) "Mold Damage": Fruits are sometimes coated with a black film caused by molds. This black film may be released at the extractors and as a result, black specks will appear in the juice.

(e) "Excessive Soiling & Contamination": Fruit harvested during the rainy months maybecome excessively soiled with mud. If such fruits pass into the processing line, they will create an unsanitary and contaminating condition throughout the processing system. Growers are required to satisfactorily clean such fruits,before acceptance by the factories. Fruit may become contaminated with oils, chemicals, fertilizers, etc. during

transportation in unclean vehicles. Such fruit will be out rightly rejected at the factories. Foreign objects like stones, gravel, and sticks must be removed from a load of fruit, if so contaminated, and at the expense of the grower, prior to acceptance of the load by the factory.

(f) Black rot, also called Thielaviopsis fruit rot, water blister, soft rot, or water rot, is a universal fresh pineapple problem characterized by a soft watery rot. Fruitlet core rot, black spot, fruitlet brown rot, and eye rot all refer to the brown to black color of the central part of an individual fruitlet.

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GUIDELINES FOR INSPECTION OF FRUIT & MANAGEMENT OF NON-CONFORMING FRUIT

A. Definition: "Non-Conforming Fruit" means:

(a) For fruit inspections for each delivery of fruit, the receiving foreperson on shift shall make a quick visual inspection and have an indicative sample of 4 fruits taken. If it is evident that the load has fruit of 2 different stages of maturity, the sample is to be drawn from the fruit appearing to be of lower maturity. The sample is to be drawn before the commencement of off- loading, and preferably before the load is positioned on the off-loading ramp.

(b) Fruit not meeting the standards of acceptance in respect to Fruit variety/maturity ratio/fruit size as set out at Fruit Acceptance Standards (Part 1).

(c) Fruit not meeting the standards of acceptance in respect to Sound and Wholesome Fruit as set out at Fruit Acceptance Standards (Part 1).

(d) If the load is assessed as meeting acceptable standards for variety/maturity ratio/size and wholesomeness, off-loading is allowed to proceed, with graders removing all non•conforming fruits.

(e) If the load is assessed as being non•conforming, that is:

More than 2% decayed fruits, or more than 10% unsound or immature fruits, or contamination with oils, chemicals, fertilizer, stones, etc. off-loading is not permitted to proceed, and a report will be made immediately to the Factory Production Manager, who shall have another assessment made. If non• conformance is confirmed, the load shall be set aside, and the assessment recorded as a "Non-conforming Fruit" report (NCF Report).

The NCF Report shall show recording date, Time, Name of Grower, Vehicle Id, Type of Fruit, Minimum Brix, Maturity; Fruit size, a simple description of • non-conformance e.g. immature, decayed fruits, fruits contaminated with oil etc; initials of the Factory Production Manager. The Fruit Logistics Manager shall immediately contact Factory and Group Technical Manager, giving them a notice of the NCF Report. The steps, as setout under "Non-conformance Measures, shall then be immediately implemented.

Non-conformance Measures

(f) The Fruit Logistics Manager shall immediately notify the G r o w e r both verbally (telephone) and in writing.

(g) The Fruit Logistics Manager shall immediately notify the grower concerned; suspending further fruit delivery and harvesting.

(h) The Fruit Logistics Manager and the Factory Production Manager and Quality Assurance Department s h a l l together seek the best resolution of the matter, in respect of the non-conforming delivery and any similar fruit already harvested but undelivered. The grower concerned will be given the opportunity to appear at the factory and participate in the effort to resolve the problem.

(i) The Fruit Logistics Manager and the Grower shall together promptly seek an agreed course of action to cure the problem of delivery of non-conforming fruits. I f n e c e s s a r y t h e F r u i t L o g i s t i c s M a n a g e r may need to visit the grower at his farm.

(j) The agreed action to resolve the problem of the delivery of non-conforming fruit; the results of such action, the agreed action to cure the recurrence of non- conformi ng deliveries; the initials of the Fruit logistics Manager and the grower, shall be recorded as part of the NCF Report.

B. Non-Conformance in Relation to Fruit Variety/Fruit Size/Maturity Ratio

(i) <u>Fruit Variety:</u>

If a load of fruit require special arrangement for acceptance because of submission of an unknown variety is delivered without special arrangement as set out at Fruit Acceptance Standards (Part 1), or if a

mixed load of fruits made up of an unknown Variety and conforming variety is delivered; the Factory Production Manager, the Fruit Logistics Manager and the Grower where possible shall agree on a solution mutually acceptable. The Factory Production Manager may determine that the non-conforming fruit cannot be accommodated because of the current processing program of the factory.

(ii) Fruit Size :

If a load of fruit is assessed at the factory as being more than 10% of sizes below the limits set out at Fruit Acceptance Standards (Part1), the Factory Production Manager, the Fruit logistics Manager, Quality Assurance and the grower shall together mutually agree on a solution that could include the additional cost to the factory of re-grading the load and/or the additional cost of processing being born by the Grower. Where a grove is identified as having more than 10% of fruit size below the limits of conformance, it is recommended, for the advantage of both Grower and factory that an assessment is made by the Factory Production Manager, the Fruit Logistics Manager and the Grower concerning the most cost- effective way of handling such load.

(iii) Maturity:

The first delivery, or portion thereof, of pineapple which do not meet the maturity criteria will result in the issuance of a Non-conforming Fruit Report (NCF Report), with no penalty, provided the grower undertakes to comply with the corrective measures agreed upon by the factory, the Fruit Logistics Manager and grower.

A second delivery, or portion thereof, of immature pineapple by the same Grower will require a mutually acceptable solution.

C. Non-Conformance in Relation to Wholesomeness

In general, a load of fruit with more than 2% decays and/or more than 10% rejects due to characteristics of unwholesomeness as set out at Fruit Acceptance Standards (Part1), of the main document hereto, will be returned to the grower for disposal or re-grading. But if it is agreed by the Factory Production Manager, that the load will be received by the factory, there shall be a mutually agreed solution that could include the additional cost to the factory of re- grading the load and/or the additional cost of processing being born by the Grower.

11.2 Annex 2. By-products of Pineapple Imported into Belize from 2016 to 2019

Product	Source	Quantity (Cases)			
		2016	2017	2018	2019
Pineapple Essence	Guatemala	1763	1935	1371	1393

Product	Source	Quantity (Cases)			
		2016	2017	2018	2019
Pineapple Filling	USA & Mexico	0	0	0	38

Product	Source	Quantity (Cases)			
		2016	2017	2018	2019
Pineapple Juices	Jamaica & St Lucia	3414	8027	9724	8732

Product	Source	Quantity (Cases)			
		2016	2017	2018	2019
Pineapple Juices	Jamaica	0	1600	2100	0

Product	Source	Quantity (Cases)			
		2016	2017	2018	2019
Pineapple Jam	Guatemala, Mexico, Taiwan	90	20	30	250

Product	Source	Quantity (Cases)			
		2016	2017	2018	2019
Pineapple Yogurt	USA	77	0	0	0

Product	Source	Quantity (Cases)			
		2016	2017	2018	2019
Pineapple Yogurt	USA	77	0	0	0

Product	Source	Quantity (Pounds)			
		2016	2017	2018	2019
Pineapple fruit	Costa Rica	0	0	0	70,000

Source: MAFSE

11.3 Annex 3. Pineapple budget 2018 – Belize Citrus Growers Association

Pineapple budget 2018		Acres	1	Fill lines that are highlighted				
							Year 1	Year 2
Number of plants per acre (double rows)		**29867**	Ft		**Estimated Production(lbs)**		**113,494**	**102,144**
Spacing between pltants(inches)		**10.00**	0.83		**Average Pound per fruit**		**4.00**	**4.00**
Spacing between rows(inches)		**18.00**	1.50		**Estimated Price**		**BZ$0.21**	**BZ$0.21**
Distance between beds		**42.00**	3.50					
5% Lost Pest/diseases		**1493**			**Estimated income**		**$23,833.67**	**$21,450.31**
Total fruit		**28373**						
					Year 1	**Year 2**		
	Months							
		Unit	**Cost/Unit**	**Quantity**	**Total cost**		Notes	
Land preparation								
	Land clearing	Hr	$200.00	1.5	$300.00	*$0.00*		
	Windrow	hr	$200.00	10.0	$2,000.00	*$0.00*		
	Ripping	Hr	$500.00	1.0	$500.00	*$0.00*		
	Harrow	Hr	$45.00	1.0	$45.00	*$0.00*		
	Beds	Hr	$45.00	1.0	$45.00	*$0.00*		
	Drains	Hr	$374.50	2.0	$749.00	*$0.00*		
Sub total					**$3,639.00**	**$0.00**		
Planting								
	Cost of slips	**plant**	**$0.46**	**29,867**	$13,738.71	*$0.00*		
	selection and desinfection of sl	day	**$30.00**	**8.0**	$240.00	*$0.00*		
	Aligning and marking	day	**$30.00**	**8.0**	$240.00	*$0.00*		
	Planting	**day**	**$30.00**	**20.0**	$600.00	*$0.00*		
Sub total					**$14,818.71**	**$0.00**		
Weed Control								
	Herbicide	gals	$45.00	3	$135.00	$137.70	Remain the same	
	Labour (manual cleaning)	day	$30.00	3	$90.00	$91.80		
	Mechanized application	hr	$40.00	3	$120.00	$122.40		
Sub total					**$345.00**	**$351.90**		
Nutrition								
	Soil & Leaf Analysis	sample	$140.00	1	$140.00	$70.00	Only leaf analysis	
	Labour for sampling	sample	$30.00	1	$30.00	$30.00		
Sub total					**$170.00**	**$100.00**		
Granular fertilizer								
	Granular Fertilizer(bags 100lbs)	bags	$57.00	8	$456.00	$168.61	10 grs/plt in ratoon	
	Foliar fertilizer(kgs)	kgs	$2.65	292	$773.80	$789.28	main the same in yr2	
	Labor for granular	day	$30.00	2	$60.00	$61.20		
	Labor for foliar	day	$30.00	10	$300.00	$306.00		
					$1,589.80	**$1,325.08**		
Lime								
	pH test	sample	$10.00	1	$10.00	$0.00	Not needed Yr2	
	Machine Hire	hr	$40.00	1	$40.00	$0.00		
	Dolomite	tons	$44.00	2	$88.00	$0.00		
	Labor for sampling	day	$30.00	1.0	$30.00	$0.00		
Sub total					**$168.00**	**$0.00**		
Sub total								
Pest and Disease Control (Insecticides)								
	Pyrinex-lts	lts	$52.50	11.0	$577.50	$589.05		
	Diazinon-lts	lts	$13.00	3.0	$39.00	$39.78		
	Pest monitoring	day	$30.00	6.0	$180.00	$183.60		
	Pest control	day	$30.00	6.0	$180.00	$183.60		
Sub total					**$976.50**	**$996.03**		

Phytophthora (Fungus)& Bacteria(Fusarium-Bacterial heart rot)						
	Alliette (500 grams=$64.13)	kg	$64.13	7.0	$448.91	$457.89
	Ridomil Gold (700grams=$52.00	kg	$52.00	9.0	$468.00	$477.36
	Phyton (130.98 per liter)	lt	$130.98	5.0	$654.90	$668.00
	Application	day	$30.00	13.0	$390.00	$397.80
sub total					**$1,961.81**	**$2,001.05**
Flower induction						
	Ethrel (Lts)	lts	$75.00	0.60	$45.00	$45.90
	Urea	bags	$48.75	0.14	$6.83	$6.96
	Labor for application	day	$30.00	7.00	$210.00	$214.20
Sub total					**$261.83**	**$267.06**
Harvesting						
	harvest	day	$40.00	6.00	$240.00	$240.00
	Place in sacks	day	$40.00	6.00	$240.00	$240.00
	Loading	day	$40.00	8.00	$320.00	$320.00
	Transport to factory	trip	$400.00	6.00	$2,400.00	$2,400.00
Sub total					**$3,200.00**	**$3,200.00**
Equipment						
	Back pack sprayer (2)		$250.00	2.00	$500.00	$510.00
	Harvesting crates		$16.00	7.00	$112.00	$114.24
	Machete (2)		$12.00	2.00	$24.00	$24.48
	spray suits (2)		$50.00	4.00	$200.00	$204.00
	Respirators (2)		$100.00	4.00	$400.00	$408.00
	rubber boots (2)		$20.00	2.00	$40.00	$40.80
	Measuring cilinders (4)		$5.00	4.00	$20.00	$20.40
	Measuring Tape		$12.00	1.00	$12.00	$12.24
	String (1 roll)	roll	$20.00	4.00	$80.00	$81.60
Sub Tital					**$1,388.00**	**$1,415.76**
			Year 1	Year 2		
GRAN TOTAL COST			**$28,518.64**	**$9,656.88**		
CONTINGENCY 5%			**$1,425.93**	**$482.84**		
TOTAL			**$29,944.58**	**$10,139.72**		

	COST/BENEFIT ANALYSIS		**Year 1**	**Year 2**
	Income Fruits sales (lbs)		**$23,834**	**$21,450**
	Total Expenditures		**$29,944.58**	**$10,139.72**
	Profit/Loss		**-$6,110.90**	**$11,310.58**

11.4 Annex 4. List of participant and pictures of participants in the pineapple value chain workshop

TRIO
VCMA
NOV 4, 2021

ATTENDANCE LIST

#	Name	M or F	Organization	Date of Birth	Indigenous		Relationship (to other persons attending this session)	Phone & Email	Signature
					Yes	No			
9. 4	Miguel Angel Colindres	M	Farmer	29/9/54		✓	Independent San Pablo	6636104	M.C.
10. 3	Alejandro Humberto Ramirez.	M.	farmer	9/2/62		✓	Independent San Pablo	6659068	A.R.
11.	Fermin Cowo.	M	Farmer	7/7/56		✓	Independent San Pablo	6636701	Fermin Cowo
12.	Julio Rivera Claire	M	C.L.B.A	11/4/65		NO		6720757	
13.	Patricio Leiva (Sick - cannot Vaccinate).	M.	farmer.	4/5/49		✓	Independent	—	x P.C.
14.	Domingo Moncada.	M.	Productores de Agricultura	6/8/55		✓	Coop.	—	
15.	Veronica Mayorga.	F	CATIE	27/01/76		✓	Consultor	6555065	
16.									
17.									

V 2 040121

ATTENDANCE LIST

NAME OF GROUP: TRio Village

SUBJECT: VCMA Workshop

DATE: November 4, 2021

#	Name	M or F	Organization	Date of Birth	Indigenous		Relationship (to other persons attending this session)	Phone & Email	Signature
					Yes	No			
1. 1	Tomas Maquin	M	Buenos Amigos	7/3/71		✓		663-5578	X. Tomas Maquin
2. 2	Carlos Hernandez	M	BCLAGRO	9/10/94		✓		675-0965 621-8477	
3. 3	EDVIN Antonio Florian	M	Buenos Amigos	1/7/84		✓		—	X.
4. 4	Martha Garcia	F	Farmer	9/7/66		✓	Independent	665 5826	Martha G
5.	Heidy Cob	F	MOA	7/12/92		✓		631 0228	
6.	Fred Roches	M	MOA	2/27/81		✓		614 7214	
7. 1	Julio Rivera	M	Buenos Amigos	9/7/78		✓		—	X J.R.
8. 2	Jose Maria Cerritos	M	Buenos Amigos	20.02.58		✓		666-8135	x J.M.C.

NOV, 4, 2021
CACMA
Trio

ATTENDANCE LIST

#	Name	M or F	Organization	Date of Birth	Indigenous		Relationship (to other persons attending this session)	Phone & Email	Signature
					Yes	No			
9.	Lloyd Orellana	M	Belize Bureau of Standards	29/11/64		✓		6158840 bbs@btl.net	
10. 1	Santos Feliz.	M	Buenos Amigos	14/3/1950		✓	Cooperative	668-9727	FELIPE
11. 2	Delmar Milla	M	farmer	21/2/71		✓	Independent	6636033	
12. 3	Oscar Orlando Velasquez	M	Farmer	17/3/76		✓	Independent	6680840	Velasquez
13. 4	Jose Mauricio Hernandez	M	farmer	31/3/76		✓	Independent	6632969	x. JOSC M J
14. 11	Manuel de Jesus Calderon	M	farmer	25/07/77		✓	Independent	6607730	x. MIC
15.	Javier Garcia	m	RRB	18/09/65		✓	RRB.	66567 914	
16.	Fernando Majil	M	CATIE	30/05/68		✓	Consultant	6287996	
17. 2	Pedro Ceritos	M	Trio Farmer	25/6/84		✓	Independent	6509798	PC
	Luis C. Tzul	M	CGA	19/3/60 2		✓		6029546	

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ATTENDANCE LIST

NAME OF GROUP: TRIO VILLAGE

SUBJECT: VCMA Workshop

DATE: November 4th, 2021

#	Name	M or F	Organization	Date of Birth	Indigenous		Relationship (to other persons attending this session)	Phone & Email	Signature
					Yes	No			
1.	Joe Lisbey	m	RRB	18/05/64		✓		6048150	
2.	Alberto Chacon	M	RRB	9/3/91		✓		636 8456	
3. 3	Adrian Mendoza	M	MOA	5/5/94		✓		6324198 owkg@outlook.com	
4. 4	Raymond Arnold JP	M	CPBL	26/6/85		✓		635-6291 raarnold@citrusproducts belize.com	
5. 1	Carlos Bunyo Jr.	M	CPBL	30/8/90		✓		655-4113	
6. 2	Armando Aruanga	M	Farmer Buenos Amigos	29/02/68		✓		—	Armando
7. 3	Alisandro Garcia	M	farmer Buenos Amigos	22/07/78		✓		—	x Alisandro
8. 4	Rodolfo Morales	M	Buenos Amigos C.L.B.A.	4/10/69		✓	Buenos Amigos Trio.	6663544	

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