



**Horticulture Program
Research, Development and Innovation Center
Ministry of Agriculture, Food Security and Enterprise**

Horticulture Program

Background

- ❑ The Horticulture Program is a part of the Research, Development and Innovation Centre in Central Farm.
- ❑ Although the Unit operates from its office in Central Farm, our responsibilities are national as we provide support and work in conjunction with the National Extension Service.
- ❑ The Coordinator is the head of the Unit. There are three (3) technical officers (one officer stationed in Orange Walk and a driver who work along with the coordinator to execute the activities of the sub-programs highlighted above. The day-to-day work of the unit is supported by the contribution of thirteen (14) field workers who assigned to various programs.

Main objectives

- ❑ The primary role of the Unit is to contribute to the competitiveness of the agriculture sector through the validation of innovative technologies.
- ❑ Additionally, the Program provides a range of development support such as facilitating training sessions, site visit and tours of the various sites in Central Farm and NATS, designing and construction of covered structures, assistance in irrigation and drainage, school garden development, etc.
- ❑ The Horticulture Program currently consists of six (6) sub-program or areas;
 - Protected Agriculture(Covered structures, Seedling nurseries, etc.)
 - Open field production,
 - Irrigation and Drainage
 - Non-Conventional systems (Soil amendments, Earthworms, etc.)
 - Support to Districts
 - School garden/Backyard gardening
- ❑ 3 of the 6 sub-programs operates crop trail/evaluation, training and demonstration sites.



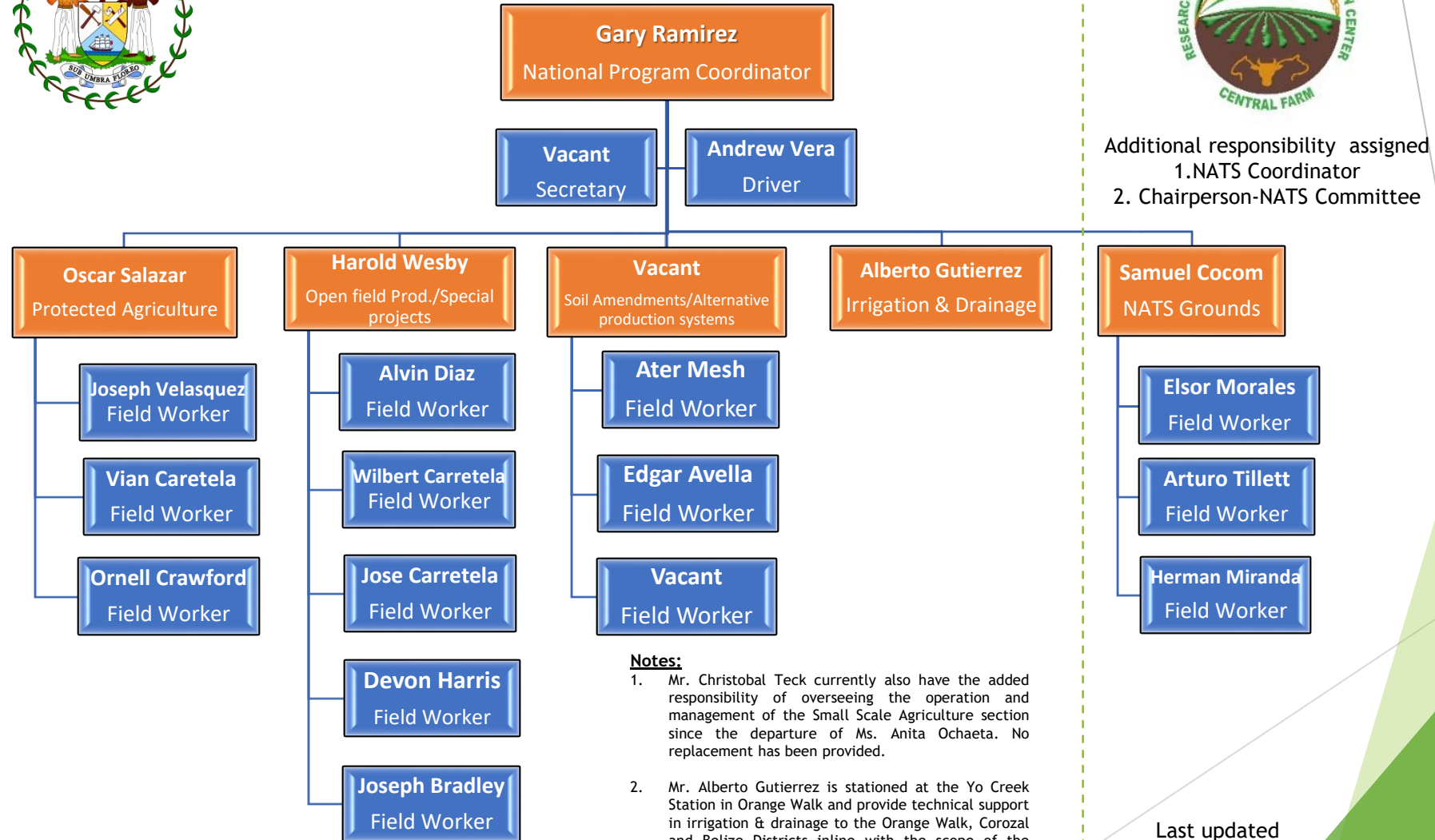
Horticulture Program

Land Use



Organogram

HORTICULTURE PROGRAM Research, Development and Innovation Center Central Farm, Cayo District Ministry of Agriculture, Food Security and Enterprise



Additional responsibility assigned
1. NATS Coordinator
2. Chairperson-NATS Committee

Notes:

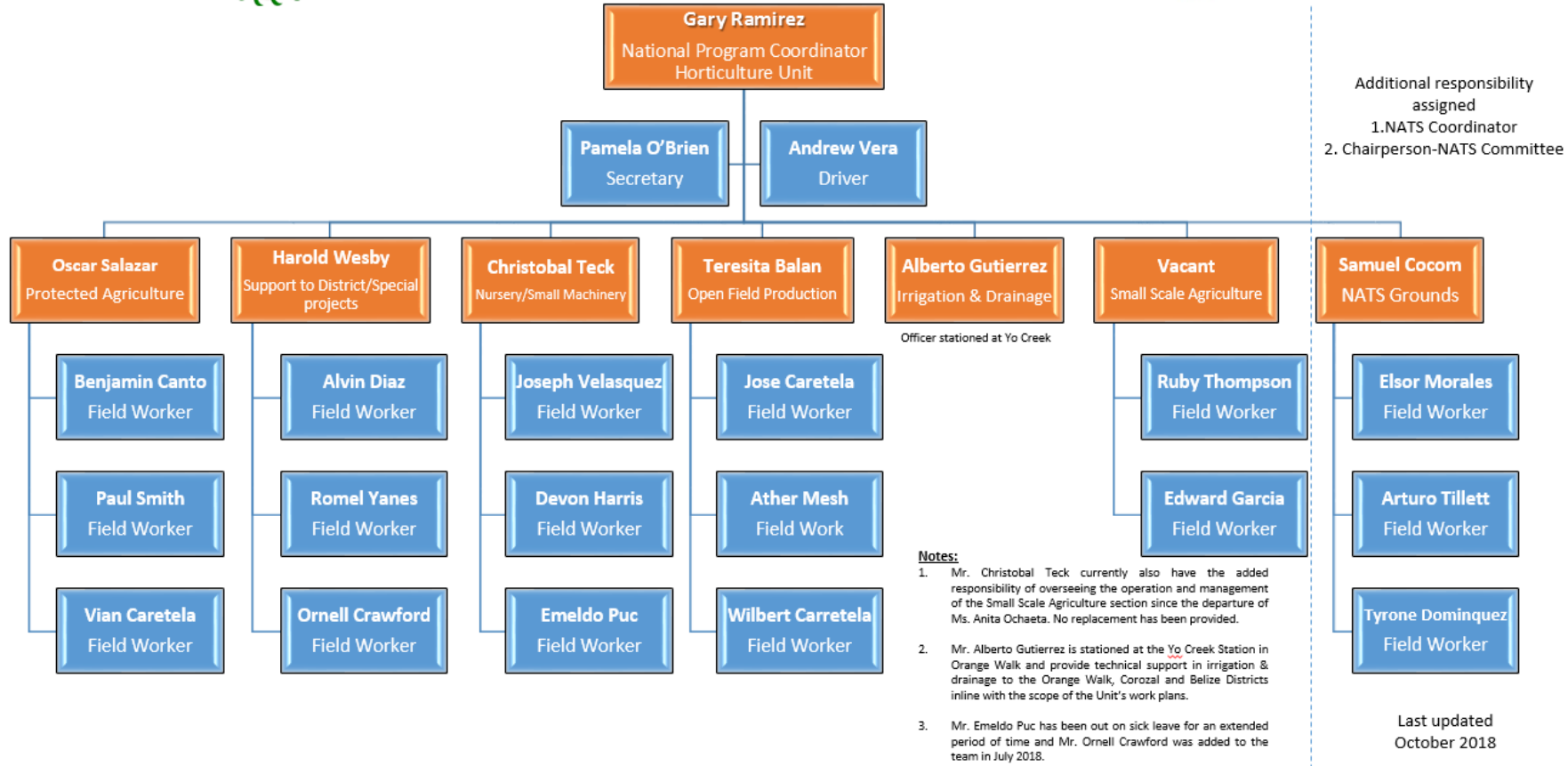
1. Mr. Christobal Teck currently also have the added responsibility of overseeing the operation and management of the Small Scale Agriculture section since the departure of Ms. Anita Ochaeta. No replacement has been provided.
2. Mr. Alberto Gutierrez is stationed at the Yo Creek Station in Orange Walk and provide technical support in irrigation & drainage to the Orange Walk, Corozal and Belize Districts inline with the scope of the Unit's work plans.

Last updated
April 2021

Organogram



HORTICULTURE UNIT
Research, Development and Innovation Center
Central Farm, Cayo District
Ministry of Agriculture, Fisheries, Forestry, The Environment, Sustainable Development and Immigration



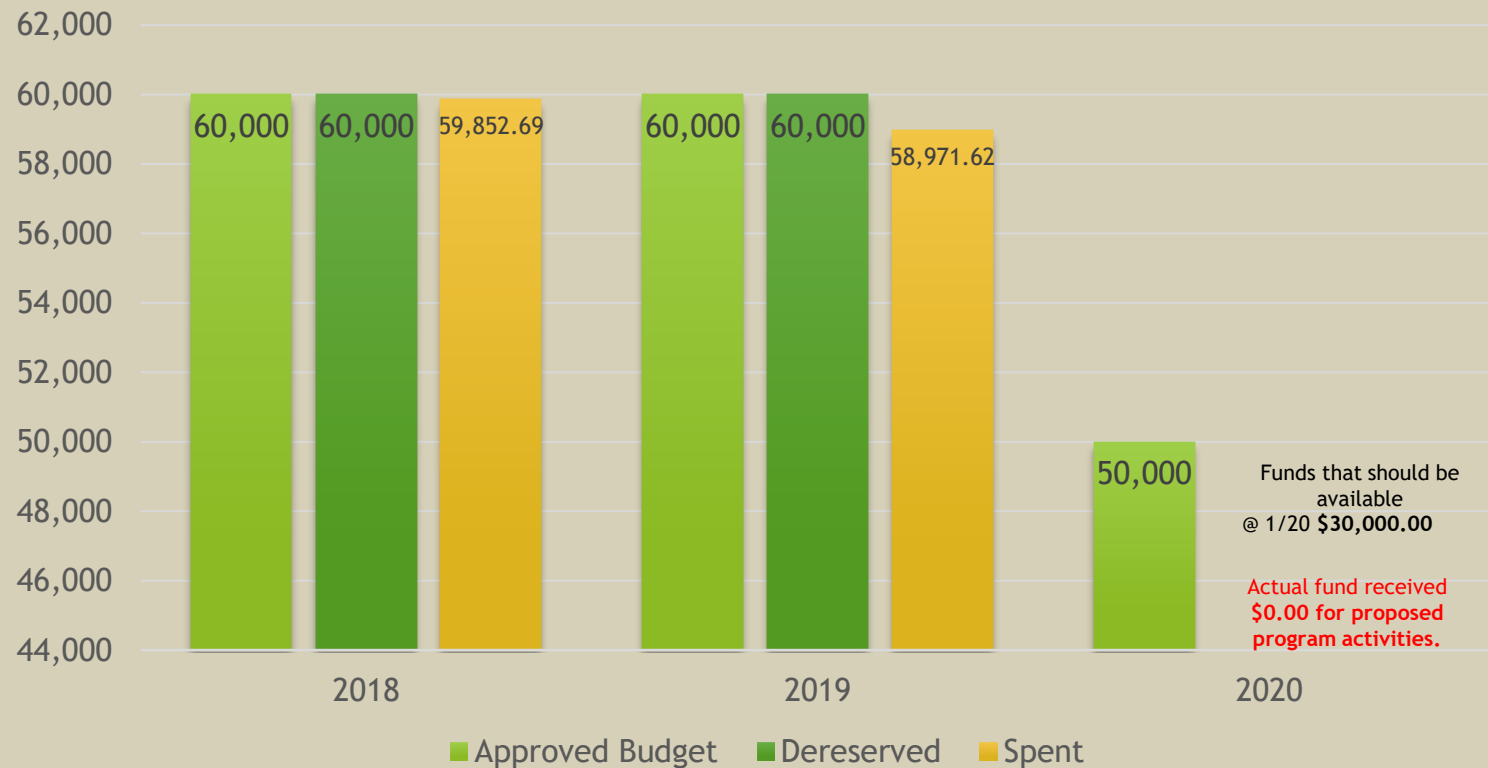
Team size: 22



HORTICULTURE PROGRAM
Research, Development and Innovation Center
Central Farm, Cayo District
Ministry of Agriculture, Fisheries, Food Security and Enterprise



Horticulture Program Cap II Funding





2020-2021 Accomplishments

Horticulture Program

Accomplishments

1. Crop Research and Development

Sub program: Open Field Production Systems (Seasonal crops)

Commodity: Onion, Potato, Carrots & Garlic

Objective: Identify suitable varieties and growing conditions for three (3) selected commodities.

Activities	Planned in Trimester	Completed in trimester	% completed	Observations/results
Onion				There is current 2 off season plots established 1-Direct plant and the other transplanted.
a. Varietal	3	N/A	0%	
b. Crop nutrition and	3	N/A	0%	
c. Off season production	4	4	Ongoing	
Potato				Funding for these activities will be pursued again in the upcoming financial year.
a. Varietal (SIP)	3	N/A	0%	
b. Suitability evaluation	3	N/A	0%	
c. Seed Production	4	N/A	0%	
Garlic				In 2019, Belize imported 242,827 lbs. (Approx. 24.2 acres. (Estimates cost \$368,166.69)
a. Evaluation of varieties	3	N/A	0%	
b. production systems	3	N/A	0%	



General Comments: The commodities above are among the most critical of seasonal products that requires consistent technical support and Research and Development in order to take advantage of potential for increase productivity and competitive advantage will reduce cost of production.

Horticulture Program

Accomplishments

1. Crop Research and Development

Sub program: Open Field Production Systems

Commodity: Tomato, Sweet pepper & Sweet Corn

Objective: Identify suitable varieties and growing conditions for three (3) selected commodities.

Activities	Planned in Trimester	Completed in trimester	% completed	Observations/results
Tomato (Varietal –Replacement)	2	3	100%	Conducted in collaboration with Prosser Fertilizer in Central Farm. Preparation current underway to replicate this activity.
Sweet Pepper (Varietal –Replacement)	2	3	100%	Traditional high yielding varieties such as Camalot are no longer on the market therefore the identification of new and suitable varieties must take place quickly.
Cabbage (Varietal –Replacement)	2	3	100%	Conducted in collaboration with East-West seeds and included 6 varieties. Farmers were organized in small groups by Extension -Cayo to view the crop.

General Comments: While the use of technology has allowed for the traditional of a significant amount of Sweet Pepper production to covered structure, there are still many farmers who engage in open field production and therefore the search for production and management technique continues to be important.

Horticulture Program

Accomplishments

1. Crop Research and Development

Sub program: Protected Agriculture (Covered Structure)

Commodity: Tomato, Sweet pepper & Cucumber

Objective: Identify suitable varieties and growing conditions for three (3) selected commodities.



What is the
Difference Between
Open Pollinated
And
Hybrid Seeds?

Activities	Planned in Trimester	Completed in trimester	% completed	Observations/results
Tomato (Open pollinated seed multiplication) Tropic, Floridade, Beefsteak, Walter, Hayslip, Caro Rich	2	3	50% (Ongoing)	The plants are currently at the early fruiting stage. Despite the high RH this time of year, there is no major issues with diseases.
Sweet Pepper (Open pollinated seed multiplication) (Capistrano,0408,0504,1314,9802,0102)	2	3	75% (Ongoing)	From the available seeds, only 3 varieties had germination sufficient to establish the evaluation plot. Current harvesting.
Cucumber (Open pollinated seed multiplication) Market-more 76)	2	0	0%	Consistently poor germination. Unable to establish enough plants for a plot.

General Comments: Open pollinated vegetable varieties are less known in Belize when compared to hybrid types but has been a growing interest and place for it given the significant increase in home/backyard gardening. The production of adequate quantities of seeds can result in the established of nurseries to support home and school gardening thereby improve the sustainability of these activities.

Types of seeds

Open Pollinated:
Pollinated by bees, birds etc. Not all open pollinated seeds are heirlooms.

Heirloom:
Seeds are open pollinated and saved for generations. Will breed true to parent.

Hybrid:
Seeds are bred for particular qualities. Saved seeds don't breed true.

GMO:
Genetically modified organism created in a lab. Created by modifying DNA.

Horticulture Program

Accomplishments

1. Crop Research and Development



Horticulture Program

Accomplishments

1. Crop Research and Development



Evaluation of Solid Rain Technology

Horticulture Program

Accomplishments

2. Development and Innovation

Chimney Solar Dryer

The UC Davis chimney solar dryer was designed to provide efficient drying even in hazy or partially cloudy conditions. Constructing the dryer is simple, and it can be built from low-cost materials found locally in markets and shops around the world. The objective is to provide the knowledge needed to build and use the chimney solar dryer, along with the basic value and process of using the sun to dry fruits, vegetables and other foods.

There are two key and unique characteristics of the chimney solar dryer:

- 1.The chimney ensures continuous airflow around the product, thus increasing the speed of drying compared to other designs.
- 2.The dryer's large heat-collection area ensures high temperatures and rapid moisture removal.

The objective is to be build the first unit in Central Farm t be used by the Argo-Processing Unit. This will give us the opportunity to make any needed modification to the design based on construction material locally available, complete and update the bill of quantities (BoQ) and evaluate performance of the Unit.

A suitable design including a construction manual has been identified and downloaded. <https://horticulture.ucdavis.edu/information/chimney-solar-dryer-manual>
The document is currently being review and estimate of material and supplies completed.



Horticulture Program

Accomplishments

2. Development and Innovation

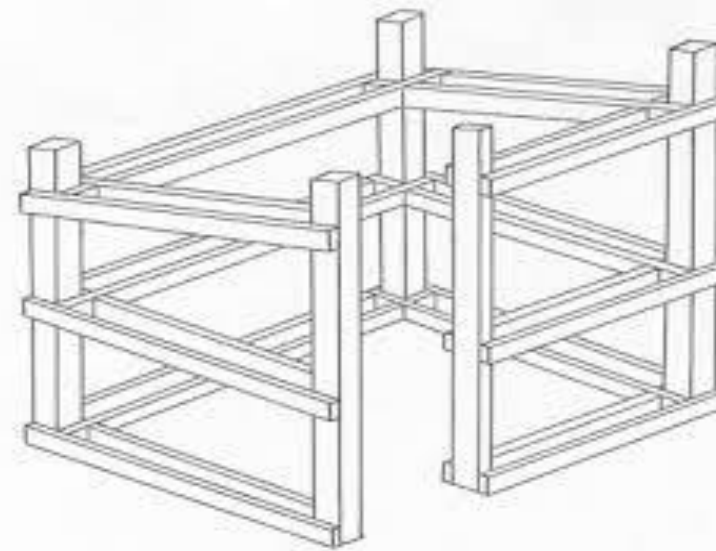
Charcoal Cooling Chamber

The Evaporative Cooler is designed to provide an environment which is both lower than ambient temperature and at a higher level of relative humidity for the storage of fresh produce. It works on the principle of a porous structure to which water is added; as air flows across this “wet wall” the air temperature is decreased due to the loss of heat through the evaporation of water.

The temperature is normally lowered by about 5 to 10 degrees, depending on the relative humidity of the ambient air. Evaporative Coolers can be used for all types of produce, but subtropical fruits respond best because their optimum storage temperatures are closer to those achieved by Evaporative Coolers. Various designs of Evaporative Coolers have been used in different parts of the world; the design employed in Rwanda was selected as being suitable for the conditions prevailing. The construction and materials employed in Rwanda can serve as guidelines, and modifications can be made as needed.

A suitable design including a construction manual entitled “Appropriate Technology Cold Store Construction and Review of Post-harvest Transport and Handling Practices for Export of Fresh Produce from Rwanda” produced by Ngoni Nenguwo in August 2000 has been identified and downloaded.

The application of this technology to covered structure production is also being considered.

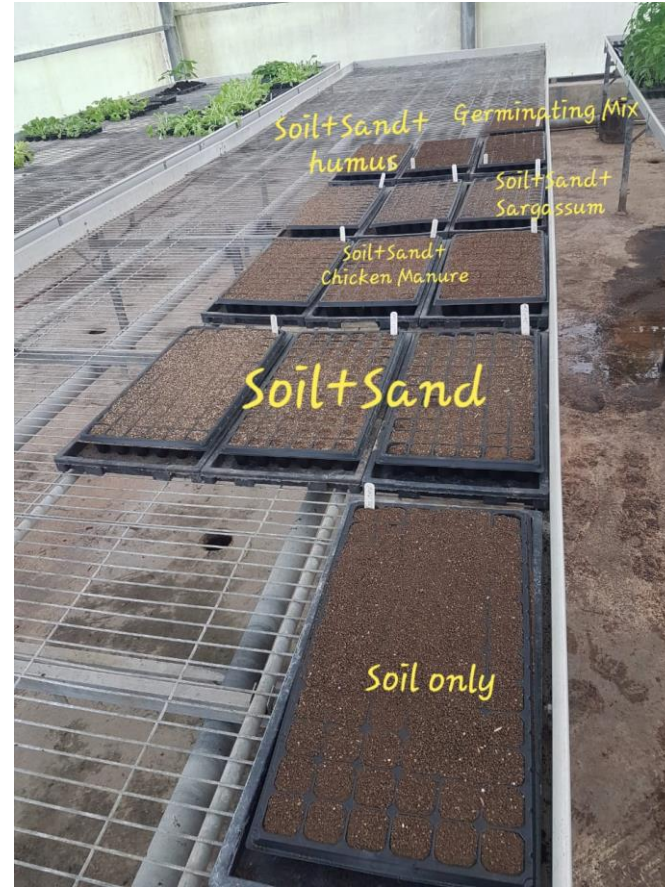


Horticulture Program

Accomplishments

Vegetable Seedling Production

Development of Soil Mix Composition



Horticulture Program

Accomplishments

Vegetable Seedling Production

Production and Distribution



Operational
Central Farm -22,000
Stann Creek station - 2,592
Toledo District station -1,080

Horticulture Program

Accomplishments

Vegetable Seedling Production

Training of Farmers and Extension officers



Locations

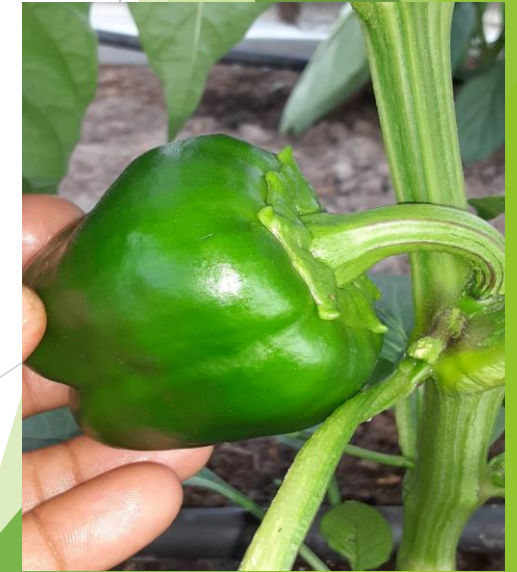
1. Stann Creek station
2. Belize District Station
3. Yo Creek Station



Horticulture Program

Accomplishments

Hattieville Community Gardening Project



Horticulture Program

Accomplishments

Dismantling and Re-location of Covered Structures



Horticulture Program

Accomplishments

Dismantling and Re-location of Covered Structures



Horticulture Program

Accomplishments

Training





Proposed & Pipeline Activities

Proposed Workplan Activities 2021-2022

1. Extract relevant info from Plan Belize
2. Define/outline priority commodities & critical stakeholders.
3. Define economic benefits and major challenges associated with selected commodities.
4. Identification of lead officers in each District responsible for veg production.
5. Development a support, mentorship, training program to help increase technical capacity.
6. Facilitate the activities of existing task force or working groups for priority commodity or critical issues.
7. Organize the review of existing value chain analysis and collaborate with organization proposing to develop others.
8. Development of plan to help management or coordination the wide-ranging issues related to these commodities (CoP, Calenderization of production & Harvesting, etc.)

Assignment of Leads, 100 Days:

Program to reduce imports of food and feed, including vegetables, processed/tinned meats, low quality snacks, beverages and drinks etc.

Updated Sugar Industry Act based on consultation with key stakeholders

Action plans for the citrus, banana and shrimp industries, developed with the respective stakeholders

Statutory instruments that enable reduction of taxes on imported machinery and equipment for agriculture, food processing

Policy approved for affordable financing and appropriate conditions for farmers with credit unions and commercial banks

Program to reduce imports of food (vegetables)

Questions

1. What are the annual imports in a particular year? Is this typical? What are the trends?
 - a) What crops
 - b) What quantities
 - c) What is the value of these imports
 - d) What is the frequency and timing of the importations?

2. What are the national demands?
 - a) Weekly
 - b) Monthly
 - c) Quarterly
 - d) Annually

3. What is the level of national production?
 - a) What are the annual production trends for the last 3-5 years
 - b) When are these crops produced or in short supplies

4. What are the priority commodities of the Ministry?

5. How has/will the recent natural disasters impact these trends? What should/can be done to help mitigate these impacts?

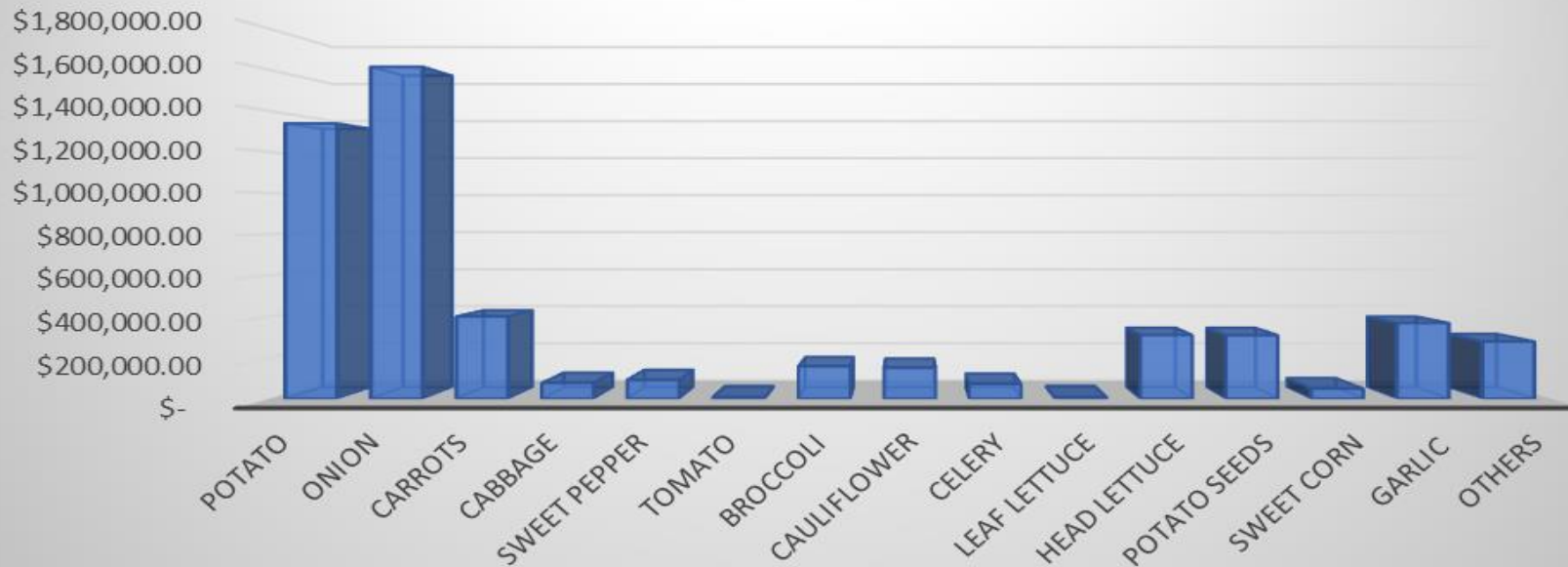
Program to reduce imports of food (Vegetables)

No.	Summary	Weight	Value	Rank
1	Potato	3,421,329.02	\$ 1,338,525.01	2
2	Onion	3,244,460.56	\$ 1,614,052.92	1
3	Carrots	941,617.22	\$ 399,941.81	3
4	Cabbage	256,435.98	\$ 77,329.34	11
5	Sweet Pepper	29,738	\$ 91,625.38	10
6	Tomato	2,461	\$ 7,851.68	15
7	Broccoli	210,036.23	\$ 157,768.98	8
8	Cauliflower	207,320.04	\$ 150,387.65	9
9	Celery	146,987.43	\$ 72,600.32	12
10	Leaf lettuce	5,393	\$ 8,581.58	14
11	Head lettuce	593,455.51	\$ 309,447.51	5
12	Potato seeds	346,079.72	\$ 309,046.76	6
13	Sweet corn	39,130.62	\$ 49,089.10	13
14	Garlic	242,827.55	\$ 368,166.69	4
15	Others	158,505.48	\$ 278,510.76	7
TOTAL		9,845,777.36	5,232,925.49	

► In 2019, Belize imported approximately 10 million pounds of vegetable and related crops at a value of over \$5.2 million dollars. Onion, Potato, and carrots are seasonal commodities ranked highest in both total weight imported and cost to the economy. According to data from the Statistical Institute of Belize (SIB), this is a relatively standard pattern over the past few years.

Program to reduce imports of food (Vegetables)

2019 Vegetable imported into Belize by value



CO Description	HS	Crop	HS Description	CPC	CPC Description	Net Mass	Quantity	Value
GUATEMALA	0710100000	Potatoes	Potatoes, frozen.	4000	ENTRY FOR HOME USE	11.00	1	\$ 115.34
MEXICO	0701900000	Potatoes	Other potatoes, fresh or chilled.	4000	ENTRY FOR HOME USE		10	\$ 7,144.88
MEXICO	0701900000	Potatoes	Other potatoes, fresh or chilled.	4000	ENTRY FOR HOME USE		3	\$ 97.33
MEXICO	0701900000	Potatoes	Other potatoes, fresh or chilled.	4000	ENTRY FOR HOME USE	80,592.00	1,009	\$ 29,330.27
MEXICO	0701900000	Potatoes	Other potatoes, fresh or chilled.	4000	ENTRY FOR HOME USE	407,894.34	4,884	\$ 133,512.96
MEXICO	0701900000	Potatoes	Other potatoes, fresh or chilled.	4000	ENTRY FOR HOME USE	2,293,691.00	28,499	\$ 836,446.62
MEXICO	0701900000	Potatoes	Other potatoes, fresh or chilled.	4000	ENTRY FOR HOME USE	518,022.00	6,358	\$ 189,155.56
MEXICO	0701900000	Potatoes	Other potatoes, fresh or chilled.	4000	ENTRY FOR HOME USE	5,950.00	75	\$ 2,156.34
UNITED STATES	0701900000	Potatoes	Other potatoes, fresh or chilled.	4000	ENTRY FOR HOME USE	114,964.00	2,398	\$ 140,565.71
						3,421,329.02	43,237	\$ 1,338,525.01

Program to reduce imports of food (vegetables)

No.	Crops	Permit granted	Actual importation	Difference	Percentage
1	Potato	1,707,849.00	3,421,329.02	1,713,480.02	100.33
2	Onion	2,353,241.00	3,244,460.56	891,219.56	37.87
3	Carrots	546,494.00	941,617.22	395,123.22	72.30
4	Cabbage	465,029.00	256,435.98	(208,593.02)	-44.86
5	Sweet Pepper	25,766.00	29,738.00	3,972.00	15.42
6	Tomato	2,083.00	2,461.00	378.00	18.15
7	Broccoli	504,038.00	210,036.23	(294,001.77)	-58.33
8	Cauliflower	464,794.00	207,320.04	(257,473.96)	-55.40
9	Celery	330,200.00	146,987.43	(183,212.57)	-55.49
10	Leaf lettuce	120.00	5,393.00	5,273.00	
11	Head lettuce	392,418.00	593,455.51	201,037.51	51.23
12	Potato seeds	238,000.00	346,079.72	108,079.72	45.41
13	Garlic	251,800.00	242,827.55	(8,972.45)	-3.56
TOTAL		7,281,832.00	9,648,141.26	2,366,309.26	10.26

Proposed Workplan Activities 2021-2022

Corozal	Orange Walk	Belize	Cayo	Stann Creek	Toledo
			Potato	Hot Pepper	
			Carrots		
			Cabbage		
			Lettuce		
			Celery		
			Broccoli		
			Cauliflower		
			Sweet Pepper		
			Tomatoes		
			Cho-cho		

Commodity	Market	Demand/Production potential	Challenges
Hot Pepper	Marie Sharp Fine Food	750,000 lbs (2021) 375,000 lbs (Annually)	<ol style="list-style-type: none"> Poor crop husbandry and nutrition management. Timely payment to farmers and unannounced end to accepting delivery of peppers while farmers still have crop in the field.

Proposed Workplan Activities 2021-2022

Commodity	Market	Demand/Production potential	Challenges
Potato	Domestic Market	500,000 lbs. monthly (2.5 Million) Annually	<ul style="list-style-type: none"> • poor agronomic practices, • Post-Harvest • Storage • No Irrigation
Carrots	Domestic Market	176,000 lbs. Monthly (1,239,600) Annually	<ul style="list-style-type: none"> • poor agronomic practices, • Improving Post-Harvest Technics (Harvesting, cleaning/washing (Manual vs Mechanical) and packaging) • Limited water for irrigation.
Cabbage	Domestic Market	249,920 Monthly 1,187,333 Annual	<ul style="list-style-type: none"> • Poor Agronomic Practices • Post-Harvest • Limited IPM • Varietal Trials (target tolerance to Diamondback moth (DBM))
Lettuce	Domestic Market	27,741 Monthly 424,320 Annual	<ul style="list-style-type: none"> • Poor Agronomic Practices • Crop Nutrient • Irrigation (Fertigation) • Varietal Trial • Post-harvest Handling (Packaging)
Celery	Domestic Market	29,000 lbs. monthly demand 115,600 Annual	<ul style="list-style-type: none"> • Poor Agronomic Practices • Crop Nutrient • Irrigation (Fertigation) • Varietal Trial • Post-harvest Handling (Packaging)

Proposed Workplan Activities 2021-2022

Program: Horticulture (Vegetables)

Commodity: Potato (*Solanum tuberosum* L.)

Objective: Contribute to food security and reduce importation by identifying at least two (2) potato varieties per usage type that are high yielding and can grow well in local climate and soil conditions.

1. Research & Development

Workplan	Resources or Inputs	Actions/Activities	Outputs	Outcomes	Time Frame
1. Identification of Varieties (SIP)	1.Focus group 2.Collaboration with IICA	1. Request assistance for partner in Development such as IICA, etc. 2. Prepare information on Agro climatic growing conditions. 3. Submit to the SIP for review and feedback.	1. Identification of potential suitable from SIP Collection. 2. Short listing of alternative varieties for Belize.	1. Established list of alternative varieties for local production.	Jul-Sept
2. Procurement of planting material	Funding	1. Establish cost for planting material. 2. Establish cost for shipping. 3. Arrival of planting material.	1. Availability of planting for trial establishment.	1. Trial with import reducing potential established.	Jul-Sept
3. Establishment of trial/evaluation plots	1. Funding of land preparations, irrigation, agro supplies, etc. 2. Technical personnel. 3. Field staff	1. Development of trial protocol including appropriate plot layout designs and cost estimates. 2. Soil testing, land preparations, irrigation system installation, etc. 3. Establish plot, monitoring and data collection. 4. Field/open day. 5. Data analysis and reporting.	1. Trial plot 2. Field day for farmers and Extension officers. 3. Data generated 4. Trial report.	1. Identification of alternative varieties that can also be used to produce seed material locally.	Oct-Dec
4. Evaluation of varietal Suitability (Fries, Chips, Baking)	1.Funding 2.Transportation	1. Harvesting and packaging of potatoes by variety. 2. Delivery of potatoes and evaluation forms to stakeholders. 3. Collection, review and reporting on feedback.	1. Data on suitability and acceptance by end users. 2. Analysis and reporting on market study.	1. The selection of suitable varieties for on-farm trials and production.	Jan-Mar

Proposed Workplan Activities 2021-2022

Program: Horticulture (Vegetables)

Commodity: Potato (*Solanum tuberosum* L.)

Objective: Contribute to food security and reduce importation by identifying at least two (2) potato varieties per usage type that are high yielding and suitable for processing.

Supporting programs	Resources or Inputs	Actions/Activities	Outputs	Outcomes	Time Frame
Agro-processing	1.Lab facility 2.Technical personnel	1. Assist with and participate in suitability evaluation by users.	1. Data on suitability and acceptance by end users. 2. Analysis and reporting on market study.	1. The selection of suitable varieties for on-farm trials and production.	Jan-Mar 2022
R & D	1. Technical personnel	1. Request assistance for partner in Development such as IICA, etc. 2. Development of trial protocol including appropriate plot layout designs and cost estimates.	1. Trial plot 2. Field day for farmers and Extension officers. 3. Data generated 4. Trial report.	1. Identification of alternative varieties that can also be used to produce seed material locally.	Oct-Dec
Extension Service	1. Technical personnel	1. Assist with coordination of field day for farmers and Extension officers.	1. Interaction and feedback from farmers and Extension officers.	1. Identification of alternative varieties that can also be used to produce seed material locally.	Oct-Dec
Communication	1. Technical personnel	1. Disseminate information generated and on activities conducted	1. Public awareness of program activities.	1. Support for local production and farmers.	Oct-Dec
Cooperative	1. Technical personnel	1. Assist with coordination of field day for farmers/producer organizations.	Same as Extension Service	Same as Extension Service	Oct-Dec
BMDC	1. Credit facility	1. Facilitate the procurement and shipping of planting material.	1. Availability of planting for trial establishment	1. Trial with import reducing potential established.	Jul-Sept

Proposed Workplan Activities 2021-2022

Program: Horticulture (Vegetables)

Commodity: Onion (*Allium cepa* L.)

Objective: Contribute to food security and reduce importation by increasing productivity by 15% and extending the planting season by at least 1 month.

Workplan	Resources or Inputs	Actions/Activities	Outputs	Outcomes	Time Frame
Varietal evaluation trial (On Farm)	1. Onion varieties 2. Agro inputs 3. Irrigation supplies 4. Technical team 5. Farmer	1. Development of trial protocol. 2. Select participants & plots. 3. Soil testing, land preparations, irrigation system installation, etc. 4. Establish plot, monitoring and data collection. 5. Data analysis and reporting.	1. Trial plot 2. Field day for farmers and Extension officers. 3. Data collected 4. Trial report.	1. Established list of alternative varieties for local production.	Oct-Dec
Crop nutrition management trail (On Farm)	1. Fertilizers 2. Agro inputs 3. Irrigation supplies 4. Technical team 5. Farmer	1. Development of trial protocol. 2. Select participants & plots. 3. Soil testing, land preparations, irrigation system installation, etc. 4. Establish plot, monitoring and data collection. 5. Data analysis and reporting.	1. Trial plot 2. Field day for farmers and Extension officers. 3. Data collected 4. Trial report.	1. Established list of alternative varieties for local production.	Oct-Dec
Off or Season extending varieties and/or practices trial	1. Onion varieties 2. Agro inputs 3. Irrigation supplies 4. Technical team 5. Farmer	1. Development of trial protocol. 2. Select participants & plots. 3. Soil testing, land preparations, irrigation system installation, etc. 4. Establish plot, monitoring and data collection. 5. Data analysis and reporting.	1. Trial plot 2. Field day for farmers and Extension officers. 3. Data collected 4. Trial report.	1. Established list of alternative varieties for local production.	Jan-Mar 2022
Integrated Pest and Weed Management trial (On Farm)	1. Natural enemies 2. Agro inputs 3. Irrigation supplies 4. Technical team 5. Farmer	1. Development of trial protocol. 2. Select participants & plots. 3. Soil testing, land preparations, irrigation system installation, etc. 4. Establish plot, monitoring and data collection. 5. Data analysis and reporting.	1. Trial plot 2. Field day for farmers and Extension officers. 3. Data collected 4. Trial report.	1. Established list of alternative varieties for local production.	Oct-Dec

Proposed Workplan Activities 2021-2022

Program: Horticulture (Vegetables)

Commodity: Onion (*Allium cepa* L.)

Objective: Contribute to food security and reduce importation by increasing productivity by 15% and extending the planting season by at least 1 month.

Supporting programs	Resources or Inputs	Actions/Activities	Outputs	Outcomes	Time Frame
Agro-processing	1. Lab facility 2. Technical personnel	1. Develop list of products that develop & select R&D areas. 2. Conduct R&D activities on onion product to promote expanded use. 3. Conduct market study of size, color and pungency preference.	1. Data on suitability and acceptance by end users. 2. Analysis and reporting on market study.	1. The selection of suitable varieties for on-farm trials and production.	Jan -Mar 2022
R & D	1. Technical personnel	1. Development of trial protocol including appropriate plot layout designs and cost estimates. 2. Analysis trial data and assist with generating reports.	1. Trial plot 2. Field day for farmers and Extension officers. 3. Data generated 4. Trial report.	1. Identification of alternative varieties that can also be used to produce seed material locally.	Oct-Dec
Extension Service	1. Technical personnel 2. Transportation	1. Participate in establishment, monitoring and data collection. 2. Participate in capacity building activities. 3. Organize and participate in exchange visits/field days.	1. Interaction and feedback from farmers and Extension officers. 2. Improve capacity and delivery of service.	1. Identification of alternative varieties that can also be used to produce seed material locally.	Oct-Dec
Communication	1. Technical personnel	1. Disseminate information generated and on activities conducted	1. Public awareness of program activities.	1. Support for local production and farmers.	Oct-Dec
Climate Change & Water Management	1. Technical personnel 2. Procure of monitoring devices	1. Facilitate the monitoring and report of climate change related impacts on production (drop in water table, saltwater intrusion, etc.) 2. Facilitate the installation of monitoring device (Temp., moisture, Eto, etc)	1. Data on existing agro climate. 2. The impact of climate change on production. 3. Water requirements for production.	1. Locally generated information on the impact on climate and access to water for irrigation.	Oct-Mar
OIRSA	Lab facility Natural enemies Technical persons	1. Develop and recommend an IPM approach for onion production. 2. Rearing and facilitate the release of predatory insects.	1. Technical publication on IPM in Onion in Belize.	1. Increase productive and reduce pesticide usage.	Oct-Dec

Proposed Workplan Activities 2021-2022

Program: Horticulture (Vegetables)

Commodity: Carrots (*Daucus carota*)

Objective: Contribute to food security and reduce importation by increasing productivity by 10%.

Workplan	Resources or Inputs	Actions/Activities	Outputs	Outcomes	Time Frame
Varietal evaluation/trial (On Farm)	1.Carrot varieties 2.Agro inputs 3.Irrigation supplies 4.Technical team 5.Farmer	1. Development of trial protocol. 2. Select participants & plots. 3. Soil testing, land preparations, irrigation system installation, etc. 4. Establish plot, monitoring and data collection. 5. Data analysis and reporting.	1.Trial plot 2. Field day for farmers and Extension officers. 3. Data collected 4. Trial report.	1. Established list of alternative varieties for local production.	Oct-Dec
Crop nutrition management trial (On Farm)	1.Fertilizers 2.Agro inputs 3.Irrigation supplies 4.Technical team 5.Farmer	1. Development of trial protocol. 2. Select participants & plots. 3. Soil testing, land preparations, irrigation system installation, etc. 4. Establish plot, monitoring and data collection. 5. Data analysis and reporting.	1.Trial plot 2. Field day for farmers and Extension officers. 3. Data collected 4. Trial report.	1. Established list of alternative varieties for local production.	Oct-Dec
Off or Season extending varieties and/or practices trial	1.Carrot varieties 2.Agro inputs 3.Irrigation supplies 4.Technical team 5.Farmer	1. Development of trial protocol. 2. Select participants & plots. 3. Soil testing, land preparations, irrigation system installation, etc. 4. Establish plot, monitoring and data collection. 5. Data analysis and reporting.	1.Trial plot 2. Field day for farmers and Extension officers. 3. Data collected 4. Trial report.	1. Established list of alternative varieties for local production.	Jan-Mar 2022
Produce quality evaluation/trial (On Farm)	1.Natural enemies 2.Agro inputs 3.Irrigation supplies 4.Technical team 5.Farmer	1. Development of trial protocol. 2. Select participants & plots. 3. Soil testing, land preparations, irrigation system installation, etc. 4. Establish plot, monitoring and data collection. 5. Data analysis and reporting.	1.Trial plot 2. Field day for farmers and Extension officers. 3. Data collected 4. Trial report.	1. Established list of alternative varieties for local production.	Oct-Dec

Proposed Workplan Activities 2021-2022

Program: Horticulture (Vegetables)

Commodity: Onion (*Allium cepa* L.)

Objective: Contribute to food security and reduce importation by increasing productivity by 15% and extending the planting season by at least 1 month.

Supporting programs	Resources or Inputs	Actions/Activities	Outputs	Outcomes	Time Frame
R & D	1. Technical personnel	1. Development of trial protocol including appropriate plot layout designs and cost estimates. 2. Analysis trial data and assist with generating reports.	1. Trial plot 2. Field day for farmers and Extension officers. 3. Data generated 4. Trial report.	1. Identification of alternative varieties that can also be used to produce seed material locally.	Oct-Dec
Extension Service	1. Technical personnel 2. Transportation	1. Participate in establishment, monitoring and data collection. 2. Participate in capacity building activities. 3. Organize and participate in exchange visits/field days.	1. Interaction and feedback from farmers and Extension officers. 2. Improve capacity and delivery of service.	1. Identification of alternative varieties that can also be used to produce seed material locally.	Oct-Dec
Communication	1. Technical personnel	1. Disseminate information generated and on activities conducted	1. Public awareness of program activities.	1. Support for local production and farmers.	Oct-Dec
Cooperative	1. Technical personnel	1. Assist with coordination of field day for farmers/producer organizations.	Same as Extension Service	Same as Extension Service	Oct-Dec
Climate Change & Water Management	1. Technical personnel 2. Procure of monitoring devices	1. Facilitate the monitoring and report of climate change related impacts on production (drop in water table, saltwater intrusion, etc.) 2. Facilitate the installation of monitoring device (Temp., moisture, Eto, etc)	1. Data on existing agro climate. 2. The impact of climate change on production. 3. Water requirements for production.	1. Locally generated information on the impact on climate and access to water for irrigation.	Oct-Mar

Proposed Workplan Activities 2021-2022

Program: Horticulture (Vegetables)

Thematic area: Seedling nursery (National)

Objective: Decentralization of seedling production activities and increase capacity for output by 50%.

Workplan	Resources or Inputs	Actions/Activities	Outputs	Outcomes	Time Frame
Establish infrastructure at District station	1. Structure frames 2. Covering material 3. Lumber 4. Fasteners 5. Construction team	1. Identification of available framing or funding to procure structures. 2. Establish infrastructure in Toledo, Stann Creek, Yo Creek and Central Farm. 3. Explore options for the Corozal District.	1. Establish 4 nursery structure with table platforms to hold trays.	1. Increase national output capacity.	May-July
Develop capacity for production of soil mix at the District station.	1. Soil 2. Sand 3. Bokashi	1. Procurement of soil material. 2. Training for Extension officers and field assistants on the production of bokashi and preparation of soil mix.	1. Availability of raw material for preparation of soil mix. 2. Production of soil mix for use in nursery operation.	1. Increase in station output of	May-July
Capacity building in nursery management	1. Seeds 2. Soil mix 3. Seedling trays	1. Establish a line of communication between nursery manager at the stations and Central Farm. 2. Conduct training on critical aspects of nursery management and record keeping.	1. Line of communication between stations and CF. 2. Improve technical capacity of officers.	1. Increase output in quality and quantity of seedlings.	May-July
Installation of irrigation & micro-climate monitoring device	1. Sprinklers 2. Climate devices	1. Cost estimates for installation of irrigation system and devices. 2. Procurement of material and supplies. 3. Installation of the irrigation and devices.	1. Four (4) fully functional nurseries	1. Increase output in quality and quantity of seedlings.	May-July

Horticulture Program

Proposed/Planned/Pipeline Activities

2. Projects

Central Farm Water Catchment System

Overall Objectives

Establish capacity to mitigate the negative impact of acute drought condition.

Specific Objectives

1. Establish a water catchment pond to become the primary source of irrigation water for crop production and other critical used with respect to the work of the Unit.
2. Use of the catchment pond for farmer training and demonstration on the proper use and maintenance of this technology.

Targeted outputs

One (1) water catchment pond 14mx14m constructed and outfitted with liners to help maintain water quality and reduce losses to seepage.

One (1) covering installed to reduce evaporation losses, one (1) solar powered water pump installed. Establishment of underground water distribution lines for irrigation and fertigation.



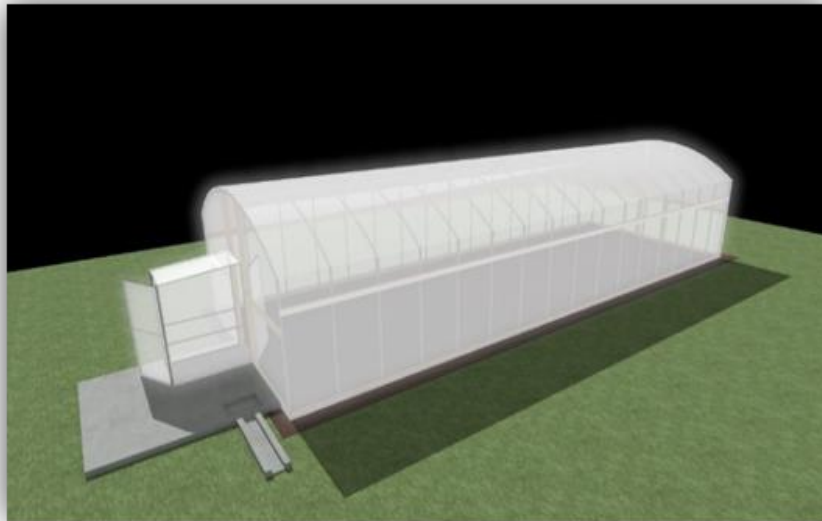
Horticulture Program

Proposed/Planned/Pipeline Activities

2. Projects

CARICOM Development Fund Project

In hopes for assisting farmers combat some of these issues, a proposal was submitted to the CARICOM Development Fund (CDF) through the Ministry of Economic Development. The project has been approved and is schedule for implementation over the coming months. The project outputs will include the following.



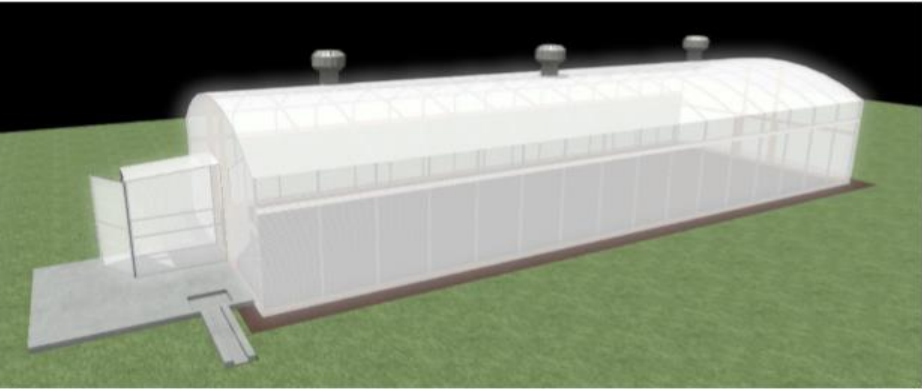
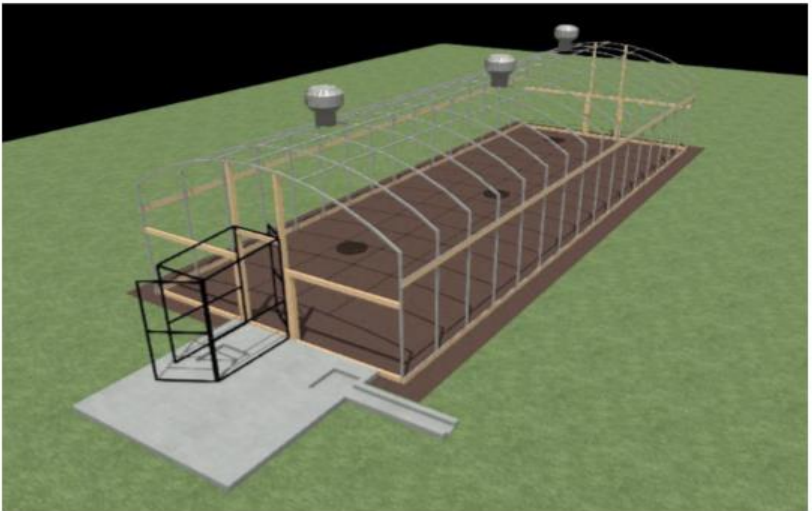
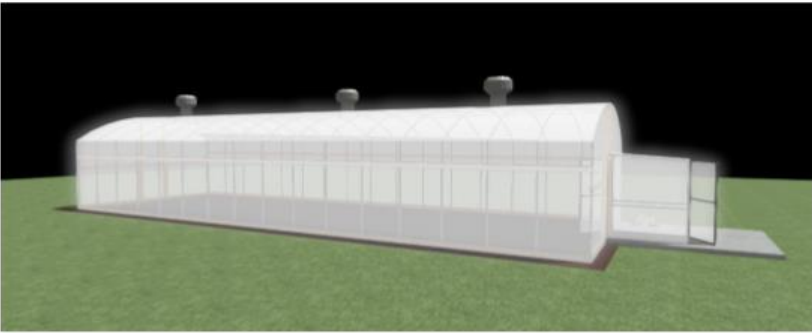
1. Development of two (2) architectural/3D sketches of modular covered structures and rainwater harvesting systems
2. The covered structure developed will be a Tai-tunnel type design completed with rainwater storage, irrigation, fertigation unit and other climate resilience accessories.
3. Procurement of one (1) covered structure construction/repair kit, irrigation installation and one (1) trailer.
4. Establishment of twenty (20) small covered structure units with necessary climate resilience accessories. The structures will measure a maximum of 18' wide and 60' long. It will have a double door entrance and covered using greenhouse grade UV plastic on top and anti-viral netting on the sides, front and rear of the structure.
5. Purchasing or manufacturing of one (1) coconut husk shredding machine. The first option is to source the shredding machine either regionally or look at other sources from coconut producing countries. The second option is to get a blueprint and source a local manufacturer to produce a prototype. In this way it can be shared among coconut producers.
6. Production of one (1) manual on the operation, management and maintenance of covered structures and irrigation systems.
7. Training of thirty (30) small producers and Extension officers in the establishment, installation, management and maintenance of covered structures and irrigation systems

Horticulture Program

Proposed/Planned/Pipeline Activities

2. Projects

CARICOM Development Fund Project



SCALE: 3/16" to 1'-0"	SHEET TITLE: 3-DIMENSIONAL	DRAWN BY: MANZELA WADE, 677-1988	CLIENT: Research, Development and Innovation Center
SHEET: S1.2		DATE: JAN-2020	

Horticulture Program

Proposed/Planned/Pipeline Activities

2. Projects

Caribbean Development Bank (CDB) School Garden Project

The specific objective of the components is to: (1.) develop and implement school garden programs in 20 schools; (2.) to enhance nutrition education for the appreciation of agriculture and for sustaining school feeding programs.

1. Equipment and Tools: (US \$20,000). The component will be for the maintenance and upkeep of the school gardens. This will require the procurement of tools and equipment for each school. An electronic list of the required tools, equipment and materials will be provided by the Ministry of Food & Agriculture. A total of 20 schools will benefit at US\$1,000 per school.
2. Training (US \$5,750) This component aims at the provision of face-to-face training of teachers, parents and students. It will include the training for the integration of the school gardens with the curriculum for the teaching of Mathematics, Science, Life Skills and others. Training will also include the added value of hands-on training and improved nutritional intake for families.
3. Establishment of the School Gardens: (US \$50,000) The component will require: (1.) design of the school gardens, (2.) procurement of the materials required for the establishing of the school gardens including the covered structures (3.) construction and installation of covered structures and accompanying components.
4. Monitoring & Evaluation: (US \$3,750): The component aims at measuring the intended and unintended outcome of the school garden program. One visit will be conducted to all schools during the duration of the program. Regular monitoring of the school garden program for the purpose of data collecting will be supported by the Ministry of Food & Agriculture.



Horticulture Program

Proposed/Planned/Pipeline Activities

2. Project

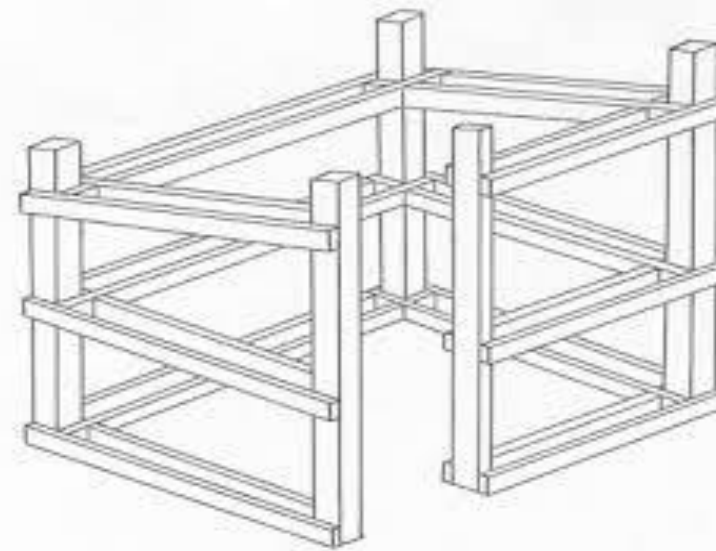
FAO TCP/BZE/8032 Managing Belizean Agriculture Resilience

The Evaporative Cooler is designed to provide an environment which is both lower than ambient temperature and at a higher level of relative humidity for the storage of fresh produce. It works on the principle of a porous structure to which water is added; as air flows across this “wet wall” the air temperature is decreased due to the loss of heat through the evaporation of water.

The temperature is normally lowered by about 5 to 10 degrees, depending on the relative humidity of the ambient air. Evaporative Coolers can be used for all types of produce, but subtropical fruits respond best because their optimum storage temperatures are closer to those achieved by Evaporative Coolers. Various designs of Evaporative Coolers have been used in different parts of the world; the design employed in Rwanda was selected as being suitable for the conditions prevailing. The construction and materials employed in Rwanda can serve as guidelines, and modifications can be made as needed.

A suitable design including a construction manual entitled “Appropriate Technology Cold Store Construction and Review of Post-harvest Transport and Handling Practices for Export of Fresh Produce from Rwanda” produced by Ngoni Nenguwo in August 2000 has been identified and downloaded.

The application of this technology to covered structure production is also being considered.



Horticulture Program

Proposed/Planned/Pipeline Activities

3. Development of National Database

Covered structure

The last covered structure survey was conducted in 2012 by Mr. Oscar Salazar and a complete report submitted in February 2013.

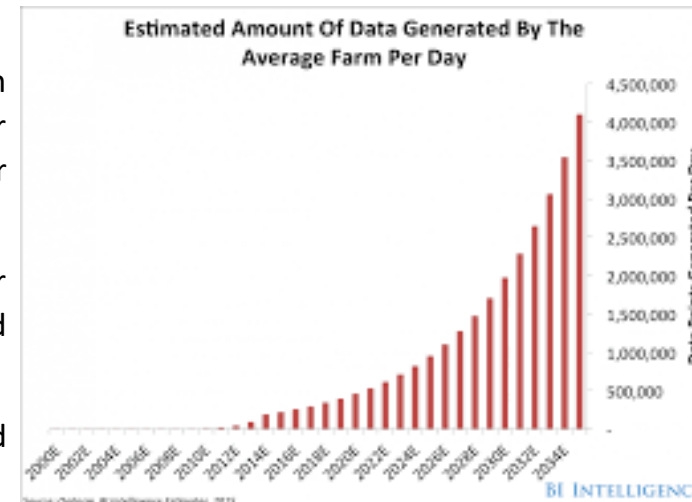
The number of structures and land under cultivation using covered structures has significantly increased since 2012. The data from the most recently completed national survey indicate that approximately 12.5 acres is now being used countrywide from covered structure production. While this information is critical, it still lack access to key details such challenges currently faced by producers, training needs and production output. A current survey would capitalize on information available in BAIMS to reduce the amount of time and resources necessary for the completion of the report.

Irrigation and Fertigation

There is no evidence that a specific irrigation and fertigation use survey has ever been done. Considering the impact on Belize with an extended dry season in 2019 and another such season predicted for this year, farmers' ability to adequate provide plant water requirement will be critical to Belizean Agriculture.

This survey would capture information type of irrigation system used in the country, water source, water usage rate and conservation practices, challenges, equipment utilized and area under irrigation in Belize.

The survey can perhaps be conducted simultaneously with efforts to update the covered structure national database.



Proposed Workplan Activities 2021-2022

Root Crop Production

1. Consultation & prioritizing of commodities
2. Collection of germplasm
3. Development of a catalog defining (where possible) the locally available material.
4. Cleaning and Micro-propagation of planting material
5. Establishment of planting material multiplication plots.
6. Identification & sourcing of improved varieties/types.

Potential Commodities for development

1. Sweet potato
2. Yams
3. Coco yams
4. Cassava
5. Yampi

Proposed Workplan Activities 2021-2022

Cassava

The food and agriculture sectors in the Caribbean Community (CARICOM) are currently facing a number of serious challenges related to low growth and heavy dependence on imported inputs and foods. Historically, the agriculture sector has been the main contributor to economic development in the Caribbean. However, the two main economic pillars of the sector— sugar and bananas – have declined significantly over the last decade, with earnings from exports of these two commodities drastically reduced due to the loss of market access, mainly in Europe.

At the same time, with a large, growing market of 16 million people in 15 Member States, CARICOM has an annual food import bill in excess of of US\$ 4 billion, with imports nearly doubling over the last 10 years. A high percentage of these imports are semi-processed and highly-processed staples (Figure 1). Two of the top ten imports by value are corn (mainly for poultry feed) and wheaten flour (mainly for the production of bread).

What if we could reduce Belize's wheat imports UP TO 40% using Cassava??

By replacing 30-40% of wheat flour with Cassava as part of import substitution efforts, the idea first started with the use of cassava flour but has transition to using grated cassava given the cost to produce the cassava flour.

Thank You!

Questions - Comments



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