



Caribbean Agricultural Research and
Development Institute

CARDI's Annual Technical Report 2021



Presented By:
Omaira Avila Rostant (MPhil) –
CARDI Belize Unit

Presented at the Annual General meeting of the Belize
Ministry of Agriculture, Food Security and
Enterprises (MAFSE)

April 21st and 22nd 2022

CARDI's newly appointed Executive Director



Mr Ansari Hosein - Executive Director / Animal Scientist
 The Chairman of the Board of Governors of the Caribbean Agricultural Research and Development Institute (CARDI), the Honorable Crenston C. Buffonge, Minister of Agriculture, Lands, Housing and the Environment, Montserrat has announced the appointment of Mr. Ansari Hosein as the Executive Director, CARDI with effect from 1st March, 2022.



Vision A Centre of Excellence delivering innovation and technologies for the Region's food and agricultural sectors

Mission To contribute to the sustainable development of the Caribbean by the co-generation, diffusion and application of knowledge, through agricultural research for development

Strategic Programmes

<p>VALUE CHAIN SERVICES</p> <ul style="list-style-type: none"> Improved production and productivity of key commodities Increased incomes Increased contribution by agriculture to GDP 	<p>INSTITUTIONAL STRENGTHENING</p> <ul style="list-style-type: none"> Enhanced institutional infrastructure that supports research excellence and efficiency Increased infrastructural and human resource capacity Increased level of available resources Improved internal and external coordination systems 	<p>Partnerships & Strategic Alliances</p> <ul style="list-style-type: none"> Increased partners and partnerships for conducting relevant high quality agricultural research Aligned to more research networks engaged in new and emerging areas of agricultural research for development 	<p>Policy and Advocacy</p> <ul style="list-style-type: none"> Recognised for excellence in tropical agricultural, research, development and training Increased awareness of CARDI nationally, regionally and internationally Development of supportive policies for strengthening agriculture value chains
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Cross-cutting Issues

- ICTs
- Results Based Management
- Financial Sustainability
- Resource Mobilisation
- Climate Change
- Inclusion and Equity
- Youth and Gender

Strategic Plan
 BUILDING A PRODUCTIVE AND RESILIENT REGIONAL AGRICULTURE SECTOR



245 acres to develop every year

- Seed development program
- -Research
- Water issues in 180 acres (Rain fed)



CARDI Belize Research and seed development Fields



Institutional Strengthening - UNIT IMPROVEMENT

INSTITUTIONAL
STRENGTHENING

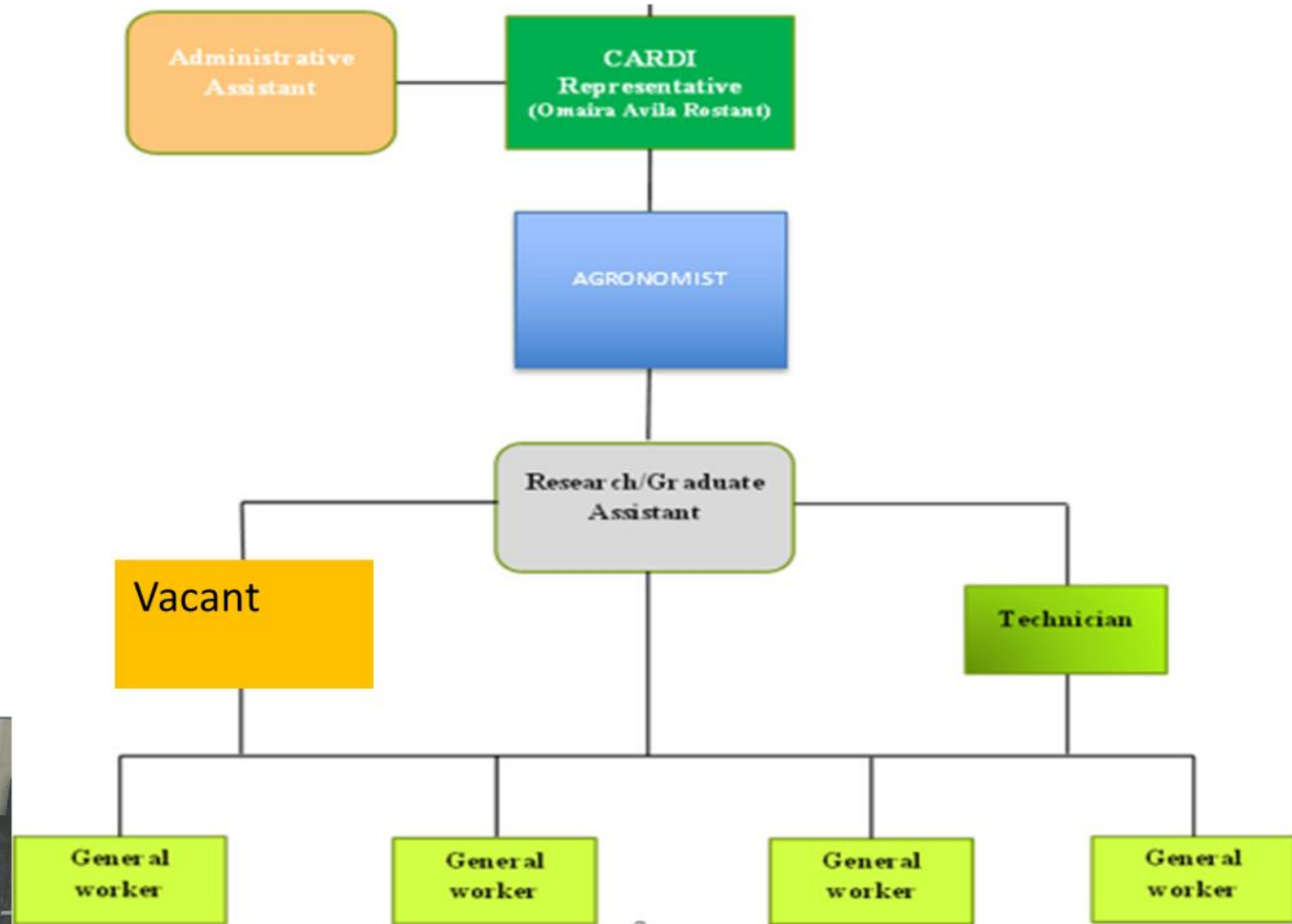
STRENGTHENING
INSTITUTIONAL



CARDI Belize - Staff



Strength team work and staff working conditions



CARDI BELIZE
Organizacional Chart



Project 1

Alliances for Coconut Industry Development, Expansion and Enhanced Support for the Caribbean (Coconuts II)

Achievements 2021

- Support the BBS for the adoption in Belize of the coconut packaged natural water and oil standards
- MAFSE Coconut nursery at Central Farm Upgrade
- Belize to received 6000 coconut nuts from Jamaica
- 23 farmers identified and work programme created for the implementation of the Lead farm approach for training
- CARDI-SIRDI MoU including a letter to support the coconut production as part of the Diversification for Sugar cane farmer
- ITC to directly support several institutions for the development of the industry



OPEN FORUM
Discussion on Belize's Draft Standards for
Packaged Natural Coconut Water and Coconut Oil

Wednesday	Wednesday	Wednesday
Belize Draft Specification for Coconut Oil	Belize Draft Code of Practice for Packaged Natural Coconut Water	Belize Draft Specification for Packaged Natural Coconut Water
English 2 nd June 2PM - 4PM	English 08 th June 2PM - 4PM	English 09 th June 2PM - 4PM
Español 10 th June 2PM - 4PM	Español 15 th June 2PM - 4PM	Español 16 th June 2PM - 4PM

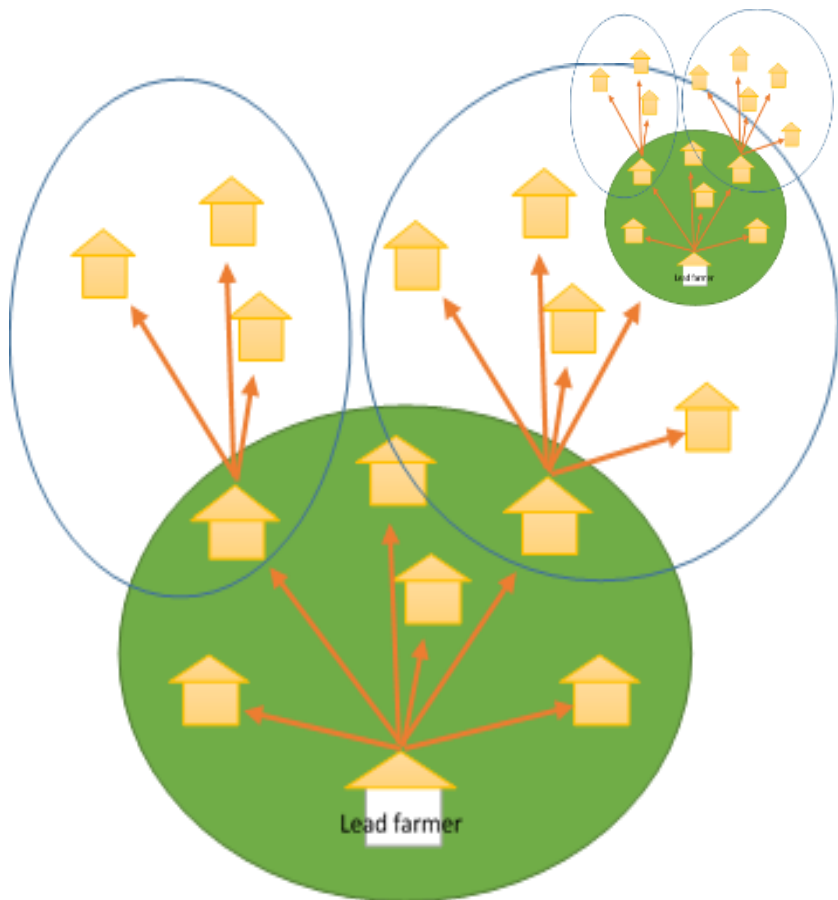
For more information please contact
 ☎ (501) 824-2934 / (501) 824-2936 / (501) 615-4903
 📧 bbk@bbs.gov.bz
 Draft Standards can be downloaded from www.bbs.gov.bz

Register Now

The 2nd phase of the Coconut Development project

funded by: the European Union (EU) and CARIFORUM through the Alliances for Coconut Industry Development Expansion and Enhanced Support for the Caribbean is being implemented in the Caribbean since 2019 by the International Trade Centre (ITC) and the Caribbean Agricultural Research and Development Institute (CARDI).

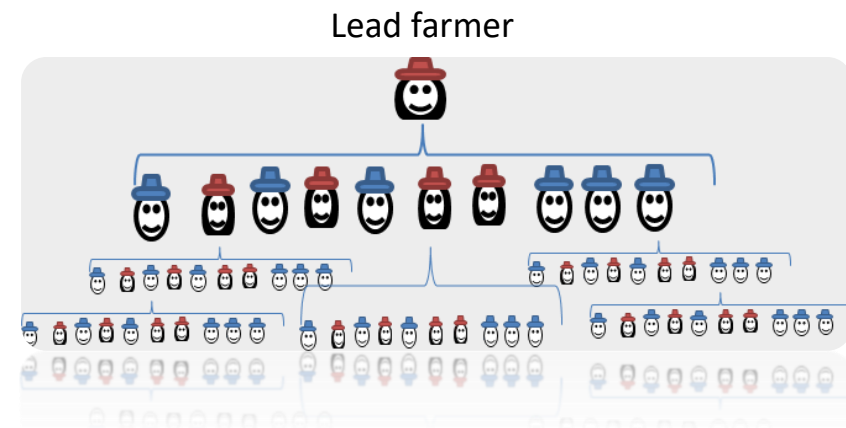
- **The Aim:** It is to build capacity of local innovative farmers to effectively share knowledge and skills with other farmers within their localities.



*Exponential growth of the
Lead Farmers model:*

***Impact and
replicability***

*1 lead farm trained 10 ring farmers; 10
new lead farms trained in total 100
farmers; 100 lead farmers trained
10000 farmers*






What is the Lead farm approach?

It is an extension approach which encourages farmers to learn from each other.

This approach:

- It is a farmer-led participatory approach
- Allows community role models farmers lead
- Encourages long lasting exchange of information
- Foments partnerships for trading, bulk purchasing and selling,
- Foments community friendships that leads to successful community

"Pilot Demonstration of the Generation of Electrical Energy through the use of *Arundo donax* as a supplemental feedstock in cogeneration" in Belize

Implemented by:  Executed by:  

Financed by: **Belize Electricity Limited**

Start date: February 2019 End date: July 2022

INVESTIGATING SUSTAINABLY GENERATED GREEN ENERGY



BELIZE



Project 2

Pilot Demonstration of Generation of Electrical Energy through the use of wild Cane as a supplemental feedstock in cogeneration in Belize (2019-2022)

- Trial Year 1 has been completed and results are promising
- Two varieties of wild cane have been evaluated and adapted for crop production they are *Arundo donax* and *Gynierium sagittatum*
- Varieties are collected and in the process of being sent for identification to the UWI Herbarium
- Facilities to support the project are completed at CARDI and SIRDI.
- Monthly data is being collected with *Arundo donax* showing great adaptability to agro production systems

Achievements 2021



Regional Sweet Potato

Value Chain Enhancement and Technology Transfer Project

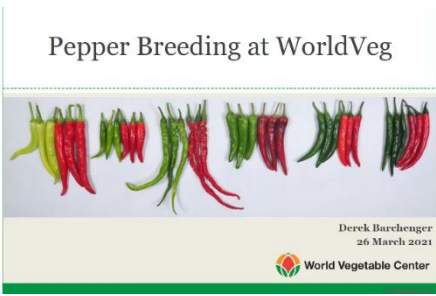


Project
3

Regional Sweet Potato Value Chain Enhancement and Technology Transfer Project (2021- 2024)

Achievements 2021

- Collected and maintaining 5 accession to date
- Four variety for consumption of the tuber
- One for the consumption of leaves as vegetable
- Varieties are being grown for morphological and molecular characterization of main varieties in Belize
- Production/ processing technology trails



Project 4

The LAC Vegetable Network: Promoting vegetable diversity for more resilient livelihoods and healthier diets in the Latin America and Caribbean Region”

Objective

- Adaptability trial of 30 varieties breed for resistance Tomato yellow leaf curl disease, bacterial wilt resistance and late blight resistance
- Trial in six countries in Central America and the Caribbean: Belize, Guatemala, Haiti, Honduras, Nicaragua, and Paraguay.

Achievements 2021

- Construction of a nursery with a capacity of approximately 5000 plantlets
- CARDI became member of the LAC vegetable network and started the multi location adaptability trials for 40 varieties of selected material at the world Veg Centre located in Taiwan.
- 12 varieties Tomato trial transplanted on the MAFSE fields
- 16 varieties of peppers trial transplant
- 12 varieties of pumpkin

AVTO	Tomato yellow leaf curl disease.		Bacterial wilt resistance.					Late blight resistance		Race 2 of the Fusarium wilt pathogen.	root-knot nematode (<i>Meloidogyne incognita</i>)	Com	
	Ty1/Ty3	Ty2	Bwr-12	Bwr-6					Ph-2	Ph-3	I2		Mi
				SLM6-124	SLM6-118	SLM6-94	SLM6-17	SLM6-110					
AVTO1915	+	+	+	-	-	-	-	-	-	+	-	+	dual purpose
AVTO2101	-	+	+	+	+	+	+	+	-	-	-	-	fresh market
AVTO1903	+	+	+	-	-	-	-	-	-	-	+	+	fresh market
AVTO2123	-	+	+	+	+	+	+	+	-	-	-	-	dual purpose
AVTO2128	+	-	+	-	-	+	-	-	-	-	-	-	fresh market
AVTO2127	+	-	+	-	-	+	-	-	-	-	-	-	fresh market
AVTO2132	Ty3a	-	+	+	-	+	+	+	-	-	-	-	fresh market
AVTO2138	-	-	+	+	+	+	+	+	-	-	-	-	fresh market
AVTO1908	-	-	-	-	-	-	-	-	-	-	+	-	fresh market
AVTO1954	+	+	+	-	-	-	-	-	+	+	+	-	fresh market



<https://avrdc.org/promoting-vegetable-diversity-for-more-resilient-livelihoods-and-healthier-diets-in-latin-america-and-the-caribbean-region/>



Project 5

Iron Bio fortified beans Trials in Belize Partners: CARDI, IICA, MAFSE, CIAT, Harvesting Plus

Achievements 2021

- 14TH national, regional and international research institutes have partner to form the CARICOM Bio fortification Network.
 - In Belize, being implemented by CARDI, IICA, MAFSE, CIAT, Harvesting Plus with adaptation trials of 51 lines of beans rich in iron
 - In Guyana being implemented by NAREI, IICA, CIAT, Harvesting Plus with adaptation trials of rice beans rich in zinc.
- In 2021-2022, the first adaptation trial to test 51 introduced varieties of been have been tested in 2 different climatic environments have been completed.
- In 2020 and 2021 climatic adaptability trials were conducted for 51 varieties and data is being analysed

Data collection for accuracy, Training evaluating and monitoring



CENTRAL FARM RCBD 2020-2021		
REP 1	REP 2	REP 3
check-CENTA PIPIL	6-DAN 32	39-SMR 279
16-SMG 22	43-SMN 100	check-ICTA LIGERO
6-DAN 32	17-SMG 24	3-BNA 12
13-SMG 13	24-SMG 35	26-SMG 37
3-BNA 12	20-SMG 28	37-SMR 274
21-SMG 32	5-DAN 27	14-SMG 19
37-SMR 274	32-SMR 168	40-SMR 282
18-SMG 25	check-CENTA PIPIL	19-SMG 26
44-SMN 102	37-SMR 274	24-SMG 35
check-ICTA LIGERO	9-SMG 7	46-SMN 105
10-SMG 8	42-SMN 97	20-SMG 28
42-SMN 97	41-SMN 87	22-SMG 33
27-SMG 38	25-SMG 36	12-SMG 12
50-SMN 123	14-SMG 19	43-SMN 100
14-SMG 19	4-DAN 15	50-SMN 123
22-SMG 33	40-SMR 282	16-SMG 22
1-ABU 19	15-SMG 21	36-SMR 272
46-SMN 105	23-SMG 34	6-DAN 32
30-SMG 41	46-SMN 105	49-SMN 115
33-SMR 228	2-BNA 9	11-SMG 11
31-SMR 100	22-SMG 33	33-SMR 228
2-BNA 9	11-SMG 11	15-SMG 21
check-AMADEUS	29-SMG 40	7-NDZ 11
19-SMG 26	26-SMG 37	18-SMG 25
48-SMN 111	30-SMG 41	38-SMR 277
39-SMR 279	13-SMG 13	10-SMG 8
24-SMG 35	33-SMR 228	28-SMG 39
35-SMR 257	45-SMN 104	27-SMG 38
4-DAN 15	10-SMG 8	8-SMG 6
23-SMG 34	27-SMG 38	25-SMG 36
47-SMN 107	12-SMG 12	48-SMN 111
9-SMG 7	18-SMG 25	34-SMR 238
41-SMN 87	21-SMG 32	29-SMG 40
8-SMG 6	36-SMR 272	1-ABU 19
36-SMR 272	35-SMR 257	check-CENTA PIPIL
20-SMG 28	19-SMG 26	21-SMG 32
28-SMG 39	38-SMR 277	5-DAN 27
7-NDZ 11	3-BNA 12	4-DAN 15
49-SMN 115	44-SMN 102	41-SMN 87
34-SMR 238	50-SMN 123	32-SMR 168
32-SMR 168	31-SMR 100	45-SMN 104
43-SMN 100	check-AMADEUS	30-SMG 41
38-SMR 277	7-NDZ 11	47-SMN 107
26-SMG 37	16-SMG 22	31-SMR 100
29-SMG 40	47-SMN 107	9-SMG 7
40-SMR 282	48-SMN 111	13-SMG 13
25-SMG 36	1-ABU 19	17-SMG 24
12-SMG 12	39-SMR 279	2-BNA 9
11-SMG 11	49-SMN 115	42-SMN 97
15-SMG 21	check-ICTA LIGERO	35-SMR 257
45-SMN 104	8-SMG 6	23-SMG 34
17-SMG 24	28-SMG 39	44-SMN 102
5-DAN 27	34-SMR 238	check-AMADEUS

YO CREEK RCBD 2020-2021		
REP 1	REP 2	REP 3
36-SMR 272	23-SMG 34	12-SMG 12
39-SMR 282	12-SMG 12	23-SMG 34
check-ICTA LIGERO	13-SMG 13	45-SMN 104
19-SMG 26	9-SMG 7	41-SMN 87
21-SMG 32	29-SMG 40	32-SMR 168
8-SMG 6	20-SMG 28	13-SMG 13
42-SMN 97	33-SMR 228	19-SMG 26
49-SMN 115	27-SMG 38	6-DAN 32
14-SMG 19	14-SMG 19	39-SMR 279
1-ABU 19	44-SMN 102	17-SMG 24
35-SMR 257	7-NDZ 11	22-SMG 33
22-SMG 33	35-SMR 257	check-AMADEUS
28-SMG 39	40-SMR 282	25-SMG 36
13-SMG 13	check-ICTA LIGERO	21-SMG 32
20-SMG 28	46-SMN 105	33-SMR 228
16-SMG 22	41-SMN 87	9-SMG 7
23-SMG 34	18-SMG 25	43-SMN 100
27-SMG 38	36-SMR 272	1-ABU 19
47-SMN 107	6-DAN 32	37-SMR 274
30-SMG 41	30-SMG 41	20-SMG 28
41-SMN 87	39-SMR 279	34-SMR 238
12-SMG 12	check-AMADEUS	10-SMG 8
7-NDZ 11	16-SMG 22	28-SMG 39
45-SMN 104	43-SMN 100	29-SMG 40
38-SMR 277	42-SMN 97	30-SMG 41
25-SMG 36	check-CENTA PIPIL	44-SMN 102
5-DAN 27	25-SMG 36	5-DAN 27
4-DAN 15	34-SMR 238	2-BNA 9
46-SMN 105	2-BNA 9	38-SMR 277
29-SMG 40	50-SMN 123	48-SMN 111
37-SMR 274	38-SMR 277	24-SMG 35
34-SMR 238	31-SMR 100	11-SMG 11
24-SMG 35	45-SMN 104	3-BNA 12
26-SMG 37	32-SMR 168	8-SMG 6
9-SMG 7	11-SMG 11	4-DAN 15
31-SMR 100	49-SMN 115	49-SMN 115
48-SMN 111	5-DAN 27	7-NDZ 11
3-BNA 12	28-SMG 39	47-SMN 107
6-DAN 32	19-SMG 26	26-SMG 37
15-SMG 21	22-SMG 33	check-ICTA LIGERO
11-SMG 11	48-SMN 111	42-SMN 97
check-AMADEUS	1-ABU 19	31-SMR 100
17-SMG 24	26-SMG 37	50-SMN 123
check-CENTA PIPIL	4-DAN 15	36-SMR 272
32-SMR 168	21-SMG 32	15-SMG 21
50-SMN 123	17-SMG 24	18-SMG 25
39-SMR 279	3-BNA 12	35-SMR 257
44-SMN 102	8-SMG 6	40-SMR 282
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33-SMR 228	24-SMG 35	16-SMG 22
2-BNA 9	10-SMG 8	14-SMG 19
18-SMG 25	15-SMG 21	check-CENTA PIPIL
10-SMG 8	37-SMR 274	46-SMN 105

STANN CREEK RCBD 2020-2021		
REP 1	REP 2	REP 3
40-SMR 282	8-SMG 6	19-SMG 26
39-SMR 279	26-SMG 37	21-SMG 32
12-SMG 12	20-SMG 28	11-SMG 11
50-SMN 123	35-SMR 257	30-SMG 41
25-SMG 36	check-CENTA PIPIL	42-SMN 97
27-SMG 38	47-SMN 107	31-SMR 100
check-AMADEUS	32-SMR 168	33-SMR 228
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16-SMG 22	28-SMG 39	5-DAN 27
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2-BNA 9	37-SMR 274	39-SMR 279
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48-SMN 111	31-SMR 100	27-SMG 38
15-SMG 21	46-SMN 105	46-SMN 105
6-DAN 32	13-SMG 13	47-SMN 107
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8-SMG 6	5-DAN 27	28-SMG 39
35-SMR 257	36-SMR 272	4-DAN 15
22-SMG 33	21-SMG 32	36-SMR 272

Biocontrol's for Asian thrip (OIRSA)



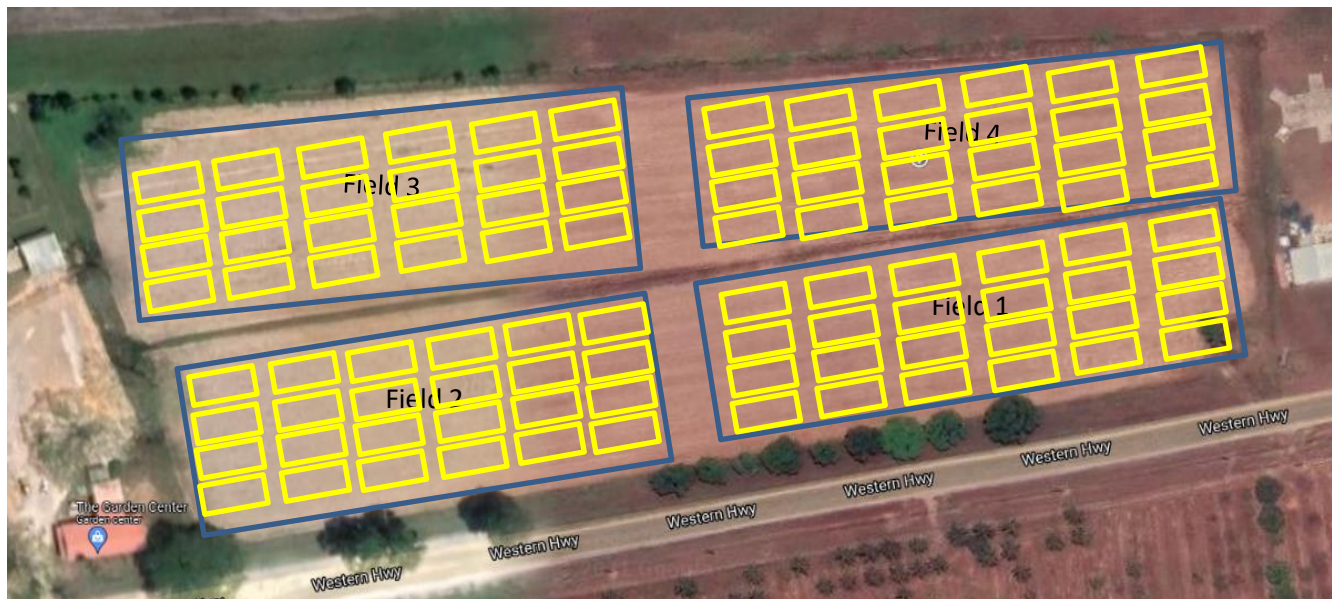


Technical assistance

Suitable Management Strategies against Asian Bean Trips (*Megalurothrips usitatus*).

Achievements 2021

- Establish and complete the field experiment Suitable Management Strategies against Asian Bean Trips (*Megalurothrips usitatus*).
- Six Private Pesticide providers are invited to try their protocol as a fast methodology to give options to farmers in how to control this new invasive pest. 6 chemical based and 3 biocontrol based
- CARDI to manage the national research together with BAHA
- CARDI team join the BAHA and MAFSE team in the National Survey and Identification of the ABT and sets on the taskforce



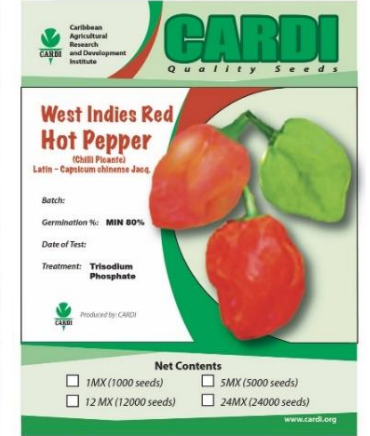
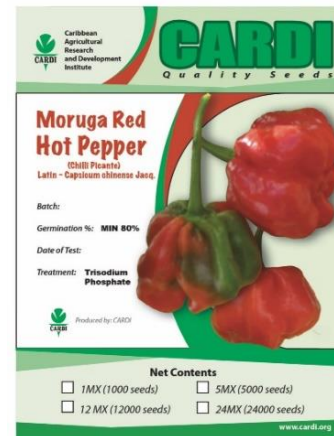
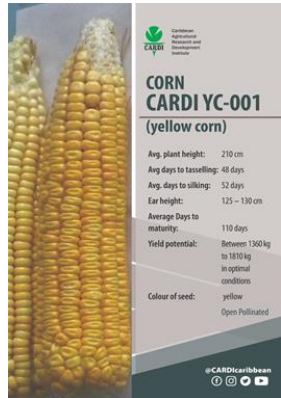
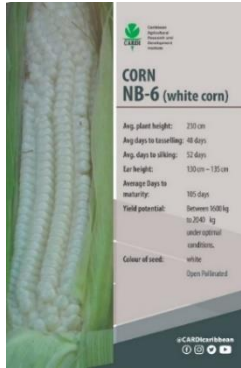
CARDI SEED PRODUCTION PROGRAMME FOR SMALL FARMERS OF CEREALS, BEAN AND PEPPERS



Objective:

Developmental project to have clean seed available to farmers that are open pollinated and price competitive

Main Action	Results achieved	Who benefited
Produce 10 acres of different varieties of red and black small beans	Sold approximately 340 Lbs	Around 50 Small scale farmers
12 varieties of cassava (<i>Manihot esculenta</i>)	Sold and give away approximately 50 sticks capable of planting 1 acres.	Being promoted for farmers and to support as seed for MAFSE rootcrop multiplication programme



CARDI YC001 – Open pollinated yellow corn

Sold approximately 1400 Lbs
20Lbs/acre = 140 acres

140 produce 2000 lbs acre= 280,000 lbs OP corn from small scale farmers

Directly - Around 81 Small scale farmers



Produce hot pepper

- West indies red
- Moruga red
- Scotch Bonnet

Sold approximately 110 ounces of seeds capable of planting around 110 acres driven by the export market of hot pepper in Belize and in the Caribbean

Directly to farmers 43 Indirectly through MAFSE cover structure programme and Maria Sharp and Hot mama's contracted farmers around 40 Small scale farmers

CARDI Belize Services to farmers and value chain stakeholders

Seed Drying services

Drying services access for 20000 lbs Bean
6000 lbs peanuts
50000 lbs corn

- CARDI has a capacity of drying 50,000 Lbs of grains in
- 4 mobile dryers each capable of drying 4,000 Lbs
- 1 Fix Unit drying 10,000 lbs
- small scale drying



Seed Laboratory Service

- Around 30 certificates since 2018 have been produce for local grain exporting companies accessing the service of purity test
- 100 certificates since 2018 have been produce germination test

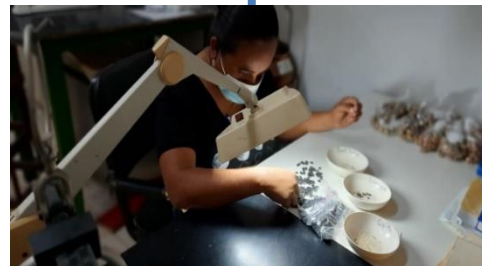


Grass seeds germination test using paper based on ISTA Rules

Equipment Rental

1) Supported
Land preparation for 50 small farmers

Ploughing
Harrowing
Beds for drainage



Beans purity test for export quality of grains based on ISTA Rules



Rental of tractor services to farmers within close proximity to CARDI



Supported MAFSE's activities

Participated in several Minister's Mai visit to the Districts of Belize



23/11/2021

- CARDI is a member of the PCB board
- Support extension unit activities



Booth at the World Food Day MAFSE programme in Orange Walk Station (15th November 2021)



Part of the Belize Bilateral Meeting with Mexico (July 8th 2021)



Online panel Discussion for International Women's Day on WOMEN IN AGRICULTURE (February 2021)

Support University of Belize

Support UBCF agriculture programme



Support IT internship programme

Received Students from the University of Belize IT Programme as interns 12 weeks programme for Bachelors and 9 week for Associate



Technology's Hand in CARDI Data Management: Crop Inventory Management System – Enrique Nabet



Technology's Hand in CARDI Data Management: CARDI Service System – Naim Villanueva



Technology's Hand in CARDI Data Management: Seed management system – Garcia

CARDI BELIZE outreach and partnership activities



PPCR_Project_and_CARDI_Agro-meteorological_(Agro-Met)_Training_Workshop (August 31st to September 1st ; 9th December 2021)

CARDI PPCR Agro-Met Training Workshop



Dr. Adrian Spence
Senior Research Scientist & Head of ICENS



Dr. Teddy Allen
Independent Climate Services Consultant



Dr. Donovan Campbell
Senior Lecturer & HOD of Geography & Geology (UWI Mona)

18th Persons from Belize were trained

Tues, Aug 31 & Wed, Sep 1, 2021
9:00 a.m. (EST) / 10:00 a.m. (ECT)






International partners

FAO
OIRSA
ITC
EU
CIAT
IICA
Harvesting Plus

Local partners

MAFSE
BAHA
PCB
UB
SIRDI
CCCC
NCCO
Met Office



CARDI partner with the Salvadorans embassy to meet with the Valle of Peace Salvadorian community invited by ambassador Hon Mrs. Julia *Carolina* Rovira Aguilar



- CARDI booth at the Belize Defense Force Open day
- CARDI supported the Activity at the Central BDF distributing corn and beans and showing CARDI's work



CARDI's Programmes affinity with the Present Belize National Agricultural programme





INSTITUTIONAL
STRENGTHENING

Lessons learnt for Institutional strengthening and Partnership Alliances

- CARDI'S Needs to improve its Communication style and channels with key partners to involve them in the work being completed in the institute
- Documentation of achievements need to be improved
- Delivery time need to be improved
- CARDI needs to organise with key partners to carryout join trainings.



PARTNERSHIPS AND
STRATEGIC ALLIANCES

Lessons learnt for Value chain strengthening

- Lack of access to water has become a main issue for research and development programmes
- Planting timing for been it is very important and determines the success of the crop, as well as affect cost of production.
- Climate variability have affected the traditional planting cycles of been, specially for time of harvesting causing been losses.
- Climate variation a major factors on Asian Thrip incidence



VALUE CHAIN
SERVICES

2. Future priorities and plans

- **COCONUT-** Training of farmers will be the main focus in 2022. Capacity building for farmers coconut management and will be synchronize with MAFSE programme.
 - Multiplication of planting material
 - Identification of local plants that can be used as mother plants to new coconut elite planting material
 - Training on how to collect plant samples for identification – April 2022
- **WILD CANE-** Final data collection to be completed and first harvest of *Arundo donax* to be done
 - Seek to expand the project to a programme for at least 3 more years.
- Calorific analysis, destruction capacity and seed viability trials to be completed.
- Complete the data collection and reported by June 2022
- **WORLD VEG** - To replicate the trial in 2023
- To host a three days Central American meeting in Zamurano, Honduras in July 2022
- **ASIAN THRIP RESEARCH** - Needs to repeat the experiment in more locations
- **BIO FORTIFIED SEEDS** - Two more yield trails will be conducted to further select the best varieties for the country and the region.
- **Continue adaptability trials of key crops**
- **Continue corn and bean single line evaluation**
- **Continue supporting CARDI's Developmental programmes**



CARICOM Soybean project

CARDI Belize outdated equipment traditionally use for soybean

VALUE CHAIN SERVICES

REBAICER
AVTIE CHVIN



Combiner to be repair



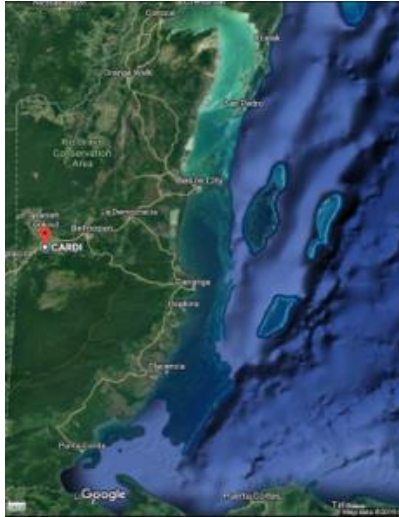
Soybean seed cleaner donated to CARDI in 2006 to big to be used at CARDI



3. Conclusion and recommendations

- 2022 will be time to develop the 2023- 2028 strategic plan
- CARDI's seek to continue strengthening its capacity to evaluate the adaptability of key crops with the aim to enhance Belize's, seed security and seed resiliency and sovereignty.
- CARDI's to continue supporting MAFSE's programmes to develop the coconut industry and work as one in order for the project to have a successful completion.
- The project seek to adopted as a programme to have a real impact on the industry
- Start awareness programme on the iron Biofortified bean consumption. In order to address the iron deficiency in of the CARICOM
- Repeat the trial using biocontrol
- Continue the evaluation of open pollinated varieties of open pollinated tomatoes , hot pepper and sweet pepper, and pumpkin, with the objective to create a seed saving programme for small scale farmers.
- Continue working in supporting the local seed production programme of hot pepper.

THANK YOU



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