RRB
Resilient Rural Belize

CATIE
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Value Chain market Assessment

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

Product 3.1 Value Chain and Market Assessment of Cabbage Production in Belize

VALUE CHAIN AND MARKET ASSESSMENT OF CABBAGE PRODUCTION IN BELIZE

Conduct of 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
DFC	Development Finance Corporation
FAO	Food and Agriculture Organization of the United Nations
GOB	Government of Belize
IFAD	International Fund for Agriculture Development
MOA	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
CVA	Climate Vulnerability Assessment

Executive Summary

Belize is a small tropical county with a relative abundance of 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 in its rural areas, which accommodate 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, along with 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 productivity and climate-induced limitations faced by small scale farmers and to 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 programme entitled "Resilient Rural Belize" (RRB) Programme. The RRB Programme 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, cabbage, pineapple, 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 cabbage 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 makes recommendations for value chain upgrading strategies, including improved production and quality of cabbage.

The cabbage market in Belize is estimated at 2,024,661 pounds valued at BZ $3,239,457.60 (based on 2020 data). The value chain is considered "simple" given that the product is sold as fresh fruit and no processing is involved. The main consumers of Cabbage in Belize are households, restaurants, hotels, and fast food establishments.

Cabbage is grown in all the districts in the country. The Cayo District is the leading producer of cabbage, followed by the Orange Walk District. The Cayo and Orange Walk Districts produce cabbage in the open field. Imported cabbage accounts for 9.7 % of total consumption.

The Ministry of Agriculture, Food Security and Enterprises has a policy to support and prioritize vegetable 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 required by these financial institutions.

All farmers require knowledge of good agricultural practices such as the use of appropriate 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. It is also important for farmers to have the knowledge to farm as a business. During the study, it was noted that in many instances, farmers did not have the necessary records to establish the cost of production or knowledge to determine if they were operating at a profit or a loss.

1. Introduction

Belize is a coastal tropical country that 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 by vulnerabilities and threats like those of Small Island Developing State (SIDS). Impacts from threats such as Climate Change on Belize's agricultural sectors have prompted the local population to adopt many strategies such as Climate Smart Agriculture (CSA). This population is primarily based in rural areas, and their livelihoods are based mainly on the agriculture sector.

Agriculture is extremely important to Belize's development, providing employment and 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, are 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, which are typically the highest agricultural income earner. In 2020, the highest contributor to the economic output in agriculture in Belize was the non-traditional sector, with grains and legumes being the highest contributor (MOA, 2021). The Gross Domestic Product per capita (constant) in 2019 was BZ$ 7066.09, 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 tubers and vegetables category based on economic value were onion, potato, carrot, and sweet pepper, ranking from first to fourth places, respectively (MOA, 2020). The Cayo District is the leading producer of Cabbage, followed by the Corozal and Orange Walk Districts, respectively. Despite this, there is no previous study recorded on the value chain analysis and market assessment of Cabbage. 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 Cabbage 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 Cabbage (*Brassica oleracea var. capitata*) in Belize is being conducted by the Tropical Agriculture Research and Higher Education Center (CATIE) in collaboration with the International Fund for Agriculture and Development

(IFAD) and the Government of Belize (GOB) through the Resilient Rural Belize (RRB) Project. Although the value chain will be studied at a national level, the priority area of the assessment is the Cayo District which encompasses the villages of Valley of Peace, La Gracia, San Marcos, Selena, Buena Vista, San Antonio, and 7 miles Maskall. The objectives of this VCMA are to (i) map and describe the cabbage value chain, including the role and relationships between the different actors (producers, transporters, packers, traders, retailers, and consumers) in the value chain; (ii) market potential; (iii) identify challenges and opportunities for the cabbage value chain; and (iii) identify and recommend adequate policy interventions based on findings to strengthen the cabbage value chain in Belize.

2. Methodology

The Value Chain Market Assessment (VCMA) for Cabbage is presented in four phases as 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 Project when the consultancy was initiated. The target areas in the Cayo District are home to the main Cabbage producers. These include the villages of Valley of Peace, La Gracia, San Antonio, and 7 Miles (Table 1).

Table 1. Population of the Target Villages in the Cayo District, 2020

Villages Population and Number of Households, 2010				
Village	**Total**	**Males**	**Females**	**No. of HH**
Valley of Peace	2,111	1,091	1,021	401
La Gracia	271	146	125	47
San Antonio	1,847	933	914	381
7 Miles	482	252	231	96
San Marcos	142	74	68	21

Source: SIB

2.2 Data Collection

Collection of current and relevant data was done in two steps: Collection of 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 Cabbage in the Belize District or in 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 (MOA), the Belize Agricultural Health Authority (BAHA), the Statistical Institute of Belize (SIB), Belize Bureau of Standards (BBS), Resilient Rural Belize (RRB) Project personnel and the online portal of the Food and Agricultural Organization (FAOSTAT). Research and studies published on vegetable production within the last five years in other countries were targeted to identify innovations and technologies that could strengthen the Cabbage value chain

in Belize. The market trends of Cabbage and cultivation of Cabbage across Belize, quality standards, and 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 while 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 various 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 Cabbage is grown, processed and marketed, labour requirements, sources of supply of raw materials, buy and sell 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. The two intermediaries that collect the Cabbage at Valley of Peace provided information on how they conduct business with the farmers. One intermediary distributes to the market in Belize City, and the other distributes to Belmopan and the San Ignacio Town market. A major restaurant in Belize City was also contacted and provided information on how they procure cabbage, the amount they consume, and the purchase price.
- 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 seed varieties, origins, and costs. They requested that their information remain confidential.

Limitations of the Study

While farmers were willing to cooperate in the study, in general, none had records of their production costs and yields. Therefore, they could not ascertain if they operated at a profit or loss. Consequently, this study relied on the national statistics provided by the Ministry of Agriculture to the Statistical Institute of Belize to establish the requisite information.

Validation of Value Chain Map by Stakeholders

To validate the data and information collected during the desk and primary research, a workshop was held in Belmopan City with actors from different levels of the value chain. These actors included input suppliers, producers, intermediaries, and technical officers from the government departments and NGOs. Given that cabbage and other vegetables are produced and marketed simultaneously by the farmers in the study area, the Value Chain Map and the workshop objectives are the same, as well as the problems identified. The production data is what will differ in this study.

The Objectives of the workshop were:

- Present the results of the Value Chain and Market Analysis for cabbage to stakeholders.
- Stakeholders to 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.

At the VCMA workshop, a presentation on the cabbage 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 six major challenges/problems were identified and prioritized. Participants prioritized training and technical assistance, reflecting many doubts on cultural practices currently applied. Marketing and the provision of infrastructure were prioritized next—both issues related to the question about post-harvesting management. Although post-harvest was not explicitly mentioned during the workshop, our interviews confirmed this. Finances and improvement of seed were given lower priority levels, and input purchase was not prioritized at all for the workshop participants.

Figure 1. Cabbage VCMA double entry matrix with priorities derived by workshop participants

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

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.

Value Chain and Climate Vulnerability Assessment Synchronization

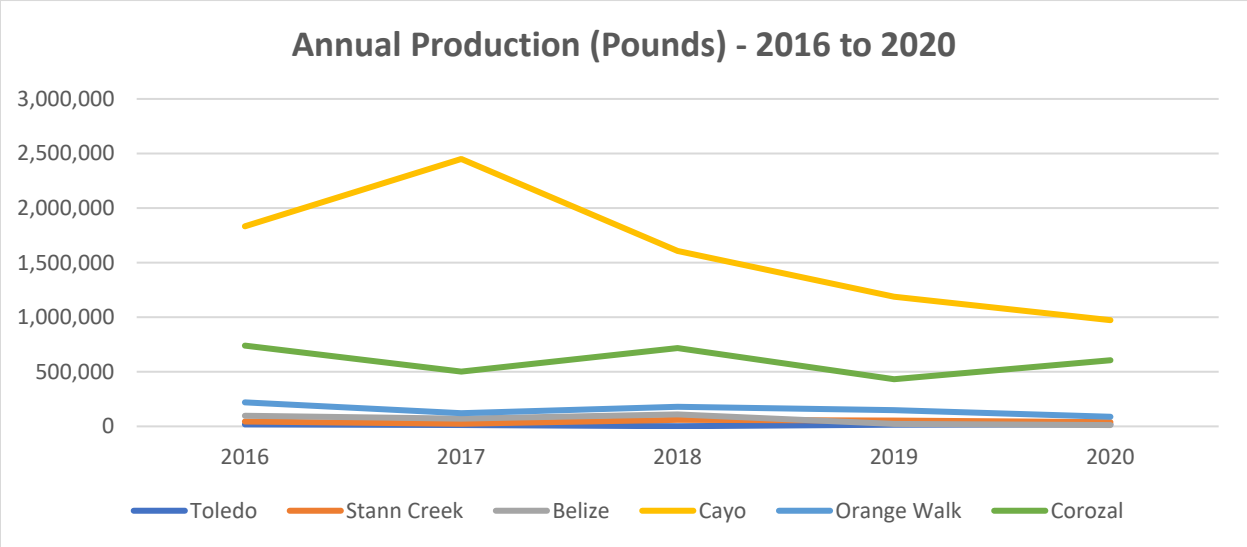
The validation workshop of the VCMA was carried out together with the CVA, with the idea to catch any comments or questions about changes in climate that members of the value-chain of cabbage may have. In terms of climate change, most farmers during the CVA workshop expressed major concern about unexpected draughts during periods of the year. They believe that these weather conditions negatively affected their crops. Most farmers have hand-dug wells or industrial wells, rudimentary irrigation systems that are not efficient, and the water is not of sufficient quality to properly irrigate the crops. During the group activity, floods were not ranked as a major concern because their occurrences were not frequent. Their concern comes from their perception that draughts have affected the fruit size and intense sunlight causes fruit burn. None of the cabbage fields are irrigated, but farmers expressed interest in learning about irrigation which they believe will improve production throughout the year. Floods were not ranked as a major concern as their occurrences are not frequent.

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

3. History of Cabbage Value Chain in Belize

Cabbage is produced in all the districts in Belize, with the Cayo District being the largest producer, see Figure 2, followed by the Corozal and the Orange Walk Districts (MOA, 2020). In both the Cayo and Corozal Districts, cabbage production has fluctuated in a downward trend since 2018. In interviews, farmers attribute the downfall in production to sporadic draughts, pest problems, and the increasing cost of seeds and inputs.

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



3.1 Cabbage Production in Belize

In Figure 3, 2020 shows the lowest production of 1.74 million pounds of cabbage. This can be attributed to the Covid 19 pandemic, which started to affect the country in March 2020. The government closed all border entries, maritime ports, and the airport. Immediately the tourism industry was affected, and tourist resorts, major restaurants, and supermarkets were also closed. This affected the consumption of many local products, including cabbage. Households became the major consumers of cabbage. However, Covid-19 can not explain production declines for Cayo and Corozal Districts during previous years. In particular, Cayo District production has drop to haft the amount produced in 2017, this in just 3 years.

Cabbage production in Belize is exclusively for the domestic market, targeting households and the tourism industry, primarily the food suppliers in local restaurants and hotels in the country. Farmers or farmer groups sell most of their produce in bulk directly to an intermediary supplier (Collector) who resells/distributes to retailers such as market vendors. Some farmers sell directly

to retailers or directly to consumers, such as large upscale restaurants. Contractual arrangements between Farmer and Collector are informal.

The current estimated average yield per acre for cabbage is 28,000 pounds/acre, which is supported for our data at least for the period 2016-2018. However, our data shows a significant yield reduction for 2019 and 2020 (Table 2). Information from the Belize District Ministry of Agriculture department says that the estimated yield per acre could be 40,000 pounds/acre.

Table 2. Total Cabbage Production and Yield in Belize (2016 to 2020)

	2016	2017	2018	2019	2020
Production (pounds)	2954,800	3179,350	2674,793	1857,729	1735,863
Yield (pounds/ac)	22,729	23,207	22,861	16,888	14,836

There are three production cycles of cabbage in the country for farmers growing in the open field and with irrigation systems. The primary production cycle is from September to December, with harvesting from December to March. This is especially practiced by farmers in the Cayo District, which supplies the country's most cabbage (MOA, 2020). Importation of cabbage normally occurs between June and August. Over the years, the MOA has been urging farmers to produce cabbage under covered structures to increase yield and reduce losses caused by heavy rainfalls and high incidence of pests.

3.2 Cabbage Demand in Belize

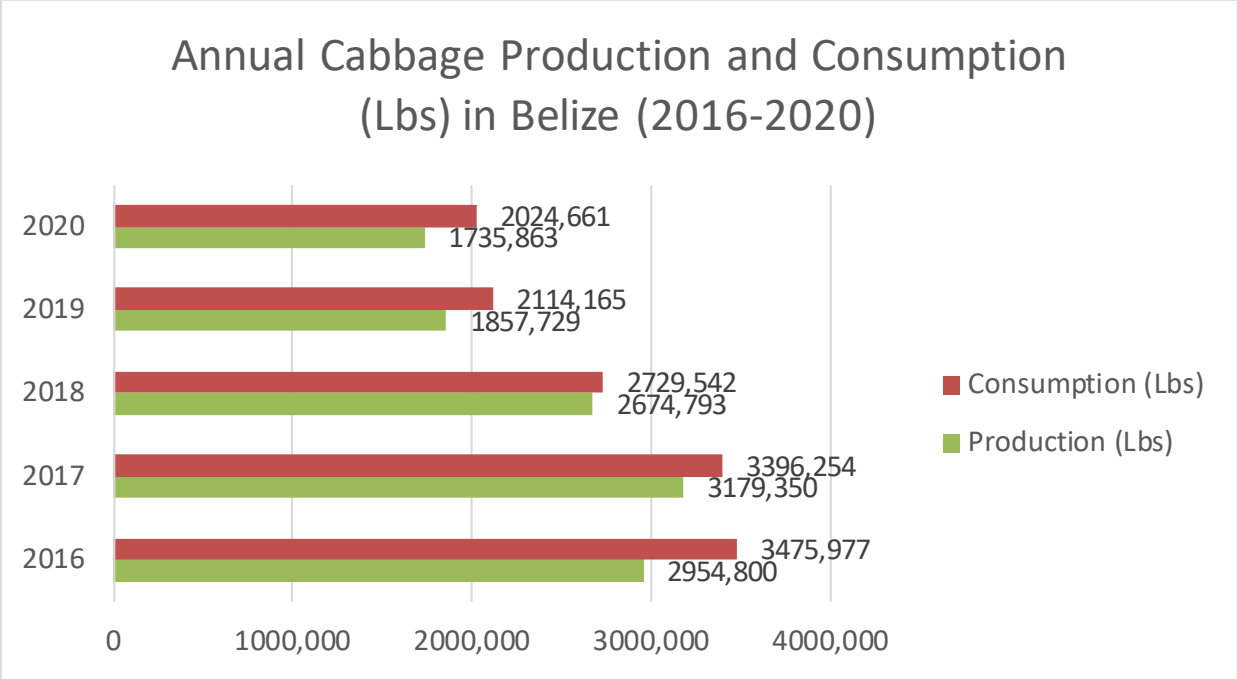
Data from the Belize Agricultural Health Authority (BAHA) shows that there has been a constant importation of cabbage from Mexico and Guatemala between 2016 to 2020 (Table 3). Notably, the decrease in importation from 2016 to 2020 is estimated at 44.6%. However, this is not as consequence of an increase in cabbage production because, during the same period, the production decreased by an estimated 41%.

Table 3. Importation of Cabbage (Pounds) into Belize years 2016 to 2020

Commodity	Importation of Cabbage (Pounds) to Belize (2016 to 2020)					
	Country of Origin	2016	2017	2018	2019	2020
Fresh	Mexico and Guatemala	521,177	216,904	54,749	256,436	288,798
	Total	**521,177**	**216,904**	**54,749**	**256,436**	**288,798**

The national production of cabbage in Belize between 2016 and 2020 was 1735,863 pounds. Figure 3 shows the annual production plus importation and total consumption of cabbage in Belize for the past five years. The estimated weekly consumption of cabbage in Belize is 47,702 pounds per week. Importation of cabbage into Belize is at an average of 9.7% of the national consumption. During the validation workshop, farmers expressed concerns about the amount of cabbage coming into the country illegally from Mexico or Guatemala. They further expressed that 2020 saw a significant reduction of illegal cabbage into Belize given the current Covid 19 pandemic and the border closure with Mexico and Guatemala. Information from BAHA states that there was no confiscation of illegal cabbage between 2016 to 2020 (BAHA, 2021).

Figure 3. Cabbage Local Production plus Importation and Consumption in Belize



3.3 Quality Standards of Cabbage 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 cabbage 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**

CARICOM REGIONAL STANDARD: Specification for grades of fresh agricultural produce. Part 2: Cabbages CRS 24: Part 2: 2010

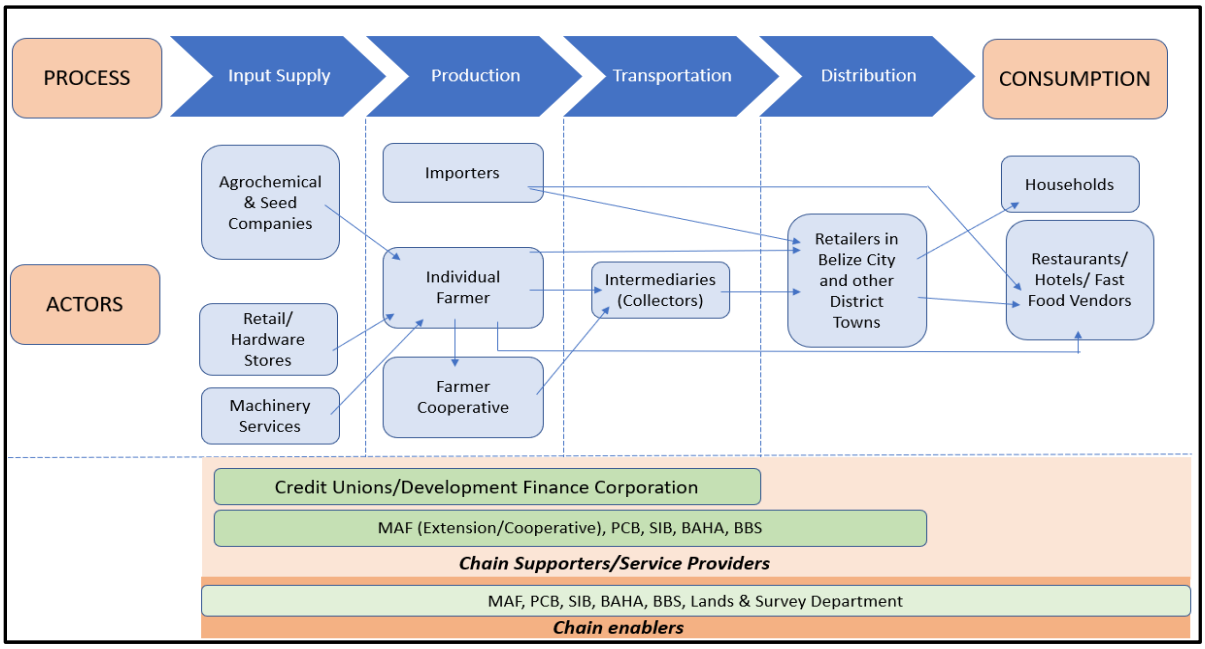
This Standard complies to commercial varieties of cabbage (Brassica oleracea) to be supplied fresh to the consumer after preparation. The Standard classifies cabbage into three different Classes. Details of the standard can be found in Annex 1

4. Value Chain Mapping

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

4.1 Value Chain Map

Figure 4. Value Chain Map for Cabbage in Belize



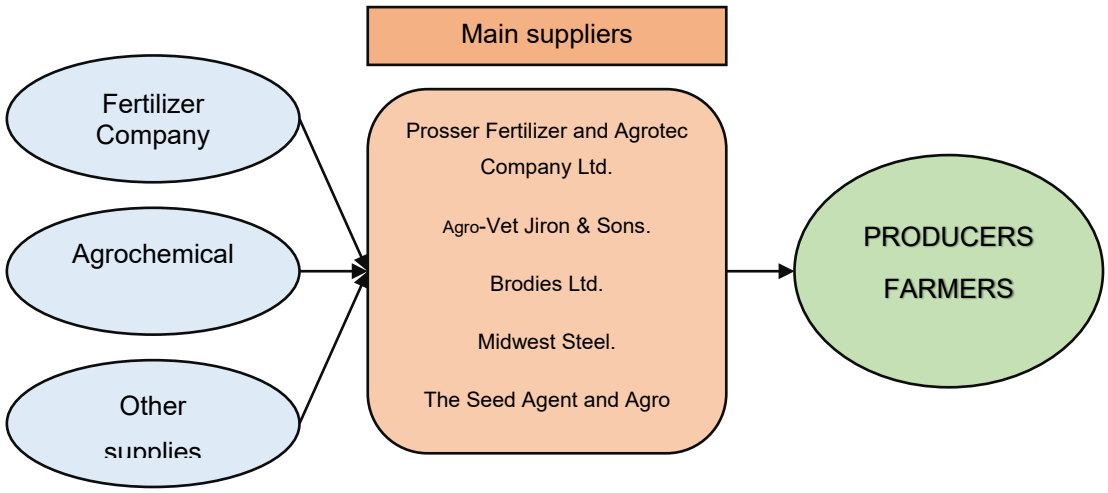
4.2 Description of the Cabbage Value Chain Actors and Their Roles

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 and seed suppliers in the Cayo and Belize Districts that dominate in the Cabbage value chain are Prosser Fertilizer and Agrotec Company Ltd., Agro-Vet Jiron & Sons, Brodies Ltd., Midwest Steel, and The Seed Agent and Agro Supplies (Figure 5).

As major actors in the value chain, these suppliers provide seeds, pesticides, irrigation equipment, small equipment such as pumps for irrigation, tractors, land preparation equipment, greenhouse netting, and many other farm equipment.

Figure 5. Value Chain Map for suppliers in Belize



Producers/Farmers

In the cabbage value chain in Belize, the main producers are in the Cayo and Corozal Districts. In the Cayo District, the seven main areas are Valley of Peace, La Gracia, San Antonio, Seven Miles, San Marcos, Selena, and Buena Vista. There are individual farmers and farmers that belong to Cooperatives. In Valley of Peace Village, most Cabbage farmers belong to the **Valley of Peace Lagoon Co-operative,** in San Antonio Village, **Maya Green Growers Co-operative Society Ltd.,** and in Seven Miles Village, **Seven Miles Farmers Association** (RRB, 2019). In Valley of Peace Currently, this cooperative has 30 active members, of which 29 are mature males and one male youth. In San Antonio, the farmers are part of a cooperative named the Maya Green Growers Co-operative Sociedad Ltd. of 13 male farmers. The other Cabbage production group is The Seven Miles Farmers Association (SMFA), with a membership of 17 persons (including two females and two youths) and located at 7 Miles Village.

In this stage, the fundamental activity of the value chain is developed. It is where the highest levels of risk are concentrated because the success or failure of production and the generation of income for the producer depends on this phase. Small, medium and large-scale producers cultivate an average of 1, 2.5 to 3, and 5 acres, respectively. Mainly, farmers cultivate in open

fields, limiting their ability to obtain stable yields in terms of volume and quality and making them more vulnerable to weather conditions. Cabbage production is carried out under irrigation and for the local markets.

For many of these farmers, Cabbage production is not their only income source as many of them do other vegetables such as sweet peppers, tomatoes, potatoes, melons, and others. Farmers plant an average of 8000 plants per acre with an average weight of 3.5 pounds per head of cabbage.

Many of the farmers use their family labour for harvesting but also use hired labour at the peak of production.

The participation of women at this stage can be distinguished into two categories: 1) The individual producers: they produce cabbage in a family way and participate in the activities of soil preparation, planting, crop management, and harvesting. The level of empowerment is low, and although they support the generation of family income, they mostly do not participate in decision-making regarding production. 2) The associated producers in cooperatives, who have a higher level of empowerment and have decision-making power over the benefits of production. In this case, they also have access to information, credit, and technical assistance. However, the knowledge gap between men and women vegetable producers continues. Most of the women have general agricultural knowledge, so the men oversee buying supplies and distribution channels.

Importers

Importation of cabbage requires an import permit from BAHA. The amount of cabbage imported is estimated at 9.7 % of the annual national consumption.

According to data from the Plant Health Department of BAHA, there was no documented confiscation between 2016 to 2020 (BAHA, 2021).

At the country level, in Figure 6, the import trend in thousands of dollars of cabbage from Mexico and the United States has been observed since 2010, and imports from the US remain constant with small fluctuations. Mexico is the main supplier of cabbage to Belize, with 95% of the total import value exceeding USD 200,000 on average per year in recent years (Table 4).

However, farmers in the Cayo and Corozal Districts argue that the national figure is not a true picture and does not reflect the actual amount brought in illegally from Mexico or Guatemala.

Figure 6. Import trend of cabbage – Belize (2010-2021)

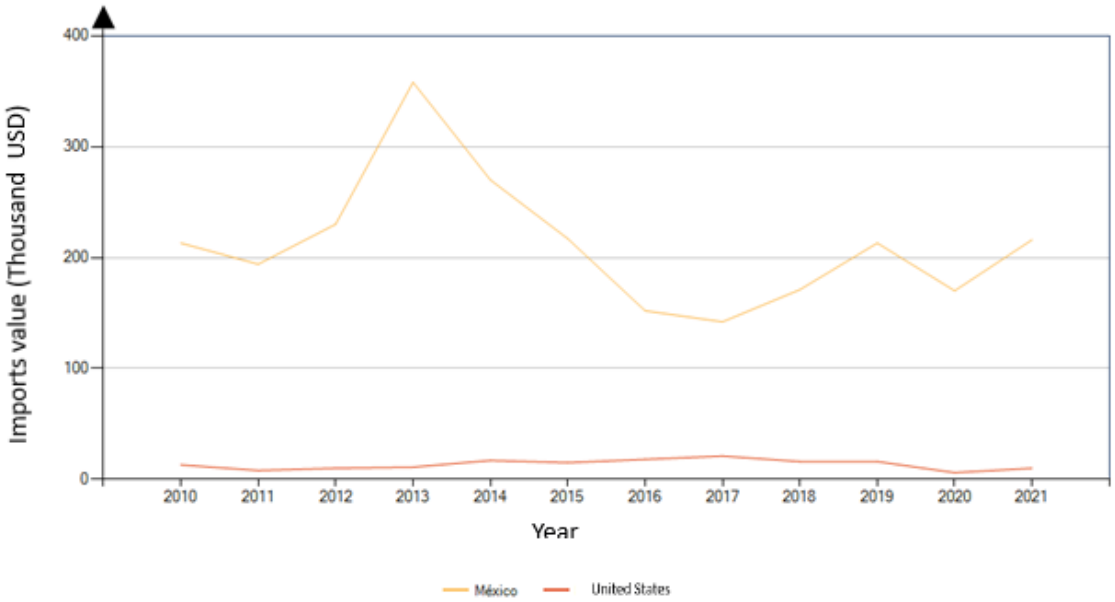


Table 4. Importation of Cabbage (USD) into Belize years 2017 to 2021

Exporters	Imported value 2017	Imported value 2018	Imported value 2019	Imported value 2020	Imported value 2021
World	163	187	229	176	226
Mexico	142	171	213	170	216
United States	21	16	16	6	10

Intermediaries (Collectors)

Intermediaries are middlemen who collect and purchase Cabbage locally and sometimes develop long-term relationships with farmers.

Collectors are well-versed in the location of the farms, and the amount of Cabbage produced and have very good knowledge of other crops produced by the farmer and their seasonality. These persons purchase directly from the farmer or cooperatives and sell to vegetable dealers/retailers at the market or persons who will resell the produce. These are the key personnel responsible for transporting the Cabbage along the value chain.

Retailers

Retailers include market vendors and grocery stores that purchase cabbage from the intermediaries and resell to consumers. Supermarkets in Belize City are major retailers of fruits and vegetables. One supermarket (Brodies) is also a private importer of cabbage for distribution to its supermarket and other upscale restaurants and hotels.

Consumers

The most significant users of Cabbage are household users. Other main users include tourist resorts, restaurants, hotel restaurants, and fast-food establishments. Cabbage consumers include households, restaurants, hotels, fast-food businesses, and supermarkets. Cabbage production in Belize is exclusively for the domestic market.

The stage from marketing crops to the market is a challenge for women farmers, so some ideas have been identified so that they can expand their control over the market:

a) Formation of groups (clusters) to increase their sales capacity and negotiating power.
b) Diversification of forms and sales channels, including solidarity markets.
c) Access to key information, such as prices, weather events, etc.

Profit Margins and share benefits along the value chain

Cost of production and prices across the value chain were obtained by interviews with key persons in the cooperatives from Valley of Peace and the Ministry of Agriculture Department in the Cayo District. Table 5 shows an analysis of the profit margins and share benefits along the value chain.

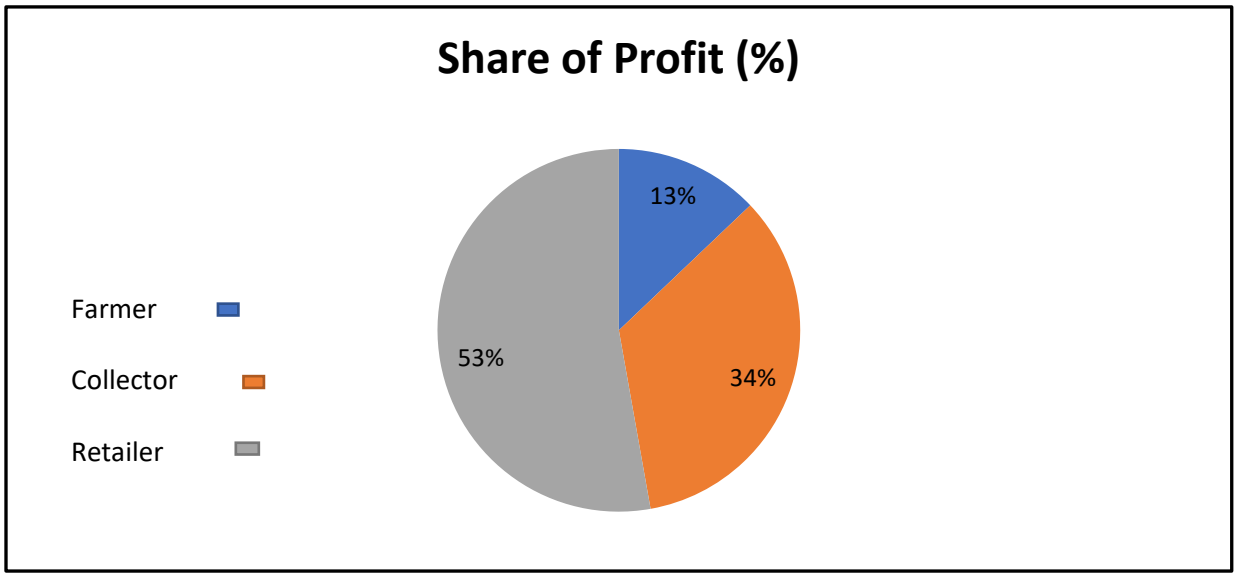
Table 5. Profit Margins and Share Benefits along the Cabbage Value Chain

Description	Actors			
	Farmers	Collectors	Retailers	Horizontal Sum
Purchase Price (Bz$)	0.00	0.55	0.90	1.45
Total Input Cost (Bz$)	0.25	0.10	0.10	0.45
Selling Price (Bz$)	0.55	0.90	1.33	2.78
Market Margin (Bz$)	0.55	0.35	0.43	1.33
% share of margin	41.4	26.3	32.3	100.0
Profit Margin (Bz$)	0.30	0.80	1.23	2.33
% of share of profit	**12.9**	**34.3**	**52.8**	**100.0**

Prices-5 yr average

The data shows that the cost of inputs is significantly higher for the farmer than for collectors and retailers. In Belize, agrochemicals and seeds are costly and are very important inputs for farming. The cost of input for the collector is very likely due to transportation of the product, given that fuel prices are high in Belize compared to other countries in the region. Together, the collectors and retailers take 87.1 % out of the total profit margin. The retailer's profit margin constitutes the highest share (52.8 %), followed by the collector (34.3 %). In this analysis, the farmer's share of profit is 12.9 % (Figure 7), while the farmer's share of total input cost is more than half (Table 5).

Figure 7. Share of profit of actors for Cabbage Value Chain in Belize



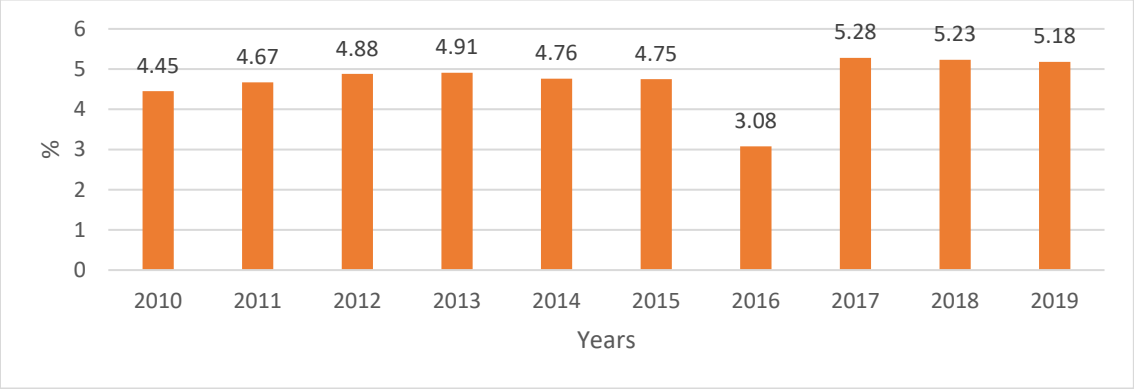
5. Role of women in Belizean agriculture and in the cabbage value chain

It is worth noting the relevance of the role of rural women in the development of agricultural activities, depending on the type of crop and the production phase. In the case of vegetables, such as cabbage, not only is planting a predominantly female activity but they are also involved in all phases of crop production. This activity is normally added to the daily activities that women must carry out at home.

The Convention on the Elimination of all forms of discrimination against women (CEDAW) highlights rural women's important role in the economy and family food security. For their part, the Development Goals (SDGs) promote a multidimensional perspective of development and the implementation of Article 14 of CEDAW to change the approach to addressing gender inequality. This new approach replaces work based on women's vulnerabilities with work based on their contributions to social, economic, and environmental development, considering them as a fundamental piece in the resilience of communities in the face of current crises.

Under the concept that employment is "persons of working age who were engaged in any activity to produce goods or provide services for pay or profit, whether at work during the reference period or not at work due to temporary absence from a job, or to working-time arrangement. The agriculture sector consists of activities in agriculture, hunting, forestry, and fishing (Index Mundi) (FAO 2017). Figure 8 shows the variations in relation to female employment in agriculture in Belize since 2010 (OIT 2020).

Figure 8. Indicators of female work in agriculture in Belize



Women in rural areas play an important role in guaranteeing the food security of their households and communities. While the men oversee the production of crops for sale, the women are usually responsible for different tasks in the home, such as: supporting the productive activity, cultivating for self-consumption, taking care of the children's education, and carrying out different household chores, such as cleaning, preparing food at home, etc.

The Government of Belize, recognizing that rural women are the most affected by poverty and lack of access to services and resources for personal development and for their contribution to the development of their communities and territories, participates in the framework of the Agricultural Council Central American (Council of Ministers of Agriculture of the Central American Integration System Region and the Dominican Republic) in the development of an Agenda for the Economic Empowerment of Rural Women and has a focal point in the Ministry of Agriculture and in the Women and Family Support Department (Ministry of Human Development) to implement this agenda at the national level and give a better response to these women. Human, material, and financial resources are currently insufficient, and it will be necessary to strengthen the institutional ones to generate the expected results. (IFAD 2019).

6. Market Analysis

Vegetable value chains are normally very basic and unsophisticated. This is exactly the case for the Cabbage Value Chain in Belize. Generally, the selected variety is dictated by the farmer. Seeds are selected based on their adaptability to Belize's tropical Conditions, shelf life, and the ability of the variety to withstand physical stress such as those incurred during transportation on extremely poor road conditions, as in the case of the Cayo District. No post-harvest practices are done. Produce is harvested from the fields and directly go to the collectors, retailers, or consumers.

The main cabbage varieties grown include Tropicana and Madox.

6.1 Market Size

The estimated local consumption of cabbage is 47,702 pounds per week. Table 6 details the yearly consumption for the last five years. Noteworthy is that the amount of Cabbage imported by private importers is 9.7 % of the annual local consumption. For most recent years, the cabbage consumption shows continuous decline – 30 percent less consumption in 2020 compared with 2016. Price increase at the retailer and producer´s level could explain most of this adjustment on consumption of cabbage. It is getting more expensive to consume cabbage – a pound cost Bz$ 0.30 more in 2020 that 2016 (see Table 9).

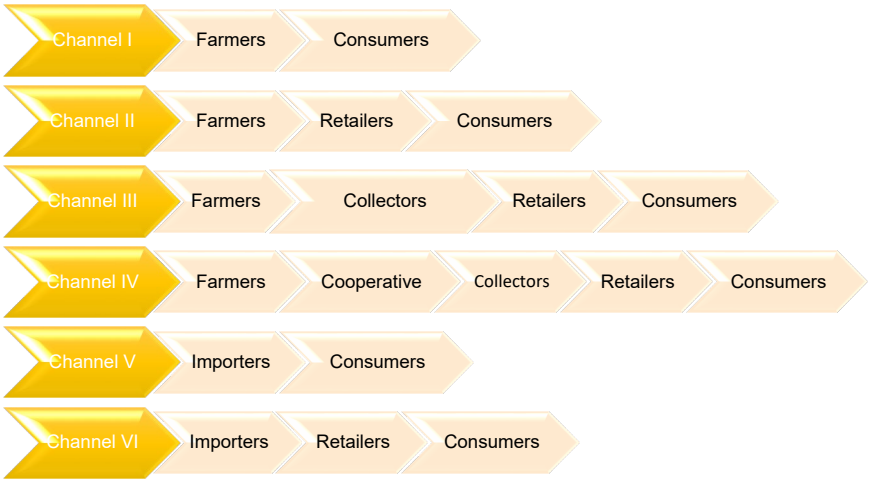
Table 6. Yearly consumption of Cabbage in Belize (2016 to 2020)

Cabbage Consumption (Pounds) in Belize 2016 to 2020				
2016	**2017**	**2018**	**2019**	**2020**
3475,977	3396,254	2729,542	2114,165	2024,661

6.2 Market Channel

A significant amount of the cabbage produced by the cooperatives and individual farmers is sold to the collectors, then to retailers, and finally to consumers (Figure 9). In Nago Bank, when prices are high, individual farmers sell their produce to the Cooperative (RRB, 2019). A few individual importers sell directly to consumers or to retailers, who then sell to consumers.

Figure 9. Main Marketing Cabbages Channels



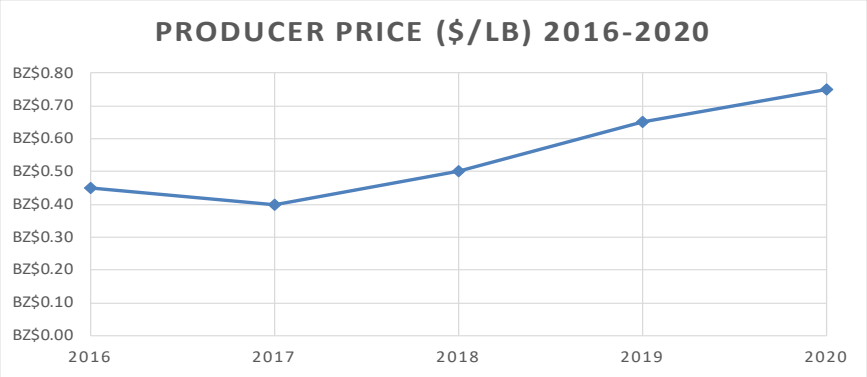
The main marketing channels identified from the point of production to consumers through intermediaries for Cabbages in Belize are shown in Figure 9. Competition by collectors results in not all member´s production passing through the cooperative commercialization effort. No need to waiting for payment and payment in cash are the justifications given by farmers for their decision to use the channel with the collector.

6.3 Producer's price trend of Cabbage in Belize

The producer's price for cabbage in Belize is not very stable. Figure 10 shows the price trend of Cabbage in Belize from 2016 to 2020 at the producer's average price of BZ$0.55/lb. This price information was sourced from SIB.

One might believe that the price for 2020, the highest on record, is a direct pandemic effect since smuggling cabbage across borders was drastically reduced. Limiting mobility restricts the movement of products. However, Figure 10 implies that even before the pandemic, the price of cabbage had an upward trend. Since 2017 we see how the price has risen by 50% in 2019 with respect to that year.

Figure 10. Price trend for Cabbage production in Belize (2016 to 2020) at Producer's Price (SIB)



Year	Average Producer Price/Lb ($)
2016	BZ$ 0.45
2017	BZ$ 0.40
2018	BZ$ 0.50
2019	BZ$ 0.65
2020	BZ$ 0.75

Consumer prices were sourced from SIB. In the last five years, they have fluctuated from BZ$1.13 to BZ$1.60. During the period, it averaged BZ$1.33 per pound (Table 7). The increase in producer price is also reflected in the prices paid by the consumer. Table 7 shows how the consumer price went from 1.23 BZ$ in 2017 to 1.60 BZ$ in 2020. However, it is important to note that the percentage increase has not been the same: for the final consumer, the price was adjusted upwards by 30% compared to 50% for the producer.

Table 7. Consumer Price Trend for Cabbage (2016 to 2020)

Year	Average Retail Price
2016	BZ$ 1.30
2017	BZ$ 1.23
2018	BZ$ 1.13
2019	BZ$ 1.38
2020	BZ$ 1.60

Our major findings: a) There is seasonal price variability in the Cabbage value chain in Belize, b) Price is based on weight; there is no tier in prices based on size or quality.

Farmers and most actors, especially the collectors and retailers, hesitate to share price information. Pricing information along the value chain is not readily available from the MOA or other national entities.

7. Supply Chain

The supply chain considers the production, importation, profitability, and cost of production across the value chain. The total production of Cabbage in 2020 in the country was an estimated 288,798 pounds, valued at BZ $216,599 (SIB, 2020). The main suppliers of Cabbage in Belize are farmers and through legal importation from Mexico and Guatemala. The imported Cabbage account for 9.7 % of the total consumption.

7.1 Amount Supplied

Table 8 shows the yearly supply of Cabbage for total consumption for the last five years. The contribution of imported cabbage for consumption is 9.7 %. However, farmers in the Belize District are adamant that illegal importation is significant. The main supply of cabbage in Belize is the farmer. Table 9 registers a marked decrease in acres planted and harvested for cabbages in all districts except the Cayo District, which has been somewhat consistent.

Table 8. Annual supply of Cabbage (pounds) (2016 to 2020)

	Pounds (Pounds)/Year			
Year	**Consumption**	**Production**	**Imports**	**Illegal Entry**
2016	3475,977	2954,800	521,177	0
2017	3396,254	3179,350	216,904	0
2018	2729,542	2674,793	54,749	0
2019	2114,165	1857,729	256,436	0
2020	2024,661	1735,863	288,798	0

Table 9. Total area harvested

District	Total Area Harvested (Ac.)				
	2016	2017	2018	2019	2020
Toledo	1	4	1.1	7	4.5
Stann Creek	3	2	4	4	4
Belize	4	3	9	1	1
Cayo	77	98	63	74	74.0
Orange Walk	11	6	7	6	3.00
Corozal	35	24	33	18	31.00

District	Total Area Harvested (Ac.)				
	2016	2017	2018	2019	2020
Total	**130**	**137**	**117**	**110**	**117**

7.2 Domestic Production

Table 10 shows the production of cabbage by district. Cayo District is the largest producer, followed by the Corozal District. Together these districts have produced between 85 to 90% of the total production.

In most districts, cabbage producers are members of a cooperative, while some farmers operate individually.

Table 10. Total Annual Cabbage Production (pounds) by District (2016 to 2020)

District	Annual Production (Pounds.)				
	2016	2017	2018	2019	2020
Toledo	18,500	12,350	1,425	15,500	18,800
Stann Creek	45,000	24,000	59,866	52,896	38,093
Belize	98,000	71,000	109,500	22,000	12,000
Cayo	1833,300	2450,000	1606,500	1187,333	973,000
Orange Walk	220,000	120,000	180,000	148,000	88,000
Corozal	740,000	502,000	717,502	432,000	605,970
Total	**2954,800**	**3179,350**	**2674,793**	**1857,729**	**1735,863**

Source: SIB

Table 11 shows the yield of cabbage production in each district. There seem to be real differences in the yields reported by district – Toledo and Stann Creek districts reported less than half of the yield reported by Orange Walk and Corozal. Interesting, Belize and Cayo report fluctuations of 50% or more in yields, i.e., Cayo District is reported to have gone from 25,000 Pounds in 2017 to 13,149 Pounds/Ac in 2020. On the other hand, Toledo and Stann Creek districts consistently report the lowest yield among the districts (Table 11).

Table 11. Average Yield (Pounds/ac) of Cabbage in Belize (2016 to 2020)

District	Total Yield (Pounds/Ac.)					
	2016	2017	2018	2019	2020	District Average
Toledo	18500	3088	1295	2214	4178	5855
Stann Creek	15000	12000	14967	13224	9523	12943
Belize	24500	23667	12167	22000	12000	18867
Cayo	23809	25000	25500	16045	13149	20701
Orange Walk	20000	20000	25714	24667	29333	23943
Corozal	21143	20917	21742	24000	19547	21470
Average Belize	22729	23207	22861	16888	14836	

7.3 Cost of Production

The Belize District MOA estimates BZ$ 0.25 to produce a pound of Cabbage. Although this may seem accurate, more detailed work is needed to conduct proper feasibility studies for most vegetable crops in Belize. Table 12 shows a recap of three studies found. Details of the cost structure for each of the studies are presented in Annex 4: *Cost of Production for a One Acre of Cabbage, produced in Belize.*

According to Table 12, the total production cost of an acre of cabbage is between BZ$7300 and BZ$8400 under an irrigation system. The cost per pound is between 0.31 and 0.35 BZ$.

Regarding the cost structure, studies do not show consistency between the items they consider in their analysis or how they are pulled together. In particular, the input item is treated very differently by each source. Despite this, we can highlight that the irrigation component has the greatest weight in the cost structure, between 40 and 65%. Expenditure by agrochemicals represents between 8.61 and 11.09%. Finally, labour expenditure ranges from 6 to 12%.

Table 12. Recap of Cost of Production Studies for One Acre Production of Cabbage in Belize

Cost Structure Component	Cabbage One Acre (MAFSE)		Cabbage One Acre (SIB, 2016)		Cabbage One Acre (SIB, 2015)	
Land Preparation	BZ$120	1.52%	BZ$140	1.66%		
Inputs	BZ$399	5.04%	BZ$729	8.66%		
Seed	BZ$120	1.52%	BZ$200	2.38%	BZ$120	1.63%
Fungicide	BZ$144	1.82%	BZ$896	10.64%	BZ$632	8.61%
Herbicide	BZ$199	2.51%				
Fertilizer	BZ$535	6.76%				
Irrigation	BZ$4,863	61.47%	BZ$3,445	40.92%	BZ$4,788	65.16%
Others (fuel, bags)			BZ$1,085	12.89%		
Labour	BZ$500	6.32%	BZ$825	9.80%	BZ$850	11.56%
Operational Cost	BZ$6,880	86.96%	BZ$7,320	86.96%	BZ$6,390	86.96%
Cost contingency	BZ$1,032	13.04%	BZ$1,098	13.04%	BZ$959	13.04%
Total Cost of Production	BZ$7,912	100.00 %	BZ$8,418	100.00%	BZ$7,349	100.00 %
Yield per acre	24000		24000		24000	
Cost for pound	0.33		0.35		0.31	

* SOURCE: GARY RAMIREZ - MINISTRY OF AGRICULTURE (MAFSE)
** SOURCE: STATISTICAL INSTITUTE OF BELIZE, 2016
***SOURCE: STATISTICAL INSTITUTE OF BELIZE, 2015

Our analysis uses a 24,000 Pounds/Acre yield, as this is the one used in all three studies. Interestingly, this yield is the only characteristic of cabbage production in the Orange Walk district (see Table 11). The national average is a yield of 18,000 pounds/acre. Using the national average, the cost of production per pound of cabbage would range between 0.41 and 0.46 BZ$. If we consider that producer prices for the period from 2016 to 2020 fluctuated between 0.40 and 0.75 BZ$ per pound, then clearly, there are producers (with very low yields) that, when facing low producer prices, must be producing with very low profit margins or even losses.

8. Climate Change Vulnerability of the Cabbage Value-Chain

While value-chain dynamics is commonly analysed and described in 3-, 5- or 10-years periods, and most experts will avoid market prospects or projections beyond the 10-years mark, any climate analysis is described in longer periods. Climate dynamics is rarely described in short periods of years, as experts understand the limited predictive value of 3-, 5-, or 10-years forecasting. In addition, climate forecasting, in general terms, will be useful for the decision-making process in the cabbage 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 cabbage business.

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

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

Cabbage Value-Chain and Changes in Climate Adequacy for Belize

By comparing current and future climate conditions, the climate vulnerability assessment team provides a first-ever effort to understand possible changes in climate adequacy to produce cabbage in Belize. A brief description of the method used to develop the comparison is presented here.

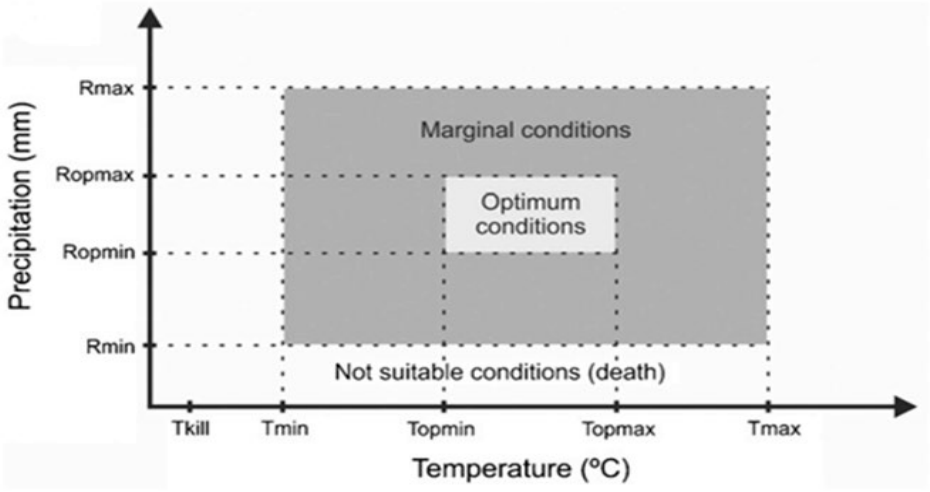
First, current climate conditions (1970 – 2000) were defined as those referring to the historical average total annual precipitation and temperature (WorldClim 2.1). Secondly, future climate conditions were represented as the average of the weather conditions over the 30-year period 2041 – 2070 (i.e., cantered in the 2050s), 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 assembly of climate projections from 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 species' climatic requirements; 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 to achieve its best performance. Figure 11 shows the interaction between precipitation and temperature parameters for absolute and optimal ranges.

Figure 11. Interaction between precipitation and temperature parameters for absolute and optimal ranges



Below in Table 13, the climatic parameters considered in the climate adequacy analysis for the cabbage production, prioritized in the RRB project, are shown. The optimal rainfall range is

between 500 and 1000mm per year, while the optimal temperature range is between 7 and 15 degrees Celsius. Given Belize average temperature of 30 degrees Celsius, it should be evident the natural restriction to grow cabbage in the Country – and how the mountains are the only spots for this crop.

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 colour) corresponds to a scale greater than 80% in the adequacy scale resulting from modeling 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 analysed (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.

Table 13. Climate parameters considered in the climate adequacy analysis requested for the cabbage value chain prioritized in the RRB project

Description of parameter used in the model	**Value used**
Gmin: Minimum duration of the growing season	60
Gmax: Maximum duration of the growing season	200
Gused: Used duration of the growing season	130
Tkmp: Temperature (°C) below which the species cannot survive	-10
Tmin: Lower limit of the absolute temperature range (°C)	7
Topmin: Lower limit of the optimum temperature range (°C)	15
Topmax: Upper limit of the optimum temperature range (°C)	24
Tmax: Upper limit of the absolute temperature range (°C)	32
Rmin: Lower precipitation limit (mm) of the absolute range	300
Ropmin: Lower precipitation limit (mm) of the optimal range	500
Ropmax: Upper limit of precipitation (mm) of the optimal range	1000
Rmax: Upper precipitation limit (mm) of the absolute range	2500

Below are the climate adequacy maps for the cabbage (*Brassica oleracea*) cultivation in Belize selected species at the national level. Figure 12 shows the climate adequacy for cultivating cabbage 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 13 shows general losses and gains in adequacy, comparing each scenario with the baseline climate adequacy for cabbage production in the whole country.

Under both scenarios, climate adequacy to produce cabbage does see major losses in suitability, with entire districts losing their suitability to plant cabbage: the north region will see climate constraints to cultivate cabbage by 2050. Considering that only temperature and precipitation are included in this analysis and that other variables will also affect the exposure to climate change, cabbage production will see major obstacles to continue their business model as usual and a clear need for prevention and adaptation actions are in order.

Figure 12. Mapping Climate Suitability for Cabbage (baseline, RCP2,6 & RCP8,5 toward 2050) for Belize

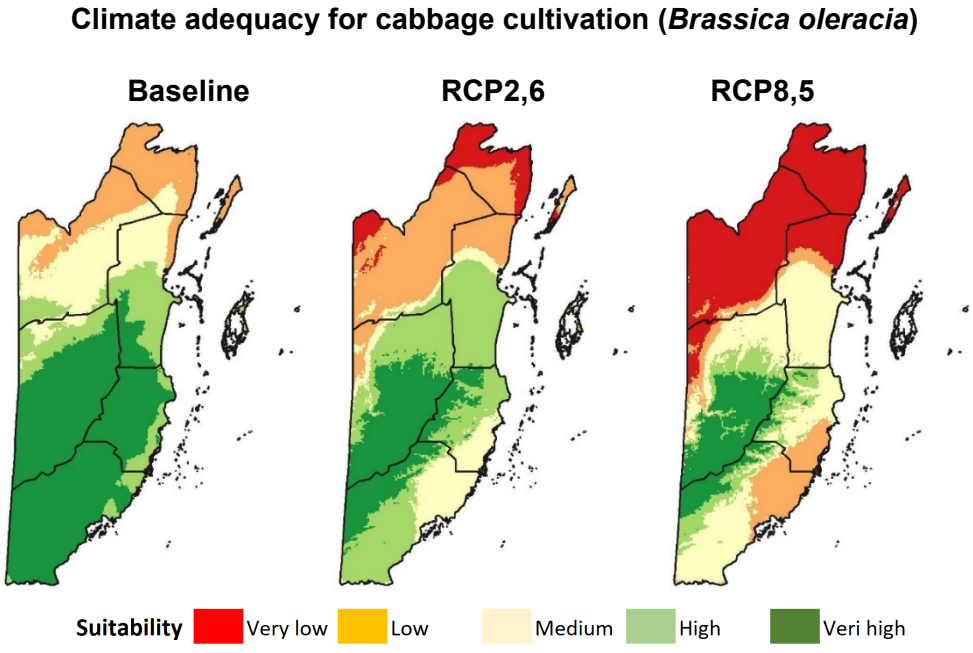
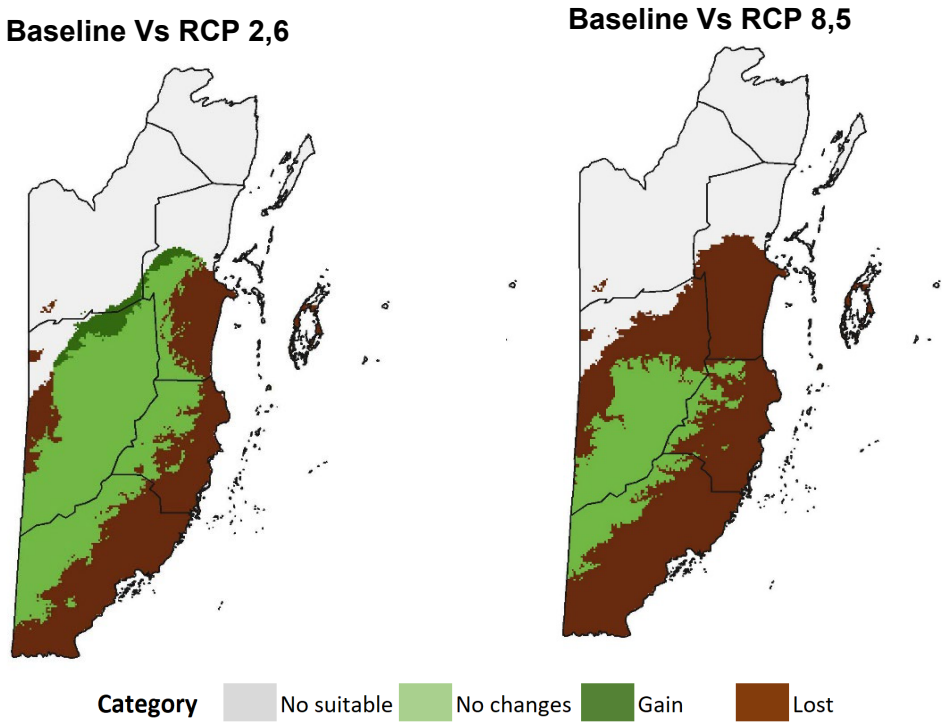


Figure 13. Mapping Climate Suitability Changes for Cabbage (Baseline, RCP2,6 & RCP8,5 toward 2050



Cabbage 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 ten intervention areas (Assessment Units of the rural resilience program in Belize RRB) and is on those areas where knowing how conditions will affect our value chain has been prioritized. For our value chain, we note that the future may play out significantly differently in RRB's intervention areas than at the national level. Assessment Units of the Rural Resilience Programme in Belize (RRB) are shown in Figure 14.

Figure 14. Mapping Intervention Areas-Assessment Units of the Resilience Rural Belize Program

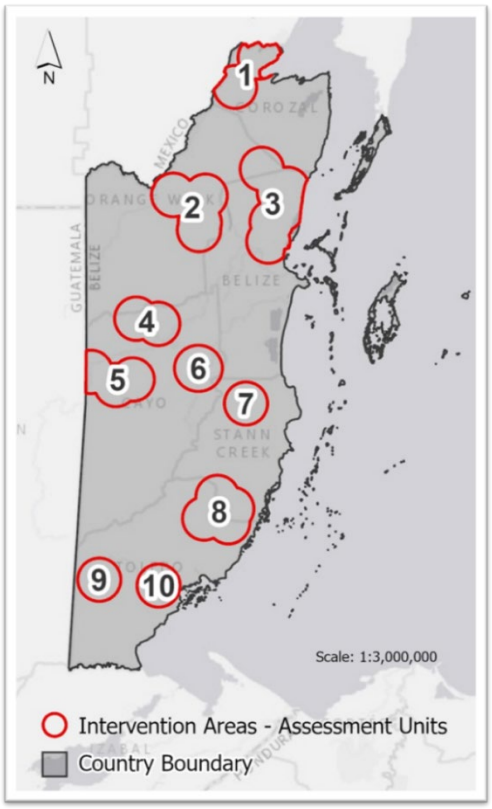


Table 14 shows changes in climate adequacy between baseline and future scenarios for cabbage (*B. oleracea)* cultivation in Belize as a percentage of each RRB programme intervention area. When the intervention area is the focus of the comparison between scenarios and not for the whole country of Belize, we can identify that all areas of the intervention are losing adequacy for cabbage cultivation. Scenario RCP8,5 implies that cabbage will not be able to be cultivated in areas 1 to 4, and areas 5 to 10 will see big losses in suitability above 40%. In particular, intervention areas 6, 8, and 10 will have their entire territory losing suitability for cabbage production. In general, future climate changes could be argued to have a big impact on cabbage cultivation in RRB target communities. Considering that only temperature and precipitation are included in this analysis and that other variables will also affect the exposure to climate changes in these communities, it is clear that cabbage producers will see major obstacles to continuing their business model as usual and that prevention and adaptation actions must be put in place. Substitution of crops, diversification, or technological innovation could be sources of relief for farmers and organizations in these areas of intervention.

Table 14. Changes in climate adequacy between baseline and future scenarios for cabbage (B. oleracea) cultivation in Belize as a percentage of each RRB

Change direction Percentage (%)	Intervention Areas- Assessment Units									
	1	2	3	4	5	6	7	8	9	10
	RCP 2,6									
Gain			2.51	38.9						
Not Suitable	100	100	88.7	38.9	23.9					
Lost			3.27		19.6		9	92	2.3	98
No changes			5.56	22.1	56.5	100	91	8.04	98	1.6
	RCP 8,5									
Gain										
Not Suitable	100	100	91.2	77.9	23.9					
Lost			8.83	22.1	51	84	58	98.1	44	100
No changes					25.1	16	42	1.93	56	

Source: Own elaboration by CVA consulting team

9. Constraints and Opportunities

The Government of Belize is giving the production of cabbage priority through the Resilient Rural Belize (RRB) Programme. This in itself is very positive for the horticulture 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 Cabbage Value Chain.

Table 15. Constraints and Opportunities for Cabbage Value Chain in Belize

Chain links	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 volume and transferring cost saving to individual farmers. A potential reduction in fertilizers and insecticides cost could help significantly in reducing the cost of production. • Substitution of organic fertilizers could be explored as a cheaper alternative to chemical fertilizers. This could be analysed together with an evaluation of the 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 delivering products between the actors. • The prices of inputs (i.e., fertilizer and pesticides) may not change rapidly enough but application efficiency could be tremendous. Training on the basics of efficient use could reduce the total bill paid by farmers.
	Seed Quality and Availability: • Seed variety suitable to Belize's climatic conditions not readily available, and when	• Opportunity for collaboration and strengthening of relationships between farmers, agronomists, and local extension services for training on Good Agriculture Practices including selection and preservation of seeds, and trials on seeds suitable to Belize's growing condition • Facilitate importation of seeds and establish local seeds banks to supply farmers.

Chain links	**Constraints**	**Opportunities**
	available, prices are very high • Seed quality not guaranteed by the supplier.	• It is recommended to support seed providers in 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 them.
Production	**Poor Knowledge on use of inputs** • Poor knowledge on use of pesticides application, fertilizer programs.	• Training on the proper use of agrochemicals and equipment. • The information given to the farmer must be calibrated/reviewed together with the input provider. The training and what the farmer learns whenever he/she buys inputs need to be correlated (equivalent). • Information sharing on alternatives inputs (i.e., organic fertilizers) could be promoted by local extension service.
	Open field cultivation with increased pest pressure • High cost of alternative production systems (screen house very costly)	• Request/apply for funds from the international cooperation to provide infrastructure (greenhouse, for example) that allows a transition from the traditional system to a sustainable or organic one. This request should be led by the cooperatives - a couple of pilot projects to identify the appropriate system and infrastructure for the cabbage business.
	Climate Vulnerability • Poor access to water suitable for irrigation and Cabbage production during drought conditions (the dry season)	• Share information on climate change and technical assistance on irrigation systems: appropriate technologies to collect and store rainwater, and how to establish good 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.

Chain links	Constraints	Opportunities
		• Possible opportunity from international funding to access grants for construction of greenhouses as a tool to mitigate climate change impacts for farmers and also post-harvest storage units.
Harvest and Post-Harvest	**Significant Crop Lost** • In interviews with key farmers, they estimate that about 10% of their crop is lost mainly because the size and damage by pests do not qualify for the market preference.	• Encouragement of Processing. There are small processing units that can serve a cooperative to process these into salads. • Organized groups or cooperatives need to understand and request the development of better post-harvest techniques. • Use the concept of "Escuela de Campo" to invite producers to learn about post-harvest management. • Conduct a study that demonstrates how much rejection could be reduced with best practices and adherence to the quality standard.
	Road Conditions • Poor road conditions between distribution and collection centre.	• RRB could consult with the Government area representative to address this issue. What should be avoided is fast deterioration of the road improvements because lack of maintenance or poor monitoring. Here, communities should be mostly involved in providing monitoring. • Identify funding and storage facilities affordable and appropriate for the farmers. • Lack of infrastructure limit the development of value-chains – Year-round Road access, 24/7 electricity and secure telephone and internet connection were mentioned by participants. One of several of these factors together with minimum post-harvesting facilities, constrain operation at several of the value-chain analysed. Improving infrastructure will decrease transaction costs and internal and external communication with significant gain in productivity and competitiveness.

Chain links	Constraints	Opportunities
		• However, the current issue of land titles for many farmers could limited the potential of financial services and functional land markets to play their part when the infrastructure issues get to be corrected. Business plans including infrastructure requirements are needed. Although, land ownership, or lack of it to be more exact, could seriously restrict the impact of the suggested infrastructure-business plans.
Marketing and Distribution	**Poor Business Practices** • Poor record-keeping results in a poor understanding of the cost of production • Lack of formal contracts with intermediary resulting in a late payment to the farmer for produce sold • No official medium to learn about price information on the market	• The farmer needs to think and act like a businessman/businesswoman. Essential also, farmers need the knowledge to farm as a business. In most cases, training on record-keeping, cost of production estimation, and knowledge about contracts 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. Marketing of produce, collective negotiation, and saving on the cost of inputs, should be obtainable by strengthening the cooperatives. • Manuals and simple brochures easy to complete/read are necessary as well as make them available to cabbage producers. • Consistency of services that provide price information to the producer can be achieved using access 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 him/her to interpret and use.
	Poor access to finance • Financial institutions require collateral such as land titles, however, many of the farmers are squatters	• Poor access to finance is normally a result of limited collateral value to offer to banks, however, access can be improved if the farmer can demonstrate administrative skills: bookkeeping, inventories, etc. NGOs 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 the capacity to provide advance payments or credit to members which are critical for planting

Chain links	**Constraints**	**Opportunities**
	and do not have land titles to use as collateral to access finance.	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 an emphasis on 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 and knowing how to manage the loans are essential to guarantee that the cooperative is working with the cheaper 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 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. • Concessional credit with favourable interest rates was made by institutions such as the Development Finance Corporation (DFC), and the Small Farmers Bank/National Bank of Belize.

10. Adaptation practices to climate change events

The main climatic threats to cabbage cultivation have been identified, and some practices that are easy to develop to reduce climatological impacts are presented. Table 16 details the main climatic events that occur in Belize, as well as the viable practices most used to adapt and mitigate the negative effects on production.

Table 16. Adaptation Practices to Climate Change – Opportunities for the Cabbage Value Chain in Belize

Constraints	**Crop damage**	**Measures Adaptation**	**Measure description**
High temperatures	It decreases the availability of water for the plant and the loss of soil moisture, which generates physiological delays in the development of the plant and loss of vigour by reducing the transport of nutrients and photo-assimilates necessary for vegetative growth.	Irrigation Change in sowing time Proper fertilization	Supply water to a crop by artificial means when the demand for water resources is high.
Heavy rains	Heavy rains can cause erosion and loss of effective areas due to the dragging of soil particles, which causes low sprouting and loss of plants. In addition, they favour the increase of weeds that compete for water, light, and nutrients.	Drains Sowing in loins Manual control or weeding Contour planting Reseeding	Topological layout for better use of the land with respect to contour lines.
Prolonged rains	Prolonged rains cause an excess of water in the soil, causing saturation, water stress, and anoxia, which hinders root development and vegetative growth necessary for plant development. It causes delays in practices and loss of fertilizer by leaching. When subjected to stress, the plant is weakened and becomes susceptible to disease and pest attack.	Drains Application of preventive and curative fungicides Sowing in loins Manual control or weeding	Construction of canals on the soil surface to eliminate excess water in the plantation, lowering the water table, improving aeration, and increasing soil nutritional access.

Constraints	**Crop damage**	**Measures Adaptation**	**Measure description**
Drought impact	Drought decreases the availability of water resources in the plant, generating stress due to water deficit; it can cause an increase in the population of pests, physiological delays in the plant caused by stomatal closure, and a decrease in the photosynthetic process and low transport of necessary photo assimilates for plant development.	Irrigation Foliar application Reseeding Change in sowing time Proper fertilization	Increase the volumes of water for irrigation to reduce the stress on the plant Improved recycling of nutrients on the farm. Modify planting dates. Reseeding
Tropical storms, hurricanes, and tornadoes	These climatic events can cause loss of total areas within the cabbage crop since the combination of strong winds and rains causes the overturning of plants and irreparable physical damage.	---	-----

11. Conclusions

Value Chain with Serious Limitations. Cabbage is grown in all the districts in the country. The Cayo District is the leading producer of cabbage, followed by the Corozal District. The main producers of cabbage are part of a cooperative. The Cayo and Corozal Districts produce cabbage in the open field where productivity is low, so there is a dire need for technical assistance to help farmers improve their farming operations. There are no examples of cooperation between actors of the value chain, and there is a perceived conflict between producers and intermediaries/collectors. The role of cooperatives and pre-cooperatives in the development of the chain is minimal because, until now, they are more focused on production problems. Private service providers are little interested in partnerships, and the assistance services offered by the state are not being fully utilized: proof of this is that producers do not follow the recommendations and specifications on crop practices, including irrigation. Post-harvest management is minimal, and there are no value-added options based on product transformation. In addition to all this, the effects of smuggling and importation have shown strong effects on cabbage and competitors in local markets, although reduced during the pandemic. 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 Ministry of Agriculture, Food Security and Enterprises has policy to support and prioritize vegetable 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.

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 from formal relations with their members, especially 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 decision-making and increase accountability. These and other barriers must be eliminated with appropriate business training.

Strengthening cooperatives. A common belief is that many cooperatives in Belize are born for the wrong reasons – mostly to take advantage of an opportunity brought up by a project. When the project disappears, so the reason for gathering in the cooperative. This is currently reported and

should be corrected with help from the institutions in charge of promoting cooperatives and should be explicitly included in the capacity building and training of farmers. Strengthening the value chain in Belize requires strengthening pre-cooperatives who could play a major production role as promoter. It has been argued that members do not recognize the clear, explicit benefit of their membership; therefore, farmer's organizations should emphasize actions that bring about financial sustainability. All farmers require knowledge of good agricultural practices such as the use of appropriate 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. Farmers attribute that about 10% of their cabbage crops remain in the fields, a loss mainly due to size and pest damages that do not meet the market requirement. This allowed processing these cabbage heads that have parts that are still edible. Processing and packaging into fresh shredded vegetables is a possibility. On Youtube, "Vegetable Processing Line for Small and Medium Size Companies" will show examples of equipment that cooperatives would be able to operate and manage.

Covid-19 partially helped national cabbage in the local market. The unforeseen impact of Covid-19 on logistics for carrying out the studies was overwhelmed. 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). Surprisingly enough, many of the products analyzed show unexpected consequences under the pandemic since 2020. First, sanitary restrictions for the mobility of people and vehicles produced a contraband reduction for several crops, mainly from Mexico. Before the pandemic, illegal imports, legal imports, and national production were common to find in major markets, especially city markets. As reported in this cabbage CVMA, contraband has been reduced, and national production has benefited in a less competitive market. What will happen if the restriction of mobility is eliminated? Nothing in the studies suggested that producers are finding national production to be of better quality or that they are ready to give up the imported goods. Therefore, RRB should prepare a strategy for when contraband returns. It is expected that, without an infusion of training, investment capital, and technical assistance, many of those sectors analyzed will return to a downward trend.

A short sightedness is common among actors of the value chain. Covid-19 had everyone focusing on the short-sight of the event, losing the potential of our research to reflect long-sight strategies. For example, having no tourism makes people ignore the opportunities that linking farmers to the tourism supply chain represents in the long run. Similarly, many people who lost their jobs move to micro-farming, affecting the normal agricultural supply in many products studied. Of course,

this is just a logical phenomenon when there is a crisis. The length of time it takes for value-chain approaches to become viable is well understood - if it doesn't break up 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 smallholders, 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, government agencies, and producers.

Priorities for the whole value chain. When considering 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 require extra effort to create consensus on priorities. Through workshops carried out for the VCMA study, a couple of challenges/needs were consistently prioritized and presented in Table 14. Similarly, priority among value chains should also be understood as a necessary step toward the efficient use of resources. To maximize the program's impact, we don't think the cabbage value chain can generate changes or act as a catalyst for improvement. However, if RRB is interested in mitigating the climate change crisis, this value chain is one of the most affected.

12. Final comments on limitations of the study

An argument can be made that the following list includes major challenges for achieving the best cabbage 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, nor between youth and adults. An explicit action plan for gender equity should be drafted, discussed, 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 events, losing the studies' potential to reflect long-sight strategies. For example, having no tourism makes people ignore the opportunities that linking farmers to the tourism supply chain represents in the long run. Similarly, many people who 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 a crisis mood. Still, it could carry out serious limitations when a value chain approach is used to harness governmental intervention in the sector. Finally, the Belize tourism sector meltdown under the 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 present in discussions and workshops carried out for the VCMA studies. Such an inattentive situation, probably due to the current emphasis on national consumers and effects from 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, Belize's agencies in charge of collecting the data may need to revisit how 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**. While carrying out the study, it was clear that not all agriculture extensionists and technicians understood what it means 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 when farmers thought it was a space for them to present demands and discuss only issues of concern to them. RRB needs to consciously remind participants and partners of 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 in space and time it brings to the value of products: relocating, holding them to more convenient times, and assuming various risks by stocking inventories. Why is the bias against middlemen so persistent? Part is explained by cultural perceptions as mere cheaters, part the misjudging of how difficult it 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.

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14. Annexes

Annex 1: CARICOM Regional Standard for Fresh Cabbage

CARICOM Regional Organisation for Standards and Quality (CROSQ)

2nd Floor Nicholas House
29 & 30 Broad Street
Bridgetown, St Michael
Barbados
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Website: http://www.crosq.org

CARICOM REGIONAL STANDARD

Specification for grades of fresh agricultural produce

Part 2: Cabbages

CRS 24: Part 2: 2010

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Michael Barbados
T: 246.622.7670 | F: 246.622.7678
Website: http://www.crosq.org

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AMENDMENTS ISSUED SINCE PUBLICATION

ATTACHMENT PAGE FOR CRS AMENDMENT SHEETS

Committee representation

This CARICOM Regional Standard was prepared under the supervision of the Regional Technical Committee for Agricultural Commodities (RTC 19), (hosted by the CARICOM Member State, Dominica), which at the time comprised the following members:

Members	Representing
Mr. Lloyd Pascal **(Chairperson)**	Dominica Export Import Agency (DEXIA)
Mr. Richard Allport	Division of Agriculture, Dominica
Mr. Ryan Anselm	Plant Protection and Quarantine Services, Dominica
Mr. Kent Coipel	Inter-American Institute for Cooperation on Agriculture (IICA)

Mr. Clement Ferreira	Nature's Best, Dominica
Mrs. Marcella Harris	Windward Island Farmers Association (WINFA)
Mr. Cecil Joseph	Dominica Hucksters Association (1995) Ltd. (DHA)
Mr. Rawle Leslie Faculty	Dominica State College – Agriculture
Mr. Angus McIntyre	Windward Island Banana Development Cooperation (WIBDECO)
Dr. Gregory Robin, Ph.D.	Caribbean Research and Development Institute (CARDI)
Mr. John Robin	Agro-Processors Association of Dominica (APAD)
Mr. Delroy Williams	National Association of Youth in Agriculture (NAYA), Dominica
r. Nadia Pacquette-Anselm **(Technical Secretary)**	Dominica Bureau of Standards

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Foreword

This CARICOM Regional Standard was developed in an effort to:

a) avoid misunderstanding and confusion among those involved in the marketing chain;

b) provide an objective basis for relating price with quality;

c) encourage better selection, packaging and presentation of produce as a means of obtaining greater income overall; and

d) assist exporters and their countries in meeting export market requirements and thereby enhancing their reputation and market position.

This standard was approved by the Twenty-ninth Council for Trade and Economic Development (COTED) on 8-9 February 2010.

In the development of this standard, assistance was derived from the following:

a) Guyana Standard, GYS 8:1994, Specification for Grades of Cabbage;

b) Jamaica Standard, Ministry of Agriculture and Lands, October 2001, Specification for Cabbage;

c) Philippine National Standard, PNS/BAFPS 17:2005, Vegetables – Cabbage (*Brasica oleracea var, capitata L.)* – Grading and classification;

d) Ministry of Agriculture Food and Rural Affairs, Ontario – Cabbage Grading and Packing Manual;

e) United States standards for grades of cabbage.

NOTE During the development of this standard, the CARICOM Regional Code of Practice for Food Hygiene was still under development.

1. Scope

This standard applies to commercial varieties of cabbage (*Brassica oleracea)* to be supplied fresh to the consumer after preparation.

2. Terms and definitions

For the purposes of this standard, the following terms and definitions shall apply.

2.1

clean

free from loose or adhering soil, pests, chemical deposits, and other foreign matter

2.2

compact

leaves are tightly formed with a firmness which is characteristic of the variety

2.3

damage

defect or combination of defects of physiological or physical cause (external or internal) which detract from the appearance or edible quality of the cabbage, such as holes caused by pests extending deeply into the compact portion or cuts and bruises that extend into the head

2.4

dispatching stage

final point of official inspection prior to market

2.5

firm

dense and not soft

2.6

free from disease

free from any visible evidence of moulds, fungal and bacterial rots, spots, or any symptom of viral infection

2.7

similar varietal characteristics

shape, colour, characteristics of the leaves, and size typical of the variety

2.8

trimmed

cabbage heads have no more than six (6) wrapper leaves, and stems are no more than 10 mm below the wrapper leaves

2.9

Well trimmed

cabbage heads are cut clean just below the lowest point of leaf growth with at least 3-5 tight wrapper leaves

2.10

well developed

cabbage heads are compact and are at a stage of development suitable for good handling, and the quality meets the requirements of the market

2.11

wrapper leaves

thick leaves that do not enfold the head fairly tightly, more than two-thirds the distance from the base to the top

1. Requirements

1.1 Quality

1.1.1 Minimum requirements

Cabbages shall meet or exceed the following minimum requirements:

a) well developed;

b) clean;

c) free from pests and diseases;

d) compact;

e) fresh; and

f) of similar varietal characteristics.

1.1.2 Classifications

Cabbages shall be classified as Class I, Class II, or Class III.

1.1.2.1 Class 1

Cabbages in this class shall meet the minimum quality requirements in 3.1.1 and in addition shall be:

a) firm;

b) well trimmed; and

c) free from damage.

1.1.2.2 Class II

Cabbages in this class shall meet the minimum quality requirements in 3.1.1 and in addition shall be:

a) firm;

b) trimmed; and

c) free from damage.

1.1.2.3 Class III

Cabbages in this class shall conform to the minimum quality requirements in 3.1.1 and in addition shall be:

a) free from serious damage; and

b) reasonably firm.

3.2 Sizing

Cabbages shall be sized according to the minimum and maximum weights of the individual cabbage head in kg.

Table 1 — Size of cabbage

Size	Minimum kg	Maximum kg
Small	0.5	1.0
Medium	1.1	1.8
Large	1.9	2.5
NOTE Size classification in each class may also be dependent on specific market requirements.		

3.3 Tolerances

Each package of cabbages not satisfying the requirements of quality and size for the class indicated as outlined in 3.1 and 3.2 shall be allowed tolerances as stated in 3.3.1 and 3.3.2.

3.3.1 Quality tolerances

3.3.1.1 Class 1

Cabbages in this class shall meet the following requirements:

a) not more than 5 % by number or weight of cabbage failing to meet the specifications of this class but meeting those of Class II; and

b) damage not exceeding more than 2 % at the dispatching stage.

3.3.1.2 Class II

Cabbages in this class shall meet the following requirements:

a) not more than 8 % by number or weight of cabbage failing to meet the specifications of this class but meeting those of class III; and

b) damage not exceeding more than 5 % at the dispatching stage

3.3.1.3 Class III

Cabbages in this class shall meet the following requirements:

a) not more than 10 % by number or weight of cabbage failing to meet the specifications of this class; and

b) damage not exceeding more than 8 % at the dispatching stage.

3.3.2 Size tolerance

All classes shall be allowed a tolerance of 10 % by number or weight of cabbage corresponding to the size immediately below or above the size indicated on the package.

3.4 Packaging

3.4.1 Cabbages shall be packed in such a way as to adequately protect the produce.

3.4.2 The materials used inside the package shall be new, clean, and of a nature that shall meet the quality, hygiene, ventilation, and resistance characteristics such as to avoid causing any external or internal damage to the produce.

NOTE The use of materials, particularly wrapping papers or adhesive labels bearing commercial indications, is allowed provided that the printing and labeling is done with a non-toxic ink or glue.

3.4.3 Packages shall be free from any foreign matter.

3.5 Labeling

Each package of cabbage shall bear the following particulars in writing, legibly and indelibly marked and visible from the outside in the official language(s) of the country in which the produce is to be sold:

a) name and address of the exporter/packer and or dispatcher;

b) nature of produce, marked in the following manner:

   1) the word 'Cabbage' where the contents are not visible from the outside; and

   2) the name of the variety or commercial type

c) country of origin of the product; and

NOTE District where grown or national, regional or local name is optional.

d) commercial specifications as follows:

   1) class and size;

   2) number of cabbage heads per container (count)

NOTE 1 Net weight of package in kg is optional.

NOTE 2 The use of red or orange should be avoided since these colours are used in the labeling of dangerous goods.

2. Contaminants

1.2 Heavy metals

Cabbages shall comply with the maximum levels for heavy metals established by the CODEX Alimentarius Commission for this commodity.

1.3 Pesticide residues

Cabbages shall comply with the maximum pesticide residue limits established by the CODEX Alimentarius Commission for this commodity.

3. Hygiene and sanitation

1.4 It is recommended that the produce covered by the provisions of this standard be prepared and handled in conjunction with the appropriate clauses of the latest edition of the CARICOM Regional Code of Practice for Food Hygiene or other international Codes of Practice, the latest recommended Code of Hygienic practices for Fresh Fruits and Vegetables (CAC/RCP 53-2003) and other Codex texts which are relevant to this commodity.

1.5 Cabbages shall comply with the microbiological criteria established in accordance with the Principles for the Establishment and Application of Microbiological Criteria for Foods (CAC/GL 27-1997).

1.6 Cabbages shall comply with Sanitary and Phyto-sanitary requirements of both the importing and exporting countries

End of document

CARICOM REGIONAL ORGANISATION FOR STANDARDS AND QUALITY

The CARICOM Regional Organisation for Standards and Quality (CROSQ) was created as an Inter-Governmental Organisation by the signing of an agreement among fourteen Member States of the Caribbean Community (CARICOM). CROSQ is the regional centre for promoting efficiency and competitive production in goods and services, through the process of standardization and the verification of quality. It is the successor to the Caribbean Common Market Standards Council (CCMSC), and supports the CARICOM mandate in the expansion of intra-regional and extra-regional trade in goods and services.

CROSQ is mandated to represent the interest of the region in international and hemispheric standards work, to promote the harmonization of metrology systems and standards, and to increase the pace of development of regional standards for the sustainable production of goods and services in the CARICOM Single Market and Economy (CSME), and the enhancement of social and economic development.

CROSQ VISION:

The premier CARICOM organisation for the development and promotion of an Internationally Recognised Regional Quality Infrastructure; and for international and regional harmonized CARICOM Metrology, Standards, Inspection, Testing and Quality Infrastructure

CROSQ MISSION:

The promotion and development of standards and standards related activities to facilitate international competitiveness and the sustainable production of goods and services within the CARICOM Single Market and Economy (CSME) for the enhancement of social and economic development.

Annex 2: List of Workshop Participants to Validate the Value Chain and Market Assessment for Cabbage

ATTENDANCE LIST

NAME OF GROUP: Valley of Peace / St. Margaret / Armenia

SUBJECT: Cabbage

DATE: Nov 10, 2021

	#	Name	M or F	Organization	Date of Birth	Indigenous Yes	Indigenous No	Relationship (to other persons attending this session)	Phone & Email	Signature
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3	3.	Edwin Manuel Nunez.	M	Valley of Peace.	28/11/91		✓		621-2379	X
4	4.	Gary Ramirez	M	Min. of Agriculture	14/3/82		✓		615-3925	
2	5.	Francisco Contreras	M	BAHA	25/11/69		✓		604-319	
2	6.	Cesar Melgar	M	NPK+	7/8/82		✓		631-3045	CM.
3	7.	Edgar Melgar	M	NPK+			✓		608 [illegible]	
4	8.	Juan Arroyo		Valley of peace	29/5/[illegible]		✓	chairman	669 5291	x. Juan Arroyo

1

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Cabbage Valley of Peace / St. Margret / Armenia

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14.	Mateo Xi Xol	M	Armenia	9/9/75	✓			621-2154	x mateo xi
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16.	Manuel Diaz Medina	M	Valley of Peace	20.03.64		✓		660-4913	x Vilma
17.	Mario Perez	M	St. Margaret Village	26.12.64		✓		635-3183	

ATTENDANCE LIST

NAME OF GROUP: Valley of Peace | St. Margaret | Armenia

SUBJECT: Cabbage

DATE: 2021.

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					Yes	No			
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3.	Maritza Blandon	F	Valley of Peace	01/11/88		✓		667-0774	Maritza Blandon
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V 2 040121

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	#	Name	M or F	Vaccinated Yes	Vaccinated No	Date of Birth	Indigenous Yes	Indigenous No	Relationship	Phone & Email	Organization	Signature
1	7.	Santiago Galdamez	M	✓		25/7/67		✓	-	628-7444	St. Martha	x Santiago Galdamez
2	8.	Tomas Sandoval	M	✓		21/12/61		✓	—	624-4969	St. Martha	x Tomas Sandoval
3	9.	Sebastian Diaz	M	✓		2/4/64		✓	—	636-6624	St. Margaret	x. S Díaz
4	10.	Javier Flamenco	M	✓		7/9/01		✓	—	633 9018	St. Margaret	x
1	11.	Jose Osins Flamenco	M	✓		16-5-68		✓	—	633 9218	St. Margaret	x José O Flamenco
2	12.	Jose Luis Echevenia	M	✓		21/07/85		✓	—	636-9258	St. Margaret	x
3	13.	Melissa Balan.	F	✓		1/10/84		✓	—	629-9785	Min Agriculture CF	
4	14.	Jose Cerritos	M	✓		15/1/73		✓	—	667-9470	Valley of Peace	x

VCMA – Valley of Peace
NOV 10, 2021
Cabbage

ATTENDANCE LIST

#	Name	M or F	Organization	Date of Birth	Indigenous		Relationship (to other persons attending this session)	Phone & Email	Signature
					Yes	No			
9.	Hector Reyes	M	RRB	15/08/78			–	671509	
10.	Alfred Serano	M	RRB	10/2/66	✓			614 4666	
11.	Fernando Majil	M	Consultor	30/5/68		✓	–	628-7996	
12.	Veronica Mayorga	F	Consultor	27/7/76		✓	–	6152065	
13.	Enrique Divio	M	Consultor	4/3/79		✓	–	631-6427	
14.	Joe Lisbey	M	RRB	18/05/64				624 8[illegible]	
15.	Lloyd Orellana	M	BBS	29/11/84		✓		6158840	
16.									
17.									

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Annex 3: Pictures of Participants at the Value Chain and Marketing Assessment Workshop

Annex 4: Cost of Production for a One Acre of Cabbage, produced in Belize

COST OF PRODUCTION FOR ONE ACRE OF CABBAGE				
16-Mar-15				
Ministry of Natural Resources & Agriculture				
Activity /Inputs	**Quantity**	**Unit**	**Unit Cost**	**Total Cost**
Land Preparation:				
Plough	1	acre	$ 60.00	$ 60.00
Harrow	1	acre	$ 40.00	$ 40.00
Bedding	1	acre	$ 40.00	$ 40.00
Inputs				
Seed	2	pk	$ 100.00	$ 200.00
Dipel	3	can	$ 40.00	$ 120.00
Baythroid	2	liter	$ 111.00	$ 222.00
Phyton	1	liter	$ 135.00	$ 135.00
Antracol	2	pk	$ 18.50	$ 37.00
Round-up	1	gallon	$ 50.00	$ 50.00
Fusilade	2	Liter	$ 64.00	$ 128.00
Spreader Sticker	2	Liter	$ 18.75	$ 37.50
Fertilizer				
14-36-12	4	bags	$ 67.00	$ 268.00
46-0-0	4	bags	$ 58.00	$ 232.00
Polyfeed (25 kg bag)	3	bags	$ 132.00	$ 396.00
Labor				
Seedling care	4	days	$ 30.00	$ 120.00
Transplanting	2	days	$ 30.00	$ 60.00
Fertilizing	4	days	$ 30.00	$ 120.00
Weed Control	1.5	days	$ 30.00	$ 45.00
Pest Control	5	days	$ 30.00	$ 150.00
Irrigating	6	days	$ 30.00	$ 180.00
Harvesting	5	day	$ 30.00	$ 150.00
Transportation			$ 300.00	$ 300.00
Fuel	50	gal	$ 9.00	$ 450.00
Oil	1	gal	$ 35.00	$ 35.00
Bags	300	bags	$ 1.00	$ 300.00
Total				**$ 3,875.50**
Equipment	Unit	Quantity	Unit Cost	Total Cost
Mistblower (Makita)		1		2845
Crates		30	20	600
knapsack sprayers (20 liter)		2	150	300
TOTAL				3445

COST OF PRODUCTION 1 ACRE CABBAGE			
ACTIVITY	**UNIT**	**UNIT COST**	**TOTAL**
Land Preparation			
Ploughing	1 hour	$40.00	$40.00
Harrowing	1 hour	$40.00	$40.00
Bedding	1 hour	$40.00	$40.00
SUB TOTAL			**$120.00**
Seeds (Rotonda)	4 pks	$40.00	$120.00
INPUTS			
Indicate	5 lts	$22.00	$110.00
Insecticide			
New BT	6 lbs	$28.00	$168.00
Karate	1 lt	$45.00	$45.00
Regent	200 cc	$38./100cc	$76.00
SUB TOTAL			**$519.00**
Fungicide			
Ridomil	1 kg	$67.00	$67.00
Bravo	2 lts	38.5	$77.00
SUB TOTAL			**$144.00**
Herbicide			
Lasso	2 lts	$30.00	$60.00
Fusilade	2 lts	$60.00	$120.00
Round Up	1 lt	$18.50	$18.50
SUB TOTAL			**$198.50**
Fertilizer			
14 - 36 -12	3 bags	$36.00	$108.00
Urea	4 bags	$33.00	$132.00
K Nitrate	3 bags	$75.00	$225.00
Polyfeed(19-19-19)	1 bag	$70.00	$70.00
SUB TOTAL			**$535.00**
Irrigation			
T Tape	3 rolls	$635.00	$1,905.00
2" Main hose	1 roll	$570.00	$570.00
Connectors	100	$2.50	$250.00
Pump 5.5 hp	1	$1,300.00	$1,300.00
Fittings			$200.00
Filter	1	$300.00	$300.00
Fuel	40 gls	$8.46	$338.40
SUB TOTAL			**$4,863.40**
Labour			
Seedbed Preparation	1 day	$25.00	$25.00
Transplanting	5 days	$25.00	$125.00
Weed Control	5 days	$25.00	$125.00
Fertilizing	2 days	$25.00	$50.00
Pest & Disease Ctrl	3 days	$25.00	$75.00
Irrigation Setup	1 day	$25.00	$25.00
Harvesting	3 days	$25.00	$75.00
SUB TOTAL			**$500.00**
TOTAL			**$6,879.90**

Item	unit	unit cost	Running cost	Total
Labour				
Ploughing	hrs	$50.00	$100.00	
Harrowing	hrs	$50.00	$50.00	
Bedding	hrs	$50.00	$100.00	
Seedbed Preparation	day	$25.00	$25.00	
Transplanting	days	$25.00	$50.00	
Weed Control	days	$25.00	$50.00	
Fertilizing	days	$25.00	$50.00	
Irrigation Setup	days	$25.00	$50.00	
gas	gal	$10.40	$249.60	
Harvesting	days	$25.00	$125.00	
sub total				**$849.60**

Irrigation

ITEM	QUANTITY	UNIT COST	RUNNING COST	Total
PVC ELBOW	5 UNITS	3.62	18.1	
PVC PIPE	5 FT	2.18	10.9	
PVC CHECK VALVE	1 UNIT	19.69	19.69	
PVC TEE	5 UNITS	4.73	23.65	
PVC REDUCER	2 UNIT	2.7	5.4	
PVC PIPE	5 FT	0.7	3.5	
PVC ADOPTAR	2 UNIT	0.75	1.5	
PVC BALL VALVE	2 UNITS	4	8	
PVC ELBOW	2 UNITS	1.15	2.3	
PVC ADOPTAR	8 UNITS	1.05	8.4	
VENTURI INJECTOR	1 UNIT	100	100	
PVC CHECK VALVE	1 UNIT	3.71	3.71	
PVC BALL VALVE	3 UNIT	16.65	49.95	
ITEM	**QUANTITY**	**UNIT COST**	**RUNNING COST**	**Total**
PVC ADOTAR	4 UNITS	2.53	10.12	
FILTER	1 UNIT	350	350	
PVC REDUCER	1 UNIT	3	3	
PVC ADOPTAR	1 UNIT	1.1	1.1	
TAFLON TAPE	1 UNIT	2.05	2.05	
PVC GLUE	1 UNIT	10.97	10.97	
POLYBARB	8 UNITS	4.5	36	
HOSE CLAMPS	23 UNITS	1.5	34.5	
AIR RELEAF VALVE	1UNIT	35	35	
WATER PUMP	1 UNIT	950	950	
POLY BARB	1 UNIT	10.5	10.5	
BLUE STRIPE HOSE	1 ROLL	570	570	
IRRIGATION TAPE	25,000 FT	1950	1950	
TAKE OFF	120 UNITS	2.75	330	
SUCTION HOSE	30 FT	8	240	
sub total				**4788.34**

Inputs

Item	unit	unit cost	Running cost	Total
Seeds (Tropicana)	pks	$60.00	$120.00	
Urea	lbs (100 LBS)	$45.25	$45.25	
14-36-12	lbs (100 LBS)	$64.50	$64.50	
Manzate(helizab)	kg	$33.00	$33.00	
Bravo/Glider	lt	$45.00	$45.00	
18-46-0	lbs (100 LBS)	$67.50	$67.50	
18-18-18	lbs(100 LBS)	$81.50	$81.50	
multi -k	sack	$90.75	$90.75	
New Mectin	100 cc	$39.95	$39.95	
Vertimec	100 cc	$45.00	$45.00	
sub total				**$632.45**
TOTAL COST				**$6,270.39**

Yield per acre	9600	3840		
Cost of production (Not Including Irr.)				
Estimated net income	**$8,117.95**			