The Belize Ag Report

Belize's most complete independent agricultural publication

10th Anniversary
Summer 2019
ISSUE 42


PCB: Reducing Reliance on Pesticides... pg 12


Sylvopastoral systems... pg 18


Sorosi... pg 21


Belizean Lauded in London... pg 3


Poached Macaw Chicks Returned to Wild... pg 20


pg 32

REGENERATION BELIZE

Regeneration Belize

2nd Annual Tropical Agriculture Conference

Belmopan

11-12-13 November 2019

Free Admission

pg 9

GROW SAFE

pg 12

The Belize Ag Report Celebrates 10th Anniversary

Yikes! Ten years has elapsed since our humble start-up in spring of 2009. Thank you writers, readers, advertisers and supporters. We'll try to keep going as long as we can be of use to the agriculture sector.

Beth Roberson, co-editor/publisher and Dottie Feucht, co-editor

Belizean Lauded in London

Pictured are: Nitesh Kumar Jangir, India; Leilua Lino, Samoa; Christopher Nesbitt, Belize; Rt Hon Patricia Scotland, Sec Gen of the Commonwealth; Rosette Muhoza, Rwanda; Elizabeth Kperrun, Nigeria and Wayne Neale, St Lucia.

Maya Mountain Research Farm (MMRF) is a Belizean NGO, situate in the Toledo District agroforestry farm of Christopher Nesbitt and his wife Celini Logan Nesbitt. Christopher applied for the newly created Commonwealth Innovation Award, highlighting his work of the last 30 years in agroforestry, food security, land repair, and the last 15 years' intensive work on carbon sequestration through agroforestry and biochar. MMRF was one of less than 15 projects accepted. Christopher states that "it was an honor and a privilege to be among them". Also he would like to thank HRH Prince Harry, and the Rt Hon Patricia Scotland, Secretary General of the Commonwealth, and Bilikisu Ibrahim, who took excellent care of the winners who made it to London. There were over 800 applicants from the 53 nations and 2.4 billion people of the Commonwealth.

Christopher landed in Belize in 1985 and served as a caretaker for a farm from 1986-88. In 1988 he purchased the land that would become MMRF. There was no road or house then, a dory being the only way in, and remains the only access. Christopher took a permaculture design course at a neighbor's farm, which greatly influenced the direction he took on his property – "an old tired citrus and cattle farm". He managed The Toledo Cacao Growers Association (TCGA) from 1997 until 1994, when he established MMRF.

He states, "We have been focusing on methods of agriculture that draw down carbon, repair some of the 950,000,000 to 1.1 billion acres of degraded agricultural landscapes, much of which are in the lowland humid tropical countries of the Commonwealth, and have worked to create a multistrata agroforestry system that provides food, fuel, fodder, marketable crops, medicinal crops and timber, while replicating the eco-system functions of soil, including soil moisture retention, habitat creation and carbon sequestration. Over the last 30 years, we have developed a way to mimic the process of succession of "wamil", using analog species which provide a series of yields while also improving soil. People who work with the Commonwealth were aware of what we have been doing."

Additionally, Christopher is a director of the non-profit *Regeneration Belize*; he is a popular speaker at their *Annual Tropical Agriculture Conference* (see pg 9). Thanks for putting Belize in the limelight, Christopher!

See Christopher's article *Carbon Farming,* issue 40.
http://agreport.bz/carbon-farming

BDF Officer Cadet Wilfredo Magaña, son of Celini Nesbitt, Christopher Nesbitt and Belize High Commissioner H.E. Perla Perdomo

Guest Editorial

Managing our Streams and Rivers is Everyone's Responsibility

By Ed Boles, Aquatic Ecologist

Having studied streams and rivers of Belize for the past 30 years, I have witnessed a trend that has greatly accelerated during the past few years...and the news is not good. Our riparian (riverside) forests, filter systems of the landscape, are being stripped out. Wetlands are disappearing. Streams and rivers are being mined. Fishes are being depleted by gill nets and pesticide-fishing (adding select pesticides to the river upstream to collect the dead and dying fish carried downstream).

On a recent 2-day float of the Sibun River mid-reach in January of this year I saw more gravel mining than I have seen in three decades. Huge stockpiles of gravel were stacked on land that should be covered in riparian forest, one pile containing about 1,500 loads according to a gravel hauler. Many new roads were cut through the natural river levee, leading to gravel bars or low-water crossings. Huge dump trucks travel on roads built in the middle of the river. Several large cut banks were sloughing off from bank clearing, and from undercutting as the river bed erodes to fill in deep downstream holes dug by large backhoes leaking oil into the water. More pumps are abstracting water for washing gravel and irrigating fields. Similar activity is happening in other rivers as more roads and increasing numbers of large concrete houses, hotels, office buildings, stores and other structures are being built all around the country. All of this ultimately impacts our coastal waters.

But there is also good news! For one thing, a growing number of us are becoming aware of and concerned about our national freshwater resources. Also, more communities are organizing into watershed associations to help look after their shared watershed ecosystems. Many farmers are now thinking about more sustainable land use and crop production strategies, and looking down the road to hand off functioning farms to their children. Belizeans are returning from universities abroad with advanced degrees in water resource management, agriculture, and related fields. Several key funding agencies are responding by supporting project efforts that address these issues, implementing positive actions. And there is another bit of good news. Given our year-round growing season, and the "self-healing" capacity of our flowing water systems, if we can collectively reduce many impacts we are all imposing on our streams and rivers, they can still recover, often within a few years.

The Belize River Watershed, a bi-national watershed with one third lying in Guatemala and two thirds in Belize, is vital to the economy of our country. The Belize River Valley is essential to the production of table food for the country and also produces a great amount of export crops including citrus, corn, beans, sugar, and beef. The river itself is becoming ever more important as a water source for expanding agriculture as farmers increasingly turn to the river irrigation water, an adaptation to the challenges of climate change and unreliable rainfall. In addition, many bottling companies and the Belize Water Service, Inc. abstract water from the Belize River. Almost everyone in the country, including tourists, drink from the Belize River; if you are one of the 150,000 plus watershed residents who draw household water from BWSI, or who drink soft drinks, beer, and/or several leading brands of bottled water, rum, and other products you are included.

However, the Belize River, as with many other rivers in the country, the region, and indeed the world, is rapidly losing its riparian forests and wetlands as agriculture aggressively expands. Impacts of the agriculture sector are not limited to deforestation of these landscape elements, and discharge of water containing heavy loads of pesticides, fertilizers, and sediment. It is also impacted by the wastewater discharge from agricultural processing facilities, as well as sewage and storm water runoff (following a heavy rainstorm) from towns and villages. Consequently, the quality of the water is degrading, and over the past few years degrading rapidly.

The **quantity** of water flowing through our streams and rivers is controlled by forests. Each tree is a water pump, drawing up hundreds of liters of soil water from the ground and evaporating it back to the atmosphere. Forests blanking watersheds are made up of hundreds of thousands to millions of trees absorbing sometimes as much as half of the rainwater and transporting it skyward, water that would otherwise be flowing into the drainage network. The volume of water flowing down streams and rivers increases greatly as trees are stripped out of a watershed. Consequently, erosion also increases as stream and river beds are enlarged by this excessive flow, often leading to more flooding and land loss.

Trees also control the **quality** of water in our streams and rivers. Riparian forests in particular, with extensive root systems that spread through the soil of river banks, create a fine network of small roots associated with fungi and bacteria. These small roots function as an extensive filtration system that absorbs and breaks down many types of pollutants (chemical fertilizers, pesticides, fecal material, hydrocarbons) and capture sediments before these materials enter the surface waters. Removing these forests results in not only extensive riverbank failure but also reduction in water quality. Heavy sediment loads impact water pumps and irrigation equipment. Low quality water requires much more treatment than good quality water before it can be distributed

to households or used in food processing and beverage production.

Wetlands include swamps and marshes surrounding oxbow lakes, lagoons, and abandoned channels. They absorb, hold, and slowly release floodwaters, reducing the magnitude of downstream flooding. Additionally wetlands bury large amounts of organic carbon, in the form of leaves and wood within their low to no oxygenated sediments, removing that carbon from circulation in the atmosphere where it would further exaggerate climate change. Destroying the wetlands in Belize and occupying low lying areas of saturated soils are affecting the amount of surface water that seeps into deeper layers of soil and rock to recharge aquifers.

Again, the news is not as bad as it is for many other areas of the world. Although unnecessary deforestation is increasing rapidly, there is still time to take action to reverse this trend while there are still many hectares of forest remaining. Agricultural institutions and responsible farmers around the region have demonstrated that the tropical landscape can accommodate rich and functional steep slope forests, riparian forests, and wetlands while also supporting healthy agricultural production systems. Agriculture that is carefully woven into the ecological network of the landscape is far more sustainable and resistant to climate change impacts than fields that are plowed without regard for the vital functions that different forest types provide. Ultimately it is a matter of recognizing and embracing best management practices for all water resource users.

Beginning in 2018 several key initiatives have been undertaken to address issues affecting water quality and agricultural production in the Belize River Watershed. In 2018 the World Wildlife Fund and the University of Belize Natural Resource Management Program conducted a rapid assessment of the Belize River system from the western border to the sea, hosted a few initial consultation meetings with stakeholder groups, and produced a draft Belize River Watershed Management Plan (BRWMP). The Coca-Cola Company joined this initiative, lending its support. This company is actually supporting healthy watershed initiatives for all of those rivers that supply its bottling plants around the world.

This is just the first phase of a long process and the management plan is just a draft at this point. To become a full and effective strategy, the BRWMP must be further modified and developed through an open consultation process involving all stakeholder groups throughout the watershed. The concerns, objectives, and needs of all stakeholder groups, including farmers, urban centers, riverbank residents, tourism facilitators, industries, government agencies, and many others must be represented in the final document. Ultimately the completed management plan will be (1) a manual of best practices and conservation strategies, identified and agreed on by stakeholders, (2) actions that are practical, sensible, and relatively inexpensive to apply, but that are very effective in helping improve the quality of our mutual watershed ecosystem. In 2019 that consultation process will continue.

The United Nations Development Program (UNDP) also funded an initiative to develop a Belize River Watershed Water Master Plan; it is also a consensus-based document focused on managing those activities that affect water quantity and quality. The water master plan focus takes into account the actual water yield of the Belize River and its groundwater, the amount of water abstracted from the river and groundwater for household use, industry, and agriculture, and the quantity of water required to maintain the integrity of the watershed. It seeks to ensure that all water users, including the environment, have access to the water needed without over drawing this shared resource, thereby ensuring water resources for now and in the future. Just as with the BRWMP, the water master plan must represent the needs of and be accepted by stakeholders throughout the watershed.

Additionally, the Japan Caribbean Climate Change Project and UNDP funded a project to (1) evaluate the status of our water quality assessment capacity in Belize, (2) pull together managers and technicians from across the country, and (3) develop strategies for improving the capacity to measure and monitor our own streams, rivers, lakes, lagoons, and groundwater. An additional project is being developed for 2019 that follows up on this initiative, helping to develop a set of water quality standards for the country.

Taken together, these efforts are synergistic to helping ensure water security for the present-day watershed stakeholders and for generations to come. These are very timely and necessary undertakings to which we all have a responsibility to contribute. Working together we can help maintain functioning watershed ecosystems, support our agricultural industry that contributes so much to our economy and livelihoods, and prepare for the challenges of a changing climate. Together we can protect and wisely use our most precious natural resource. Water is our future.

Mission Statement:

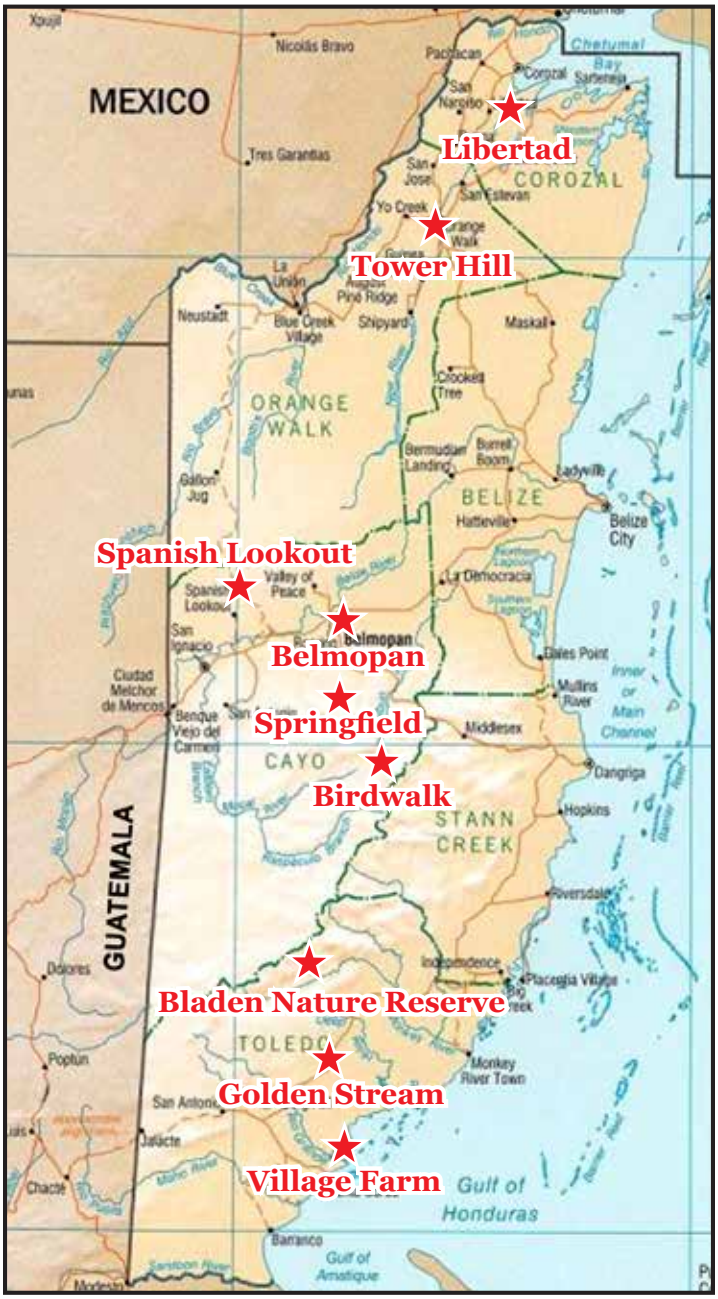
The Belize Ag Report is an independent semi-annual agriculture newsletter. Our purpose is to collect, edit and disseminate information useful to the Belizean producer, large or small. We invite opinions on issues, which are not necessarily our own. Belize Ag neither solicits nor accepts political ads.

The Belize Ag Report, P.O. Box 150, San Ignacio, Cayo District, Belize, Central America
Telephone: 663-6777 ***(please, no text, no voicemail)***
Editors: Beth Roberson and Dottie Feucht
Publisher: Beth Roberson
Printed by BRC Printing, Benque Viejo, Cayo District, Belize
Submissions as follows:
Letters to the Editor, Ads & Articles to:
belizeagreport@gmail.com
Deadlines for submissions: 45 days prior to publication.
2+ Issues per year
Original Site Design by Xen Wildman
Website Design & SEO by Ximbalo Web Studio

Rainfall 2018

Although the trend of lower rainfall in northern Belize, and higher rainfall in the south still remains generally true, much variation can be seen within each area.

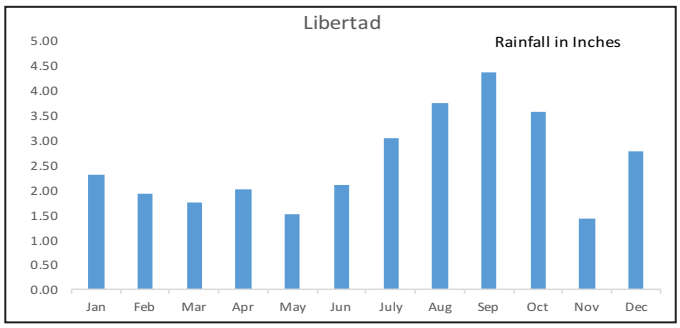
All of the rainfall charts and graphs for this article were created by Dottie Feucht.



Rainfall - Libertad
Corozal District

Corozal rainfall courtesy of Belize HydroMet.

2018	inches
Jan	2.29
Feb	1.91
Mar	1.73
Apr	2.00
May	1.51
Jun	2.08
Jul	3.02
Aug	3.75
Sep	4.36
Oct	3.55
Nov	1.42
Dec	2.75
Total	30.35



Effective Rainfall

What is '*effective rainfall*'? That is the portion of the total rainfall, which infiltrates the soil, creating a direct effect on not only to soil, but to all things related: soil life within, plant life on and within, and eventually animals and humans who consume those plants.

When rain falls on your farm, does it sink in and grab onto the sponge-like qualities of the organic matter or does it run off, perhaps even carrying topsoil along with the sky's libation? Effective rainfall slowly seeps in (avoiding drowning flood puddles) and holds the water in situ, ready for dispersal as needed – perhaps later on saving your crop from damage by drought. **Gabe Brown, in *Dirt to Soil [pg 130]*, opines that we can "create our own drought"***. Crops, cover crops, debris on the soil and forest all increase water retention in soil.

"One percent of organic matter in the top six inches of soil would hold approximately 27,000 gallons of water per acre! " (USDA)

Organic matter percentage in Belize's farming communities typically ranges between 1.5 to 2%. One farm at 31 Mile George Price Hwy (GPH) (not part of the fertile farm belt), had over 5% (2015) which was created by rehabilitation of the land using free-range poultry and lots of rice bran. When CARDI Country Director, Mr. Anhil Sinha visited this farm in 2015 with view to participation in a purple corn trial, he was asked by the owner , "What shall I do [to the land] to prepare it?" Sinha's response: "Nothing, absolutely nothing". During these trials, a severe drought in August challenged the crops growing simultaneously at Central Farm, Cristo Rey Rd, Cayo and Mile 31 GPH; the only one to harvest any appreciable crop was that rehabilitated farmland at Mile 31 GPH.

It is possible to build 0.75% organic matter in your soil per year. See Andre Leu's *Building Topsoil* presentation from the 2018 TAC, at:
https://www.youtube.com/watch?v=3mccLVb5uW8
B.R.

*Read Chris Harris' review of *Dirt to Soil* on pg 27 of this issue.

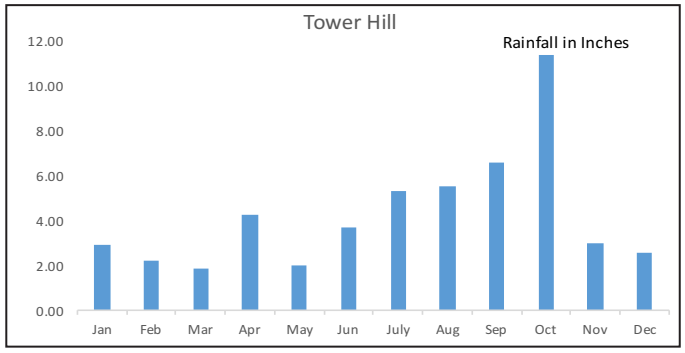
Dirt to Soil will be on sale at the Tropical Agriculture Conference in Nov – see pg 28.

Rainfall - Tower Hill

Orange Walk District

Orange Walk rainfall courtesy of Belize HydroMet.

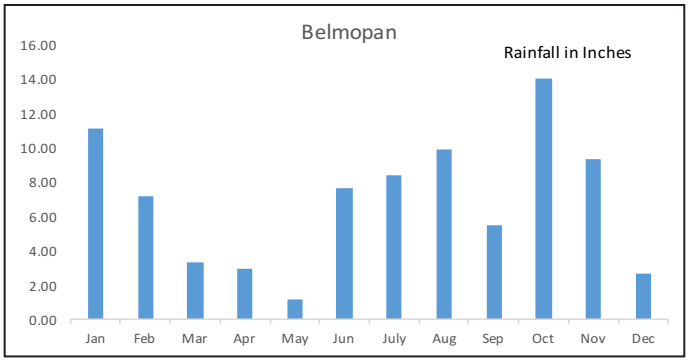
2018	inches
Jan	2.90
Feb	2.23
Mar	1.84
Apr	4.23
May	2.02
Jun	3.69
Jul	5.28
Aug	5.54
Sep	6.59
Oct	11.31
Nov	2.99
Dec	2.58
Total	51.55



Rainfall - Belmopan

Thank you Mr. Don Thompson, manager of *Help for Progress* in Belmopan. He has recorded rainfall there since 1999.

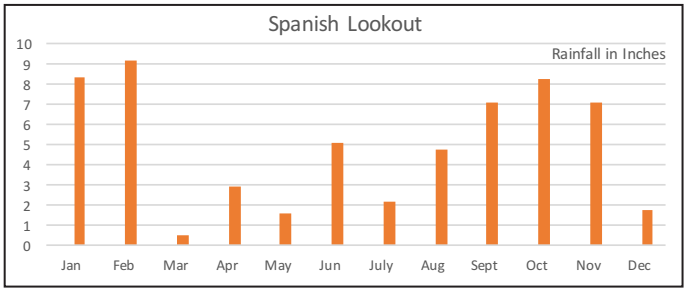
2018	inches
Jan	11.08
Feb	7.19
Mar	3.33
Apr	2.89
May	1.20
Jun	7.67
Jul	8.39
Aug	9.88
Sep	5.49
Oct	13.98
Nov	9.28
Dec	2.70
Total	83.07



Rainfall - Spanish Lookout

The David J. Thiessen family have been keeping rainfall records in Spanish Lookout for 50 years. The highest year on record was 1979 when 84.58" fell. The lowest year was 2003 when only 41.96" fell all year. Thank you Thiessen family and Friesen Hatchery for sharing these records.

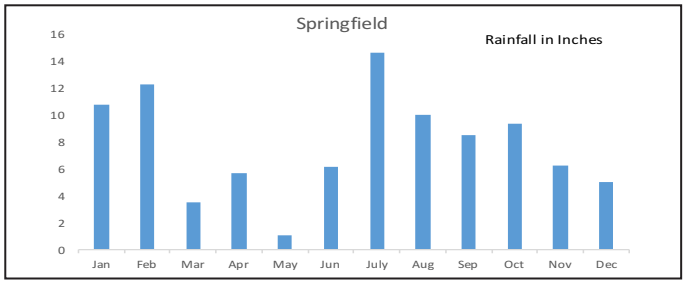
2018	Inches
Jan	8.35
Feb	9.13
Mar	0.52
Apr	2.92
May	1.56
Jun	5.05
Jul	2.15
Aug	4.78
Sept	7.05
Oct	8.22
Nov	7.11
Dec	1.76
Total	58.60



Rainfall - Springfield Community

Springfield has kept rainfall records since 2005. Their average annual rainfall is 94 inches. 2005 was the lowest year on record with 78.8" and 2006 was the highest year on record with 122.1". We thank, the Springfield Community and Mr. Andrew Beiler for sharing this data.

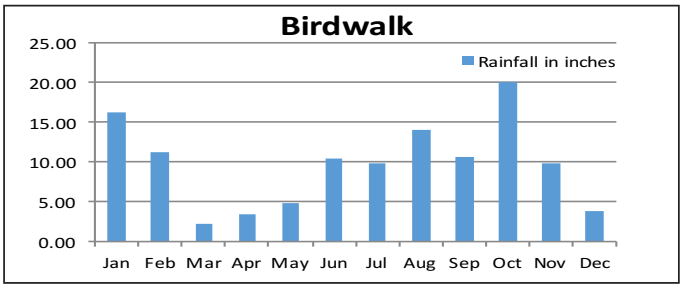
2018	Inches
Jan	10.70
Feb	12.20
Mar	3.50
Apr	5.70
May	1.10
Jun	6.10
Jul	14.60
Aug	10.00
Sep	8.50
Oct	9.30
Nov	6.20
Dec	5.00
Total	92.90



Rainfall - Birdwalk Community

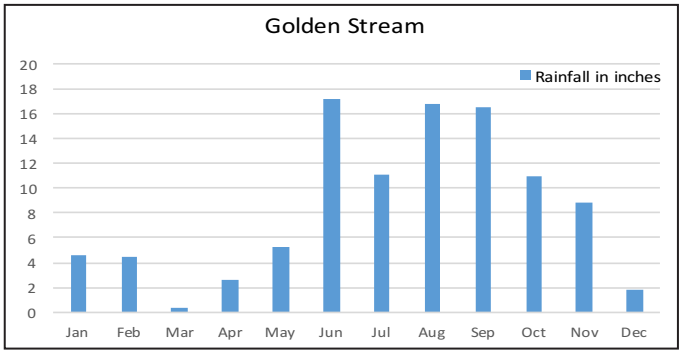
Birdwalk Community has kept rainfall records since 2012. Their average annual rainfall is 119.506". We thank Mr. David Shirk for sharing this data.

2018	inches
Jan	16.20
Feb	11.21
Mar	2.19
Apr	3.35
May	4.89
Jun	10.52
Jul	9.92
Aug	14.05
Sep	10.59
Oct	19.97
Nov	9.87
Dec	3.82
Total	116.58



Golden Stream Corridor Preserve

2018	inches
Jan	4.54
Feb	4.44
Mar	0.31
Apr	2.60
May	5.29
Jun	17.21
Jul	11.14
Aug	16.76
Sep	16.48
Oct	10.90
Nov	8.80
Dec	1.89
Total	100.35

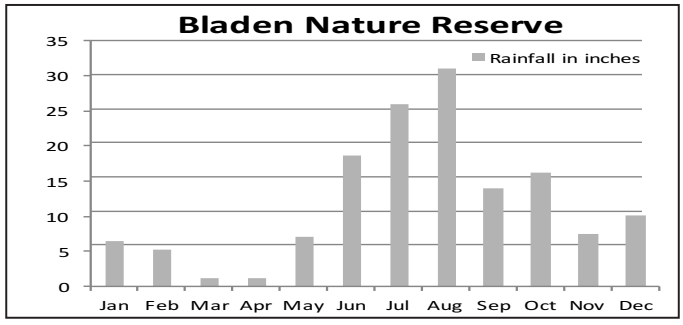


Rainfall - Ya'axché *(2 sites)*

Ya'axché Conservation Trust's field office is in Golden Stream, Toledo. They have collected rainfall data since 2009. They sent us rainfall data from two of their research stations. Thank you, Ya'axché Science Director Mr. Said Gutierrez, Ms. Elizabeth Dorgay and Mr. Oscar Requeña for sharing this data.

Bladen Nature Reserve

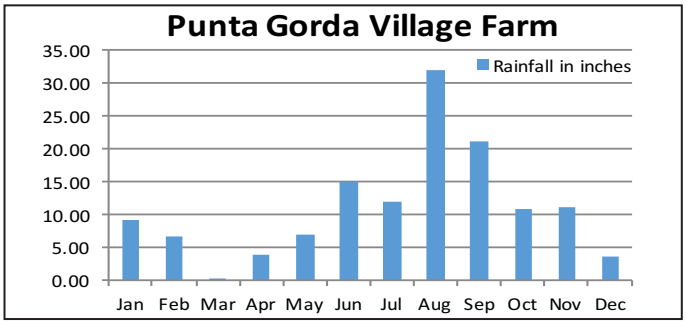
2017	inches
Jan	6.60
Feb	5.19
Mar	1.16
Apr	1.08
May	7.18
Jun	18.89
Jul	26.24
Aug	31.32
Sep	14.16
Oct	16.27
Nov	7.50
Dec	10.11
Total	145.70



Rainfall - Punta Gorda Village Farm

Ms. Tanya Russ of Village Farm has collected rainfall for decades at her farm, which sits on the coast between Seven Hills Creek and Middle River. Their average annual rainfall has been 128.99". She notes that January 2019 was the driest January she has ever recorded. Thank you Tanya!

2018	inches
Jan	9.22
Feb	6.53
Mar	0.40
Apr	4.00
May	7.00
Jun	14.85
Jul	12.02
Aug	32.05
Sep	21.20
Oct	10.85
Nov	11.05
Dec	3.60
Total	132.77



Regeneration International and Regeneration Belize to Host 2nd Annual Tropical Agriculture Conference


RB Vice Chair Santiago Juan Ms Vianny Alvarado

When you think of the 2nd week of November in Belize, think of the Regeneration International and Regeneration Belize's Tropical Agriculture Conference. This year will be the 2nd annual event. The 2018 conference, (held the 2nd week of November also) was a rousing success, with over 1,100 Belizean farmers flocking to Belmopan's NATS grounds, to listen and learn regenerative farming methods from 6 international experts, all hailing from the tropics and 11 local experts.


Min of Agriculture Hon Senator Godwin Hulse

Monday afternoon, 11th November, the opening ceremonies are scheduled at the NATS grounds. Minister of Agriculture Senator Godwin Hulse and others will speak.

Tuesday 12th and Wednesday 13th November will be 'Farmer Presentation Days', with multiple stages simultaneously offering different topics. **Admission to all is again free**, due to the generous sponsorships of many local ag-related businesses, many of whom will have booths and displays on site.

At the 2019 conference, again to be held at the NATS (National Agriculture & Trade Show) grounds, presentations will be made by international speakers: André Leu on *Building Topsoil*, and also on *Alternatives to Pesticides*; Dr. Don Huber on *Mineral Nutrition and Plant Disease*; Reginaldo Haslett-Marroquin on *Regenerative Tree-Range Poultry Systems*; Brock Menking on *Cattle in the Regenerative Farm Environment;* and a regenerative cane farmer who awaits confirmation. Local experts who will present this year include: Christopher Nesbitt of Maya Mountain Research Farm, recent Commonwealth Innovation Award winner, on *Repairing Degraded Land and Drawing Down Carbon*; Santiago Juan of San Lorenzo Farm on *Under-utilized Native Crops* [Santiago spoke on this last yr. This year will feature different native crops.]*;* Dr. Rosita Arvigo of Rainforest Remedies on the *Connections between Soil, Food and Health*; Dr. Ed Boles, acquatic ecologist on *Watershed Management and Agriculture*; Omaira Rostant Avila, CARDI Country Representative, on *Open-pollinated Corn*; Henry Anton Peller on *Rebuilding Soil with Cover Crops and Farmer-to-Farmer Learning*; and Dr. Carlos Itza, agricultural consultant on *BioFertilizers*.


RI Director André Leu


RI Director Reginaldo Haslett-Marroquin

Several panels will feature both international and experts drawn from the local ag communities, who will discuss how particular regenerative practices have been and might be applied here in Belize. Questions and comments from the audience are welcome.

All of last year's presentations were captured on film by Hummingbird Productions, and are freely available on Regeneration Belize's YouTube channel of same name.

REGENERATION BELIZE

Regeneration International (RI) poses the question:
How can we cool the planet and feed the world?

Fortunately, the solution is right under our feet.
regenerationinternational.org

Regeneration Belize (RB) is a Belizean non-profit organization in Regeneration International's Alliance since 2018.
regenerationinternational.org/belize

RB promotes regenerative practices in Belize in order to:

- Draw down skybound CO_2 (carbon dioxide) and entice it back into the soil, where much of it originated
- Increase farmers' yields and profits via improving soil fertility & increasing % of soil organic matter (mainly carbon), creating resiliency against droughts & floods
- Grow healthier nutrient-dense foods
- Diminish farmer costs by less use of external (purchased) inputs

Whatever type of farming you do, everyone can do something to draw down carbon and increase soil fertility and profits

Come to the 2nd Annual Tropical Agriculture Conference (TAC) on Tue 12th Nov & Wed 13th Nov, at the NATS grounds, Belmopan. ***Free admission!*** Presentations begin 8:30 am, continuing til 5 pm.

regenerationbelize@gmail.corn

Visit Regeneration Belize's YouTube channel to see videos created in Nov 2018 at RB's 1st Annual TAC.

BEYOND THE BACKYARD

Ay Caramba!

By Jenny Wildman

Just when the avocado, *Persea americana,* season is coming to a close, I read a very disturbing article that suggests that some of our favorite indulgences could be annihilated by the effects of climate change. I am sure the same holds true for most of the basics produce but the thought of losing avocados, coffee, chocolate, lobsters, oysters and beer is far more devastating. Had wine and olives been on that list of extinction I would have gone into serious depression. I really do not want to lose guacamole or to travel in search of some.

I immediately went out and bought avocados to start planting from seed. You know, with a glass of water and 3 toothpicks; now the window ledge looks like a series of sputnik invaders. The growing time is at least 5 years and I plan to plant as many varieties as possible. Our season in Belize is about 4 months but with different early and late varieties such as Haas, Gigante Verde, Lamb Hass, Pinkerton, Noche Buena and Lawrence, it should be possible to grow avocados year round.

In 2009 the Ministry of Agriculture at Central Farm started such a project. The world market peaked in 2018 making avocado

prices at their highest ever. Traditionally Belizeans have favored the larger, green-skinned butter pear which grows extremely well in northern Belize, to huge sizes. The rest of the world appears to favour the smaller Haas, dark with wrinkled skin often called alligator pear. It apparently ships well and has become the known flavour. It's what you grow accustomed to but the influx of different peoples is changing our local demand. The fruit is prized for its health benefits often touted as a superfood. It is loaded with nutrients, antioxidants, vitamins, minerals, healthy fats and fiber.

Some of the known benefits:

- High in potassium so supports blood pressure levels and protects against macular degeneration. (more than bananas)
- High in oleic acid, good for the heart; good HDL; increases the antioxidant intake.
- Rich in fiber, supports the digestive system and aids weight loss.
- PLUS wonderful in taste

In another study it states that people who regularly consume avocados are happier and healthier. They are leaner with less belly fat.

Evidence places the avocado from the Tuhuacan Valley in Mexico 10,000 years ago.

Now given that guacamole is often accompanied by tequila it is worth a look at the benefits that agave juice may offer (in moderation). Tequila

- is a good digestive aid. It is a prebiotic which helps the good existing bacteria in the gut boosting the lactobacilli.
- aids weight loss.
- lowers blood glucose levels ...diabetes
- promotes bone health... less osteoporosis
- and can reduce the risk of dementia.

It seems as though these two are a perfectly matched. Just add a little salt and lime and ole, you will be dancing La Caramba to perfect health.

I have been interested in the use of avocado pits as a natural colorant and did some tests on the use of avocado seeds ground as powder which I now see is sold from Peru. Cold pressed oil can also be obtained from the pits and pulp, centrifuged and filtered and used in skin care products for psoriasis and sensitive skin due to its restorative properties. Just mash up an avocado and use as a calming face mask. The pits contain a lot of nutrients and some recent research says that they may contain ingredients that could reduce the risk of Alzheimers, aid diabetes, lower cholesterol, fight fungal infection and prevent microbial growth. Yet they taste very bitter and contain trace elements of cyanide, tannin and persin which is a natural fungicide. So whilst use has its pros and cons more research may be required to ensure safe dosage for consumption. Other promising uses are as a natural dye for fabric and food.

So if you decide to grow avocados commercially and thwart the wave of climate change there are more opportunities out there for their use than just as vegetables. However for me the avocado is strictly in a bowl of guacamole with tortilla chips or with accompanying huevos rancheros. Enjoy.

The History of Central Farm 1948 - 1966

(Filed in January 1990 in the Belize Archive and Records Service)

The Central Farm Agricultural Station was started on the 20th October, 1948. It started as an Ex-servicemen Rehabilitation Scheme and was later changed to an experimental station. At its inception the area was completely in high bush; the first work gang consisted of twelve men under a farm manager who cleared it with machetes and axes. The farm manager, Mr. G.S. Southwell, and the director, Mr. Fishlock, were the first to be sent from the UK to be stationed in Belize. The first tractor was received in 1950 and a small garden was laid out. Government started construction of permanent buildings and a garage.

Mr. S.S. Dale was appointed livestock officer in 1951 to begin preparation for livestock. Mr. Fishlock returned to England in 1951 and was replaced by Mr. J.W. Goodban; the senior agricultural officer was Mr. G.S. Gregory. Both of these men were stationed in Belize whilst Mr. Southwell continued as farm manager. Mr. V. H Vial was appointed experimental officer in June 1953. When Mr. Southwell returned from leave in July of 1953 he was transferred to Punta Gorda and Mr. Coe, who was the development officer, was posted to act as farm manager. Other personnel stationed at Central Farm were Mr. C. A. S. Hynan as agricultural education officer, having arrived in June, 1953; Mr. J.B. Hutchinson as land clearing engineer in June, 1953, and Mr. G.L. Wanrooy, who took the post of tobacco officer in December, 1953. Most of the specialist officers were recruited between 1951 and 1953; after the year 1953 the government whole-heartedly began developing the station as a centre of agricultural activity in the country.

The director of agriculture, Mr. J.W. D. Goodban went on leave in February 1954, and Mr. G. B Gregory acted as director. Mr. G.A. Southwell, the one-time farm manager, was transferred to Grenada in December 1954. Mr. Gregory was transferred to Fiji in August, 1955 after 6 years, serving twice as director during that time. Mr. M.K Chopin joined the staff as an agricultural officer in January, 1955 and replaced Mr. Gregory in Toledo District. Mr. Coe, the development officer who had served for twelve years as farm manager resigned and left the country in June 1955.

A soil chemist, Mr. D. T. Romney, joined the staff on June 15th as agricultural chemist. He had previously spent 2 years in British Honduras a member of the land use survey unit.

Mr. I.S. Hazell, the farm manager, and Mr. G. La Granade, cacao officer, both newly appointed, arrived in the country in December, 1955. Even with a small staff the training hostel, opened in October, 1953 was in full use. Between 1953 and 1955, 59 people, including teachers, farmers, and staff were trained at the facility. The mechanical section of the station had grown considerably and was in position to aid in straightening houses and clearing areas after Hurricane Janet.

Between 1948 and 1958 Central Farm was a vibrant center where farmers could obtain information and observe trials being conducted; it played a vital role in the development of agriculture in Belize. By 1958, the livestock section of the department had a dairy test herd of fifteen cows under observation. In April of 1958 two young purebred Brahman bulls were imported from Texas, and four Jamaica Red heifers were purchased from Jamaica. The pig breeding program started with 15 Large Black guilts and 2 Large Black boars that were imported from England; the offspring of these were sold to farmers. In July, 1958 an agronomist, Mr. D. Von Ram, formerly of the Sudan Agricultural Service, joined the staff. Prior to his appointment Mr. R. E. Keogh served as acting agronomist; he was reassigned to Belize District as agriculture officer.

Mr. G.L. Ogilvie of the Agriculture Department of Granada was appointed cocoa officer replacing Mr. La Grenade in July 1958. The agriculture education officer, Mr. Hynan, left the country in February, 1958. The post of agriculture education officer was filled by Mr. R. Hill in September, 1959 shortly after Mr. C. Van Hamn resigned and left the country. Director of Agriculture, Mr. M. A. G. Hansebell, left on leave in November, 1959 and Senior Agriculture Officer, Mr. A.V.C. Thomas, acted as director.

By 1959, Central Farm had a modern and fully-equipped workshop under the control of an equipment overseer. Except machinery for land clearing, the overseer was responsible for the upkeep and repair of all machines and mechanical equipment. This amounted to a total of 139 units, from Land Rovers to lawn mowers.

In the Land Clearing Section, the unit consisted of 4 D7 Caterpillar tractors and 2 D4's with ancillary equipment. To meet popular demand, machines were widely dispersed for work in all districts. An area of 700 acres in all districts was cleared; in addition 5,000 operational hours were recorded for work on roads, drains, embankments, and other clearing.

Continues on page 30

Reducing Reliance on Highly Hazardous Pesticides in Belize

By Miriam Ochaeta-Serrut, MA
Registrar of Pesticides

Pesticides Control Board

Highly Hazardous Pesticides (HHPs)[1] have been recognized as an issue of concern, along with the need for concerted action in addressing them, through the promotion of agro-ecologically based alternatives and strengthening of national regulatory capacity to conduct risk assessment and risk management.

In June 2016, the Pesticides Control Board (PCB), established in 1988 for the regulation of pesticides in Belize, aligned its criteria for the classification of **Restricted-Use Pesticides (RUPs)**[2] with those developed in 2008 by the Food and Agriculture Organization/ World Health Organization (FAO/WHO) Joint Meeting on Pesticide Management, for the identification of HHPs.

---

1 Definition of a Highly Hazardous Pesticide (FAO/WHO International Code of Conduct on Pesticide Management): "Pesticides that are acknowledged to present particularly high levels of acute or chronic hazards to health or environment according to internationally accepted classification systems such as the World Health Organization (WHO) or the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) or their listing in relevant binding international agreements or conventions. In addition, pesticides that appear to cause severe or irreversible harm to health or the environment under conditions of use in a country may be considered to be and treated as highly hazardous."

2 Definition for Restricted-Use Pesticide (Pesticides Control [Amendment] Act, 2002): "A pesticide which, if used in accordance with a widespread and commonly recognized practice, may generally cause, without additional regulatory action, unreasonable adverse effects on the environment, including the applicator and other people."

Criterion 1: Pesticide formulations that meet the criteria of classes 1A or 1B of the *WHO Recommended Classification of Pesticides by Hazard*; or

Criterion 2: Pesticide active ingredients and their formulations that meet the criteria of carcinogenicity categories 1A and 1B of the *Globally Harmonized System of Classification and Labelling of Chemicals* (GHS); or

Criterion 3: Pesticide active ingredients and their formulations that meet the criteria of mutagenicity categories 1A and 1B of the *Globally Harmonized System of Classification and Labelling of Chemicals* (GHS); **or**

Criterion 4: Pesticide active ingredients and their formulations that meet the criteria of reproductive toxicity categories 1A and 1B of the *Globally Harmonized System of Classification and Labelling of Chemicals* (GHS); or

Criterion 5: Pesticide active ingredients listed by the *Stockholm Convention* in its Annexes A and B, and those meeting all the criteria in paragraph 1 of Annex D of the convention; or

Criterion 6: Pesticide active ingredients and formulations listed by the *Rotterdam Convention* in its Annex III; or

Criterion 7: Pesticides listed under the *Montreal Protocol*; or

Criterion 8: Pesticide active ingredients and formulations that have shown a high incidence of severe or irreversible adverse effects on human health or the environment.

This alignment updated the criteria used by the PCB for the classification of RUPs, which heretofore was only Criterion 1, that is, solely in relation to acute toxicity.

In addition, the PCB agreed to a ninth criterion:

Criterion 9: As a precautionary measure, pesticide active ingredients and formulations subjected to regulatory action in countries with recognized registration systems, over human and environmental health concerns.

This action was also considered critical in the development of a procedure for the periodic review of registered pesticides, to ensure that measures can be taken if new information on product performance or risks indicate that regulatory action is needed.

To this end, the PCB, having contributed to the regional database managed by Costa Rica's Instituto Regional de Estudios en Sustancias Toxicas/Universidad Nacional (IRET/UNA) for three consecutive quinquenniums[3], has utilized updated health hazard indicators based on imported volumes, environmental fate and health effects, for the prioritization of fourteen (14) pesticide active ingredients (AIs) for piloting of a procedure for the review of registered pesticides. These are: ametryne, atrazine, chlorothalonil, 2,4-D, diuron, ethoprophos, glyphosate, lambda cyhalothrin, malathion, mancozeb, metiram, propanil, terbufos, and terbutryn.

Using the FAO Pesticide Registration Toolkit designed as a decision support system for developing countries, registered pesticide formulations containing these AIs have been run through the toolkit module for the identification of HHPs. This preliminary exercise for the alignment of RUPs and HHPs has been completed, with the updated listing of RUPs presented in the following table on pgs 13 & 14.

---

3 Monitoring pesticide use and associated health hazards in Central America 2000 – 2004; 2005 – 2009; 2010 - 2014

No.	Registration Holder	Trade Name	Registration No	Active Ingredient 1	Active Ingredient 2	No.	Registration Holder	Trade Name	Registration No	Active Ingredient 1	Active Ingredient 2
1	UPL Costa Rica S.A.	Quickphos	0086-2	Aluminum Phosphide		48	Dow Agrosciences Guatemala S.A.	Kuron 16 SL	0096-10	2,4-D	picloram
2	Koppers Performance Chemicals	K-33 (60%) Wood Preservative	0231-2	Chromated Copper Arsenic		49	Dow Agrosciences Guatemala S.A.	Matamina 60 SL	0096-8	2,4-D	
3	Arch Wood Protection Inc.	Wolmanac Concentrate	0231-1	Chromic Acid		50	ADAMA Crop Solutions ACC, S.A.	Paso D 30,4 SL	0096-17	2,4-D	picloram
4	Drexel Chemical Company	Diazinon 60 EC (Drexel)	1999-2	Diazinon		51	AGRO-QUIMICA INDUSTRIAL RIMAC S.A.	Rimaxil 60 SL	0096-9	2,4-D	
5	ADAMA Crop Solutions ACC, S.A.	Diazol 50 EW	1999-6	Diazinon		52	Dow Agrosciences Guatemala S.A.	Tordon 30,4 SL	0123-2M	2,4-D	picloram
6	ADAMA Crop Solutions ACC, S.A.	Diazol 60 EC	1999-4	Diazinon		53	Quimicos y Lubricantes, S.A	Totem 60 SL	0096-20	2,4-D	
7	ADAMA Crop Solutions ACC, S.A.	Diazolution 60 EW	1999-1	Diazinon		54	Quimicos y Lubricantes, S.A	**Totem 72 SL**	0096-19	2,4-D	
8	AGROQUIMICA INDUSTRIAL RIMAC S.A.	Rimazinon 60 SL	0099-5	Diazinon		55	El Clono Agropecuario	Banazeb 60 SC	0112-25	Mancozeb	
9	Agroinsumos, S.A.	Preglone 20 SL	0238-2M	Diquat	Paraquat	56	E.I. DuPont de Nemours and Co.	Curzate M 72 WP	0112-23	Mancozeb	Cymoxanil
10	Agroinsumos, S.A.	Reglone 20 SL	0238-1	Diquat	Paraquat	57	ROTAM Agrochemical Co.	Diligent 72 WP	0112-12M	Mancozeb	Metalaxyl
11	Westrade Guatemala S.A.	Lannate 21.6 SL	0115-3	Methomyl		58	Dow Agrosciences Guatemala S.A.	Dithane 60 SC	0112-14	Mancozeb	
12	E.I. DuPont de Nemours and Co.	Lannate 40 SP	0115-7	Methomyl		59	UPL Costa Rica S.A.	Glory 75 WP	0112-27	Mancozeb	Azoxystrobin
13	E.I. DuPont de Nemours and Co.	Lannate 90 SP	0115-2	Methomyl		60	Pilarquim (Shanghai) Co. Ltd.	Helcozeb 80 WP	0112-19	Mancozeb	
14	ROTAM Agrochemical Co.	Lash 21.6 SL	0115-6	Methomyl		61	Westrade Guatemala S.A.	Indozeb 60 SC	0112-24	Mancozeb	
15	ROTAM Agrochemical Co.	Lash 90 SP	0115-5	Methomyl		62	Sulphur Mills Ltd.	Manco 80 WP	0112-16	Mancozeb	
16	E.I. DuPont de Nemours and Co.	Vydate 24 SL	0119-1	Oxamyl		63	Quimicos y Lubricantes, S.A	Mancozeb 42 SC	0112-21	Mancozeb	
17	Agrocentro S.A.	Angloxone 20 SL	0120-10	Paraquat		64	Quimicos y Lubricantes, S.A	Mancozeb 60 SC	0112-20	Mancozeb	
18	Agroinsumos, S.A.	Gramoxone Super 20 SL	0120-1	Paraquat		65	AGRO-QUIMICA INDUSTRIAL RIMAC S.A.	Mancozeb 80 WP (RIMAC)	0112-15	Mancozeb	
19	Shandong Luba Chemicals Co. Ltd.	Lubaquat 20 SL	0120-11	Paraquat		66	Westrade Guatemala S.A.	Manzate 35 OF	0112-11	Mancozeb	
20	Duwest Inc.	Paraquat 42 TC (Duwest)	0120-7	Paraquat		67	Westrade Guatemala S.A.	Manzate 43 SC	0112-10	Mancozeb	
21	Pilarquim (Shanghai) Co. Ltd.	Paraquat 42 TC (Pilarquim)	0120-6	Paraquat		68	UPL Costa Rica S.A.	Manzate 75 WG	0112-13	Mancozeb	
22	Agro Insumos S.A.	Paraquat Full 20 SL	0120-15	Paraquat		69	UPL Costa Rica S.A.	Manzate 80 WP	0112-1	Mancozeb	
23	Jinan Luba Chemicals Ltd	Proquat Tech 42 TC	0120-12	Paraquat		70	Agro Insumos, S.A.	Ridomil Gold MZ 68 WG	0112-18	Mancozeb	

No.	Registration Holder	Trade Name	Registration No	Active Ingredient 1	Active Ingredient 2
24	Quimicos y Lubricantes, S.A	Rafaga 20 SL	0120-13	Paraquat	
25	AGROQUIMICA INDUSTRIAL RIMAC S.A.	Rimaxone 20 SL	0120-8	Paraquat	
26	Prosser Fertilizer & Agrotec	Super Pro-Quat 20 SL	0120-4	Paraquat	
27	Agroinsumos, S.A.	Gramuron X 30 SC	0120-2M	Paraquat	Diuron
28	Agro Insumos S.A.	Doblette 20 SL	0120-14	Paraquat	Diquat
29	Agro Insumos S.A.	Curyom 55 EC	0349-1	Profenofos	Lufenuron
30	AMVAC de Costa Rica S.A.	Counter 10 GR	0243-4	Terbufos	
31	AMVAC de Costa Rica S.A.	Counter 15 GR	0243-1	Terbufos	
32	Tikal Agrosolutions	Forater 15 GR	0243-5	Terbufos	
33	ROTAM Agrochemical Co.	Saddler 35 FS	0225-3	Thiodicarb	
34	Bayer S.A.	Semevin 35 FS	0225-1	Thiodicarb	
35	Pilarquim (Shanghai) Co. Ltd.	2,4-D amine 60 SL	0096-12	2,4-D	
36	Biesterfield U.S.,Inc.	2,4-D amine 60 SL (Biesterfeld)	0096-3	2,4-D	
37	Westrade Guatemala S.A.	Agromina 60 SL	0096-18	2,4-D	
38	AGROQUIMICA INDUSTRIAL RIMAC S.A.	Bullgrass 30.4 SL	0123-3M	2,4-D	picloram
39	Shandong Binnong Technology Co., Ltd	Capture 60 SL	0096-22	2,4-D	
40	ADAMA Crop Solutions ACC, S.A.	Deferon 60 SL	0096-21	2,4-D	
41	Dow Agrosciences Guatemala S.A.	DMA 68,3 SL	0096-2	2,4-D	
42	Agrocentro S.A.	Elimina 60 SL	0096-15	2,4-D	
43	Agrocentro S.A.	Elimina 72 SL	0096-14	2,4-D	
44	Tikal Agrosolutions	Espuela 30.4 SL	0123-4M	2,4-D	picloram
45	Dow Agrosciences Guatemala S.A.	Flash 7.5 SL	0123-1	2,4-D	picloram
46	Tikal Agrosolutions	Foram 16.5 SL	0096-16	2,4-D	picloram
47	Dow Agrosciences Guatemala S.A.	Fullmina 60 SL	0096-7	2,4-D	
71	Agro Insumos, S.A.	Ridomil Gold Mz 68 WP	0112-12	Mancozeb	Metalaxyl
72	UPL Costa Rica S.A.	SAAF 75 WP	0112-26	Mancozeb	Carbendazim
73	UPL Costa Rica S.A.	Tridium 70 WG	0112-28	Mancozeb	Azoxystrobin
74	Parijat Industries Pvt. Ltd.	Victor 80 WP	0112-22	Mancozeb	
75	UPL Costa Rica S.A.	Vondozeb 42 SC	0112-4	Mancozeb	
76	UPL Costa Rica S.A.	Vondozeb 62 SC	0112-17	Mancozeb	
77	UPL Costa Rica S.A.	Vondozeb 75 WG	0112-5	Mancozeb	
78	UPL Costa Rica S.A.	Vondozeb 80 WP	0112-3	Mancozeb	
79	Quimicos y Lubricantes S.A.	Agente 36 SL	0043-25	Glyphosate	
80	Agrocentro S.A.	Glifosato Aleman 35,6 SL	0043-15	Glyphosate	
81	ADAMA Crop Solutions ACC, S.A.	Glyphogan 35,6 SL	0043-18	Glyphosate	
82	Jiangsu Good Harvest-Weien Agrochemical Co., Ltd.	Glyphosate 35,4 SL (Jiangsu)**	0043-16	Glyphosate	
83	Jiangsu Good Harvest-Weien Agrochemical Co., Ltd.	Glyphosate 69,8 GR (Jiangsu)	0043-17	Glyphosate	
84	Pilarquim (Shanghai) Co. Ltd.	Helosate 35,6 SL	0043-12	Glyphosate	
85	Agrocentro S.A.	Jaripeo 68 SG	0043-19	Glyphosate	
86	AGRO-QUIMICA INDUSTRIAL RIMAC S.A.	Kila 44,9 WP	0043-9	Glyphosate	
87	Drexel Chemical Company	Nock-Out 35,6 SL	0043-14	Glyphosate	
88	Quimicos y Lubricantes, S.A	Pantek 36 SL	0043-24	Glyphosate	
89	Agrocentro S.A.	Ranchero 24 SL	0043-23	Glyphosate	
90	AGRO-QUIMICA INDUSTRIAL RIMAC S.A.	Rimaxato 35,6 SL	0043-10	Glyphosate	
91	Quimicos y Lubricantes, S.A	Root Out 36 SL	0043-21	Glyphosate	
92	Monsanto	Roundup 35,6 SL	0043-2	Glyphosate	
93	Agroinsumos, S.A.	Touchdown Forte 50 SL	0043-11	Glyphosate	
94	Rainbow Agrosciences Limited	Wipeout 35,6 SL	0043-3	Glyphosate	

Additionally, in relation to *glyphosate* formulations now classified as Restricted-Use Pesticides on the basis of Criterion 9, use as a ripener in sugarcane, and for weed control in public areas is expressly disallowed.

With the engagement of stakeholders, the development of risk reduction plans is the next step. This entails the assessment of risks and needs, and the development of measures for regulatory and non-regulatory risk mitigation, such as the identification and implementation of suitable alternatives.

The process for HHP identification, assessment and mitigation is being carried out by the PCB following a methodology developed by the FAO (2016), under the auspices of a two-year project supported by the government of Mozambique and the Quick Start Programme of the Strategic Approach to Chemicals Management (SAICM)[4].

Furthermore, within the framework of a risk reduction strategy for sound chemicals management in Belize, and in relation to environmental indicators, specifically, the effects of pesticide leaching and runoff on water quality, the PCB is currently collaborating in a 2019 study that will be testing for the above-mentioned 14 pesticides in environmental matrices (water and sediment).

The timeliness of these exercises must be noted within the context of the PCB's five-year Strategic Plan (SP): 2017 – 2021. Phase III of the SP implementation commenced in April 2019 with a second two-year action plan (2019 – 2021), for which a key action is the updating of the pesticide legislative framework. The updated legislation shall be guided by the FAO/WHO International Code of Conduct on Pesticide Management, a voluntary framework that guides government regulators, the private sector, civil society and other stakeholders on best practice in managing pesticides throughout their lifecycle.

Sound pesticide management requires the enhanced engagement of stakeholders and is an important factor in the implementation of a holistic approach for sustainable intensification of agricultural production. Having recently marked its 30th anniversary, the PCB remains committed to its vision of "A Belize where the environment and associated eco-systems, human health and socio-economic development are protected through the responsible use of pesticides."

Reducing reliance on highly hazardous pesticides and adopting sustainable pest control strategies contribute to "healthy ecosystems that produce more, prevent or maintain pests and diseases at acceptable levels and are more resilient to shocks".[5] In creating the paradigm shift that is needed to achieve a sustainable food system, the full engagement of all stakeholders working together to reduce adverse impacts on the environment and enhance ecosystem services is considered to be of critical importance.

4 http://www.fao.org/3/a-i5360e.pdf
5 FAO/WHO International Code of Conduct on Pesticide Management

SPANISH LOOKOUT COMMUNITY CROP STATISTICS for the year 2018

	Acres	Bags
Yellow Corn, Summer	23,515	1,144,504
Yellow Corn, Winter	1,093	47,404
Corn for Silage	165	
White Corn, Summer	815	35,943
White Corn, Winter	740	36,759
Milo, Summer	29	650
Milo, Winter	553	13,887
Red Kidney Beans	4,854	48,170
Blackeye Peas	4,028	29,917
Soy Beans	8,287	139,309
Rice	2,383	103,556
Other Crops	1,823	7,843

Agriculture Prices at a Glance- $$$$$

JULY 2019

A-B denotes the difference between 1st preference & 2nd preference and sometimes between wholesale & retail and bulk or small amounts. Trend (H) means Higher over last 30 to 60 days (L) Lower (S) Steady. A blank symbol (-) denotes that the item is either not available now or at the time of the last issue.
Prices intend on being farm gate in Belize dollars - usually price per lb

BELIZE CATTLE by District - Provided by BLPA	T	Dist.	Per lb	Dist.	Per lb	Dist.	Per lb
Fattened steers	L/S/L	Czl	1.70	OW	1.90	Bze	1.65
750-1100 lbs	L/S/L	Cy	1.60	SCr	N/A	Tol	1.65-1.75
Weaner steers	L/L/-	Czl	1.45	OW	1.35	Bze	1.40
" "	L/S/L	Cy	1.10	SCr	N/A	Tol	1.30-1.50
Breeding heifers	H/L/S	Czl	1.50	OW	1.50	Bze	1.50
" "	L/S/L	Cy	1.30	SCr	N/A	Tol	1.40-1.50
Cull cows	L/H/L	Czl	0.70-1.20	OW	1.00-1.75	Bze	1.00-1.20
" "	L/S/L	Cy	1.05	SCr	N/A	Tol	1.00

U.S. CATTLE		
U.S. price - corn fed - 1000-1200 lbs	L	US$ 1.10500
U.S. price - feeders 600-800 lbs	L	US$ 1.37025

BELIZE HOGS			
Weaner pigs - 25-30 lbs - by the head	S	100.00	80.00
Butcher pigs 160 - 230 lbs, per lb	S	1.85	1.70

BELIZE SHEEP			
Butcher lambs - live per lb *	S	2.50	
Mature ewes - live per lb	L	1.75	

BELIZE CHICKEN			
Wholesale dressed, per lb (Sp Lkt)	S	2.32	Large Birds 2.20
Wholesale dressed, per lb (Bl Crk)	S	2.36	Large Birds 2.32
Broilers - live per lb (Sp Lkt)	L	1.10	
Broilers - live per lb (Bl Crk)	S	1.18	
Spent hens per 4 lb bird (Sp Lkt)	H	1.25 / lb	
Spent hens per 4 lb bird (Bl Crk)	L	3.25	

CITRUS		
Oranges per lb solid, est. final	L	2.2347 ($13.1849 per box)
Grapefruit per lb solid, est. final	H	5.1166 ($20.466 per box)

COCONUTS		
Green Coconuts, bulk	S	Dwarf 0.35; sm 0.40; med 0.45; Maypan / lg 0.50
Dry Coconuts, bulk	L	0.25 - 0.35

GRAINS, BEANS & RICE	T	A	B	C
Belize yellow corn, bulk (Spanish Lookout)	H	0.245		
Belize yellow corn, bulk (Blue Creek)	S	0.26 only available to already contracted buyers		
Yellow corn/local retail (low volume, Sp Lkt)	-	27.50 / 100 lb cleaned & bagged		
Belize white corn, bulk (Cayo District)	-	28.00 - 29.00 / 100 lb		
US Corn, #2 yellow	H	US$4.8025 / 56 lb bushel		
US organic, #2 yellow corn feed grade	L	US$8.25 - 9.00 / bushel		
Belize soy beans (Spanish Lookout)	L/H	0.43 set price	0.4286 floating price	
Belize soy beans (Blue Creek)	H	0.48 only available to already contracted buyers		
US soy beans, #2 yellow	H	US$9.5675 / 60 lb bushel		
US organic, #1 feed grade soy	L	US$18.50 - 19.00 (futures)		
Belize milo (Spanish Lookout)	-	22.00 - 23.00 / 100 lb		
Belize milo (Blue Creek)	-	0.21 / lb		
Red kidney beans (Spanish Lookout)	H	1.25		
Red kidney beans (Blue Creek)	-	N/A		
Black eyed peas (Spanish Lookout)	H	0.95		
Black eyed peas (Blue Creek)	-	N/A		
Paddy rice per pound (Spanish Lookout)	S	0.38-.51 farm price, dried		
Paddy rice per pound (Blue Creek)	S	0.40 farm price, dried		

SUGAR/HONEY		
Sugar cane, ton, estimate ONLY	L	$42.45
Bagasse, per ton - payment, not estimate	L	$0.25 (price still undetermined)
Honey, 5 gal (approx 60 lbs)	S	$210.00 (CQHPC)
Honey, specialty, 5 gal (approx 60 lbs)	S	$210.00-250.00 (Cayo)

SPECIAL FARM ITEMS			
Eggs - tray of 30, farm price	S/L	4.88 (Sp Lkt)	5.10 (Blue Creek)
WD milk/lb farmer base price (varies by fat%)	H/L	approx 0.51 contract	approx 0.31 non-contract
Raw milk (farmer direct sales)	S	6.00 per half gal	

CACAO		
Cacao beans Organic (MMC) /lb	L	3.00 dried fermented
Cacao beans Organic (MMC) /lb	L	1.00 wet beans
US Cacao beans, metric ton (ICCO)	H	US$ 2,466.67

These prices are the best estimates only from our best sources and simply provide a range to assist buyers and sellers in negotiations.

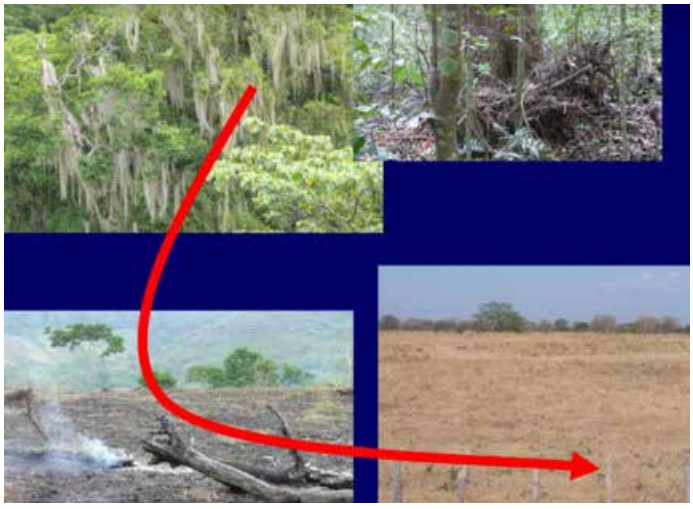
Silvopastoral Systems: A Summary of Dr. Alvaro Cadavid's presentation at Tropical Agriculture Conference

By Daniel Juan

A silvopastoral system (SPS) is a type of agroforestry that allows the intensification of cattle production based on natural processes that integrate trees and shrubs in pastures with animals. SPSs are recognized as an integrated approach to sustainable land use. A well-managed SPS has been shown to improve overall productivity and provide additional economic, environmental, and social benefits for livestock farmers and cattle compared with grass monocultures.

Many farms in Belize have practiced this management system to some degree for many years. Transitioning to SPS requires experimental and practical considerations for choice of plant species and planting distances in specific environments. Belize has many species which are well known and either native or well adapted, including leucaena (*Leucaena leucocephala*), madre cacao (*Gliricidia sepium*), pishoy (*Guazuma ulmifolia*), moringa (*Moringa oleifera*), chaca (*Bursera simaruba*), and mulberry (*Morus alba*) among others. It is common in Belize to find live fences with madre cacao and chaca, and paddocks with pishoy scattered throughout. Often these trees are pruned during the dry season to supplement cattle feed and the residue is used as firewood.

SPS offers a number of benefits. For one, it tries to mimic the original ecosystem as closely as possible. By so doing it reduces man's negative impact on biodiversity. In this regard, as the number of trees increases so do the number of bird species that remain or return to their native habitat. A number of other species such as armadillos, skunks, agouti and raccoons are encouraged to frequent these semi-forested areas. As a consequence wild cats often traverse the fields in search of small prey.



A second benefit is the preservation of water bodies and streams. It is well established that tree cover reduces evaporation from water surfaces and deep roots reduce erosion and are able to tap into a lower water table. These are important considerations given our severe dry spells and potentially hotter and drier climates.

Equally important is the fact that carefully selected tree species afford a great deal of high quality forage to cattle year round. For instance, luecaena, which is native to Southern Mexico and Belize, is extensively used in Colombia for cattle production. Its high protein content affords cattle much needed nutrients particularly during the dry spell when tropical grasses tend to be more lignified with a reduced protein content. Additionally, this specie can be used as fuel in rural areas. Madre cacao is also commonly incorporated as live fences. This specie offers high quality protein to cattle and is an excellent source of lush forage during the dry season, especially if it has been pruned six to eight weeks prior to harvest. Madre cacao is also a very good source of fuel and an outstanding source of very durable post and poles for construction. Furthermore, its ease of establishment from stem cuttings is remarkable.

An additional benefit of having trees in pastures includes higher water retention in top soil due in part to a thicker layer of organic matter from leaves and twigs. This benefit may play an important role in preserving grass growth during drier spells. Furthermore, the benefit of shade for livestock cannot be overemphasized. It is well established that elevated temperatures reduce grazing time and reproductive ability in males and females. It must also be noted that grazing time is related to cud chewing time which in turn is positively correlated to productivity.

Implementation guidelines:

The establishment of silvopastoral systems is a long process because trees take years to establish, but, of course, is specie and management dependent. Shrub type plants such as leucaena are started by seed and transplanted. Seedlings can be transplanted at a height of about 1.5 to 2 ft. and generally at a density of 120 - 140 plants/ha. Madre cacao is planted by cuttings. If these are to be incorporated as live fences it is important to use stems long enough to avoid the growing tips being removed by the grazing/browsing species. For instance, if used in cattle paddocks, stems should be no shorter than six feet above ground. In this way as the growing tips emerge cattle are unable to ingest or break them. If these are intended for sheep and goats the stems need be no taller than three feet although personal observation indicates stems can be as short as one foot without any detriment by grazing/browsing species. Madre cacoa can easily be incorporated into live fences by simply burying stems/posts in between the existing fence line. This has the added benefit of reduced toppling by curious or scratching animals until the root system is well established.

A preferred method of establishment is using electric fences to protect newly planted trees: setting an electric fence/boundary (either battery, solar or standard AC operated) as a perimeter around plants until they are ready to be grazed. Although this

method requires periodic clearing around plants until proper establishment, the grass can be harvested and provided to animals or stored as silage or hay depending on resources and preferences.

It must be remembered that management includes proper record keeping and observation to ensure paddocks are not overgrazed nor under-grazed. If larger trees are incorporated into the system these might require pruning to ensure sunlight penetrates to the ground surface. Depending on the specie the foliage might be fed to livestock or simply allowed to enrich the soil. The branches may be used as fuel or construction material, serving as a secondary income for farmers. Furthermore, farmers must ensure not to have too high a density of plants that contain secondary metabolites that may prove disadvantageous to animals. For instance, leucaena contains the amino acid *mimosine* which can be toxic to ruminants at elevated levels and therefore requires slow introduction of animals to the specie and remaining within recommended planting densities.

In conclusion, silvopastoral systems have multiple benefits; they should be readily introduced to farms that don't have an SPS and improved in those that do. One example of a farm that planted leucaena in its SPS resulted in 4.5 head/ha and 15,000 liters of milk/year. These substantial results should encourage us to consider silvopastoral systems.

Editor's Note: See a video of Dr. Alvaro Zapata Cadavid's presentation on Integrating Livestock and AgroForestry at https://www.youtube.com/watch?v=UVXYqlHmpKk. This was filmed at Regeneration Belize's 1st Annual Tropical Agriculture Conference (TAC), Nov 2018, Belmopan. Find other videos from the 2018 TAC on youtube at the Regeneration Belize channel.

THE FARMERS' MARKET AT BLUE MOON

BUILD BELIZE BY BUYING BELIZEAN

Bread, cakes, meat, vegetables, dairy, cheese, crafts, plants, herbs, spices, flowers, books, fruit, cosmetics, soaps, juices, coffee, chocolate, sausages, bacon, eggs, chicken, fish and more. ***From roots to gourmet.***

EVERY FRIDAY AT THE STATUE ROUNDABOUT IN BELMOPAN 7am to 1pm

Belize Wildlife & Referral Clinic 2018 Highlight: Poached Macaw Chicks Intercepted, Treated And Returned To The Wild!

By Dr. Isabelle Paquet-Duran

As with stories of illegal wildlife poaching and trade, this story starts sadly. Two Scarlet Macaw chicks were poached in the Chiquibul by a group of illegal trespassers. Thanks to the amazing Friends for Conservation & Development (FCD) Chiquibul rangers, the poachers were intercepted shortly before the Guatemalan border. While some individuals managed to escape in the encounter, 2 young men were arrested. In their possession were several illegally hunted game birds and two live Scarlet Macaw chicks.

FCD rangers immediately informed the main office, who then contacted Dr. Isabelle Paquet-Durand, the field veterinarian of the Scarlet Macaw Conservation Project. So by the time the trespassers, their illegal merchandise and the live chicks reached the police station in San Ignacio, Belize Wildlife & Referral Clinic's (BWRC) wildlife vet was already waiting to receive the precious chicks. After 24 hrs of stabilization, a full health check revealed no serious injuries. The chicks responded well to rehydration and accepted their new diet. The good news: while the chicks had received an inappropriate diet for 4 days, they responded well to the switch to a proper diet. To the really amazing twist: thanks to the seamless cooperation between FCD, police and BWRC and careful handling of the chicks, they were not injured; so strict quarantine under veterinary supervision could be considered. Due to the fact that they were poached outside the monitored area, BWRC could not determine their exact location of origin or find their parents. But, did you know that under special conditions fostering can be done with macaws (and other species as well)?

FCD's research team, under the leadership of Boris Arevalo, has been monitoring a number of nests in the Chiquibul. Therefore, we knew that there was a nest with similarly aged chicks into which the rescued chicks could be inserted. After receiving green light from the vets, and with permission from CFO and CEO of the Forest Department, we inserted the chicks into a foster nest in less than 72 hours.

To end this story quite unlike it started: the new parents fed their adopted chicks within less then 4 hours and successfully fledged their foster chicks a few weeks later! It does not get better than that! After years of losing chicks as a result of poaching this was a first successful arrest with live chicks and a complete turn around from certain death to flying free over the Chiquibul. And we hope that capturing and prosecuting the poachers will deter further poaching.

About BWRC: BWRC is a veterinary teaching clinic and wildlife rescue center located near Unitedville on the George Price Highway. Founded in 2011, BWRC's vision is "Sustainable development and wildlife conservation in cooperation". BWRC's mission is "to support wildlife conservation, animal welfare and the veterinary profession in Belize with veterinary care, rehabilitation and education for future generations".

BWRC works under a memorandum of understanding with the Forest Department's wildlife program; the activities include a veterinary teaching clinic for non-domestic and domestic species. BWRC provides veterinary care and surgery for all wildlife species and rehabilitation for many species. BWRC provides free veterinary care with the goal to return as many wildlife patients to their wild home as possible. BWRC has a 24/7 phone line to answer questions about wildlife in need or wildlife giving humans trouble (615-5159 or 632-3257 or email bzwldlifeclinic@gmail.com)

BWRC engages in outreach and training of governmental and non-governmental partners, supports a number of projects in the field to work towards the greater vision of coexistence. As a registered not-for-profit business, BWRC finances its operations and 4 local staff through fundraisers, grants, donations, international student courses and domestic animal referral services.

2018 had many highlights and in total BWRC veterinarians and staff cared for 526 wildlife patients in 2018, a value of Bz$56,326.65 of charitable veterinary services. Since 70% of BWRC's patients are victims of human interference, whether illegal trafficking or human wildlife conflict, BWRC's most important activity is educating the public. We were especially excited about Wildlife Ambassador Program, which commenced in Oct. 2018 with a 2-day training workshop for Belize enforcement agencies and 20 selected community ambassadors. Further BWRC events in support of conservation efforts were the 2nd Chiquibul Challenge Marathon and Cayo Race for Conservation.

Please do not hesitate to contact BWRC with any questions you may have regarding wildlife conflict, crime or emergencies. For ways to help, check out our website www.belizewildlifeclinic.org or call 615-5159.

Sorosi: Bitter Melon

By Karin Westdyk

Sorosi, often spelled cerasee, is commonly known as bitter melon for good reason. Along with aloe vera and neem it is one of the bitterest herbs in the pharmacopeia of plant medicines in Belize. In some places it is called balsam pear and goes by a number of other names, but its universal Latin name is *Momordica charantia* and is a member in the cucurbitaceae family, along with cucumbers, gourds, pumpkins, melons, and squash.

The bumpy green oblong fruit of sorosi grows on a creeping vine that climbs fences and walls and spreads out over land. It easily reseeds itself and is considered an invasive by some, so careful pruning is key. The vine bears simple pale yellow flowers, both male and female. It is the female flower that morphs into a spectacularly coloured bright orange fruit when fully ripened; the fruit bursts open to reveal an incredible display of crimson red seeds encased in a soft bright red pulp. The seeds spill to the soil providing a continual supply of one of the most interesting under-utilized and seriously bitter medicinal as well as edible plants of Belize.

Not native to Belize, sorosi is believed to have been brought here indirectly from Africa via slave trade with Brazil where it is still commonly used as a tonic for colds and flu. From Brazil, its seed and knowledge spread north throughout Latin America and the Caribbean. Sorosi is also known and used in Mediterranean countries as well as the Middle East and parts of Asia.

Ayurvedic medicine is a 5,000-year-old system of natural healing and sorosi is one of the most important herbs used in treating diabetes*. Research studies suggest that sorosi stimulates the pancreas to produce more insulin. In traditional Chinese medicine a tea from the root is used to get rid of kidney stones. It is also used as a tonic for the prevention and treatment of parasites and for menstrual disorders, as well as a toning herb after childbirth. A sorosi bath is used to treat ticks and lice, as well as sores and rashes of the skin, including psoriasis. And it is said that sorosi will ease the pain associated with arthritis or rheumatism.

A tea made from the vine is used for high blood pressure, to cleanse the colon, for dysentery, for easing stomach pain and cramping. It is also used as a laxative, and ironically, as a remedy for diarrhea. It is used to treat malaria, for purifying the blood, and in some areas it is also used as a form of birth control.

In China soresi is used as both medicine and food. All parts of the plant are edible. A good source of dietary fiber, it is low in calories, but rich in vitamins A, B, C, E and K as well as folate, zinc, potassium, calcium, magnesium, iron, and phosphorus. It is used in salads and in simple stir fry dishes where it is cooked in oil over a high heat while adding salt as well as sugar to neutralize the bitterness.

In India, a popular dish, known as Karela is prepared by first soaking the sliced and seeded unripe green fruit in salt water to remove some of the bitterness. After squeezing out most of the liquid, it is sautéed in oil and then fried with curry, onions, tomatoes, cilantro, chilies, garlic, ginger, and powdered chili and turmeric. In the Philippine Islands, cerasee is cultivated as a vegetable and cooked like other leafy vegetables.

Though it is an important and nutritional food consumed in many cultures, the medicinal value of soresi is just being explored and will likely surpass its value as a food. It is being studied as a cancer cure at the University of Miami School of Medicine where an element called guanylate cyclase found inside the ripened fruit has demonstrated the ability to inhibit the growth of cancer cells caused by chemicals. In another study at Memorial Sloan Kettering Cancer Center in New York, sorosi has demonstrated anticancer, lipid-lowering and antiviral effects in animal and in-vitro studies and is being considered as a possible cure for leukemia.

**Sorosi may hide the true sugar content in both blood and urine. So, it is recommended that you consult your doctor before taking as a treatment for diabetes.*

Black Sapote
By Deborah Harder

Though originating in Central America, black sapote is still quite unknown in Belize. Usually called "chocolate pudding fruit", the power of suggestion is necessary to extract any true chocolate flavour from it. But it has its own pleasant flavour.

The tree is attractive and a good shade tree, with dense, shiny, dark green foliage. The fruits resemble large green persimmons, with black flesh that is soft when ripe.

Cultivation - Grafted plants can bear in about two years. They are valuable because they produce abundantly in the winter, November through January, when few other fruits are in season.

Use - The fruit needs to be picked when mature, but hard and green. Ripe fruits fall and smash on the ground. We pick them by the bucket in season and eat them as they ripen in the house. If they are mature, they should ripen in one to six days after picking. To determine if they are mature on the tree, you may be able to see that the colour loses its darkest green shade, gaining a slightly more yellow tone, and also that the "cap" on the stem end of the fruit lifts slightly around the edge.

The soft flesh, which has a rather bland flavour, can be mixed with almost any fruit or flavouring such as vanilla or cocoa along with milk, cream and sweetener, to make a pudding-like dessert. With cream and vanilla, close your eyes and you'll think you're eating whipped cream. Try layering it in a glass dish with other coloured fruits and cookie or cake crumbs for a dramatic trifle. The flavour blends well with bananas, so we mash the two fruits together; no other sweetener is needed. Eaten with granola and milk, this combination is a breakfast staple for us in the winter.

Black Sapote Pudding (Serves 6)
2 ripe black sapotes
Milk, cream, or a mixture
Sweetener to taste, or mashed bananas
Optional flavouring: vanilla, cinnamon, mint extract, cocoa

Cut black sapotes in half. Remove seeds if desired. Greener black sapotes may be peeled; riper ones must be scooped from peel. Place cleaned fruit in bowl and stir in milk, cream, sweetener, and flavourings as desired.

Eggplant, 'The King of Vegetables'

By Mary Susan Loan

Eggplant (*Solanum melongena),* also known as aubergine in the UK, berenjena in Spanish-speaking countries and brinjal in India, or garden egg, is one of over one-hundred plant species of the *Solanaceae* nightshade family, which includes tomatoes, potatoes and peppers. Botanically, eggplant is actually a fruit, which is considered to be a vegetable. Eggplants are grown in many varieties and sizes, including classic egg, pear shaped, oval, pumpkin shaped, oblong and round. Colors of the fruits range from white, yellow, orange striped, white and pale purple striped, pale to dark purple, to nearly black. A dark purple egg-shaped 'Black Beauty' is the most recognized and widely grown variety. 'Black Magic' is considered to be one of the most nutritious varieties.

Eggplant, wild and cultivated, is believed to have originated in India, then spread to tropical and semi-tropical regions of the world. The first record of eggplant cultivation is an ancient Chinese agriculture treatise from 544. Eggplants are perennial plants which are harvested as an annual. Despite eggplant being known as a warm weather loving plant, the state of New Jersey is one of the most productive eggplant growing states in the United States. China holds the eggplant growing record worldwide: over 62%, followed by India, then Egypt, Turkey, and Indonesia. The 2016 commercial global production is estimated to have been 51.3 million tons, grown on approximately four million acres of soil.

Eggplants grow from seed to harvest in approximately eight weeks. Soaking the seeds helps to ensure germination. Starter cups are recommended to grow seedlings to about three inches prior to planting. A rich sandy, loamy soil is preferred. The vines produce strong stems and green leaves with a soft velvet feel. The star-shaped blue-violet flowers become the fruit. Although plants are hearty, flea beetles can be a common nuisance. A popular treatment to rid flea beetles is to mix one cup of isopropyl alcohol with 3 cups of water, gently mix in about one tablespoon of liquid soap, then spray the plants. Growing in damp conditions may create powdery mildew, which may be controlled by watering evenly and cutting off affected leaves. Keeping the garden weeded and avoiding overcrowding helps prevent powdery mildew.

Eggplants grow on a strong sturdy vine to approximately 18-30 inches from the ground. Staking the plant can help prevent the vines from falling over and breaking when they are heavy with fruit. The fruits are firm and shiny when ripe and should be cut, rather than pulled from the vine, as they are firmly attached.

Eggplants are very nutritious; they are rich in anti-oxidants, flavonoids, fiber, potassium, magnesium, and vitamins B6 and C. Leaves of the eggplant can be harvested to cook as a vegetable, or used as a kidney detoxifier. It is said the raw leaves juiced or chewed are the most effective. A tea can be made by boiling about one cup of chopped leaves in a quart of water for a few seconds, then filtering the tea to drink three times per day. Eggplant leaves are said to help kidneys to filter blood. They are used regularly in both Japan and Nigeria: www.finelib.com/abouttropicalfruitsandvegetables. A gentleman in Belize City with kidney disease contacted the *Belize Ag Report* seeking eggplant leaves for tea as a substitute for dialysis as is done in Japan. Cristo Rey Cayo farmers have been generously supplying eggplant leaves for him. Information about the use of eggplant leaves to help clean the kidneys can be found on-line.

Ratatouli, eggplant casseroles, baba ganoush, and eggplant sandwiches are favorite eggplant recipes. Small chunks of raw eggplant can be added to salads, even eggplant 'bacon' can be made by marinating, then dehydrating the eggplant until it is crispy. Here is a very simple baba ganoush recipe. Heat oven to 400 F. Wash, then cut about 12 slits around an eggplant, cut one or two garlic cloves into small slivers and insert into the eggplant slits. Wrap the whole eggplant in a large sheet of heavy duty aluminum foil, with a little twist on top. Bake the eggplant for about one hour until it is soft. Once it is cooled, cut off the top, then peel back the skin. Mash the pulp and some of the peel with a fork until it is all mashed, squeeze juice of 1/2 lemon, drizzle a little olive oil over the top, sprinkle with salt and pepper to taste, then mash a bit more. For a creamy puree version, place the eggplant pulp and seasonings in a food processor. Sprinkle the top with paprika and a few sprigs of cilantro before serving. Serve with cut up veggies, bread or crackers.

For a quick and inexpensive beauty aid, whir up one cup diced raw eggplant, skins on, in a blender with two cups water until well blended, strain off the water, save the eggplant water and pureed pulp. Mix the pulp mixture with about a tablespoon of honey, apply to skin and allow to dry for about twenty minutes, then rinse. Save the eggplant water and store in the fridge to use as a facial toner. This facial or hand treatment is said to help fade freckles and age spots and reduce wrinkles. The liquid from the eggplant puree is very tasty and could also be used in a smoothie or soup recipe.

Eggplants can be found in the San Ignacio open air market year-round. Eggplants can be grown in containers or in your back yard garden in Belize year round.

If you are fascinated by eggplant please check out *World Vegetable Collection* on-line for a wealth of interesting information about eggplant.

Please contact me for the eggplant 'bacon' or other eggplant recipes. loanmarysusan@gmail.com

Yalbac Ranch and Laguna Seca Timber Nursery

Nurseries are not required of sawmills, by the Forest Department nor the Forest Stewardship Council (FSC); nevertheless, owners of Yalbac Ranch and Laguna Seca, private working forest lands located in the south west corner of the Orange Walk District, set a good example. They have a voluntary commitment to the principles and criteria of the FSC for sustainable forest management and are constantly protecting the plant, animal, archeological and other natural resources within an area of approximately 236,108 acres, roughly two and half times the size of the Mountain Pine Ridge Forest Reserve. They have 10 year sustainable forest management plans. They harvest sustainably and are committed to replanting the same number of trees that they harvest from their forest that covers 10 square kilometers (4 square miles). They began their nursery in 2014 as a reflection of their commitment to be good stewards of their forest.

The number of plants in their nursery varies from 3,000 to 10,000 plants depending on the success of seed gathering. That is the number of new trees planted each year.

Not only do they plant Mahogany, but also secondary hardwoods such as Santa Maria, Cabbage Bark, Jobillo, and many other species of hardwoods. In the past Mahogany was the only specie that any attention was paid to by most people who planted trees. Yalbac decided to increase the number of species to develop a larger variety of species and more choices for lumber. So by and large, the tree species that are harvested are replaced.

From their work force of about 70 people, Yalbac dedicates two employees to gather seeds throughout the year, dry them and put them into seed bags to sprout. After the seedlings reach 6-12 inches growth, they are set in the forest during the rainy season along the skidder and truck passes and in barquediers. No fertilizer is used to start the seedlings. Yalbac uses GPS to identify the locations of new saplings and updates their maps to make it easy to find the saplings. After six months the employees return to the saplings to see if they need a little help such as light chopping around the plant.

Strangely enough the most challenging thing about maintaining their replanting program is not in the seed gathering, seedling production, sapling planting or care, but rather in the high tax rates that were recently put into effect on large tracts of private land. The tax rates are not categorized to take into account large-scale, non-developed working timber land nor the long, 50 year harvest cycle of timber land, which is vastly different from large-scale, developed farm land, such as row-crops which yield income semi-annually. Some owners like Yalbac are facing the possibility of having to sell off tracts of land due to the onerous taxes. That would be a travesty because it would likely mean the end of forest cover on them, with very negative impacts to Belize's priceless watershed network.

University of Belize Central Farm: Vegetable Grafting

By Sergio Gomez, Senior Agriculture Technician, Agriculture Engineer, University of Belize Central Farm

The University of Belize Central Farm hosted the first of a series of workshops intended to increase the knowledge of students and industry professionals. On March 1st and 2nd the university hosted its first workshop on vegetable grafting. The workshop was a successful learning experience for 75 students and industry professionals. Vegetable grafting is a relatively new technology to Belize but is widely utilized in Asia to improve plant production, reduce susceptibility to disease and increase plant vigor. Commercial production and demand for grafted vegetable plants continue to increase across Asia and Europe. In Central America countries like Guatemala and Honduras are becoming increasingly aware of its attributes and potential to manage soil borne diseases and adverse soil conditions.

According to the director of the University of Belize Central Farm, Dr. Roxana Alvarez, "As the world moves towards climate smart agriculture that forces humanity to be conscious of our use of resources as we strive to gain food security, we must evolve our processes and adopt proven technology. As a university, it is our responsibility to be trendsetters and leaders in education; for these reasons we invested in the vegetable grafting training session with the objective that new entrepreneurial and sustainable production ideas can be explored. The partners invited were those considered crucial in the agriculture sector. They are those persons on the frontline of ensuring that there is increased productivity, enhancing resilience in these challenging times and working at reducing greenhouse gas emissions caused by agriculture. Farmers, extension officers, agriculture students, high school agriculture teachers, ITVET and members of Pro-Organic Belize successfully participated in the vegetable grafting training session."

Participants were able to address questions and practice on their grafting techniques. Presenter at the workshop were leading experts in the field.

Mr. Bruce Hicks, is an agriculture professor and department chair from Butte College, California. As a Certified Crop Advisor (CCA), has been active as a crop consultant in California and for USAID international agriculture projects. Mr. Hicks is currently working in Belize, at the University of Belize Central Farm teaching soil science and assisting with the crop production classes as a Fulbright scholar.

Mr. Eric Gutierrez-Benites is an agriculture instructor at Zamorano University; he has an M.S. in Plant Breeding and Plant Genetics from the University of Wisconsin and B.S. degree from Zamorano.

Dr. Ravishankar Manickam is the Scientist and expert at vegetable grafting at WorldVeg headquarters. He previously worked as a Research Site Coordinator at the WorldVeg South Asia office for eight years, focusing on grafting training and participatory technology development. Ravi also served as an assistant professor at Maharana Pratap University of Agriculture and Technology in Udaipur, Rajasthan, India from 2006-2008. He holds a PhD in Nematology from the Indian Agricultural Research Institute.

According to Mr. Hicks, "Solanaceous vegetables such as tomato, pepper & eggplant and cucurbit vegetables watermelon, cucumber, cantaloupe can be grafted with rootstocks to enhance resistance to devastating soil borne pathogens such as bacterial wilt, nematodes, and fusarium. This workshop is most likely the first exposure to vegetable grafting in Belize.

Fungal & bacterial pathogens as well as parasitic nematodes are responsible for substantial crop losses, sometimes complete crop failure. These pathogens flourish in warm, humid climates such as Belize. Once present in the soil, fungal and bacterial pathogens as well as parasitic nematodes persist for many years.

Grafting rootstocks with disease & nematode resistance onto scions with desirable market qualities is a potentially profitable method but grafting is not suitable for all farmers. Grafting is expensive but proven to be effective in many countries when soil borne pathogens are present."

According to the World Vegetable Center, "Grafting vegetables can protect crops against a range of soil-borne diseases and can improve crop tolerance to flooding during the hot-wet season. We (the Center) have developed effective grafting techniques for tomato, eggplant, chili, sweet pepper and several cucurbits. Vegetable grafting is used by farmers in Taiwan, Japan, Korea and Vietnam and there are good business opportunities to expand this method to other countries."

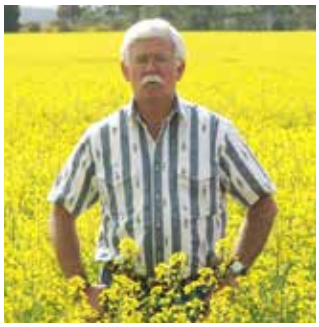
A Note from Neal Kinsey

Editor's Note: Last fall we asked Neal for some reflective comments about the then upcoming *Transforming Tropical Agriculture Conference* ***hosted by Regeneration International and Regeneration Belize. Shortly after that, the name was shortened to*** *Tropical Agriculture Conference (TAC).* ***Please bear with us then, as Neal uses the original name and also the future tense. Although Neal was unable to join us last year or this year, he has the 2020 TAC dates penciled in to present at the 2020 event and hopes to lead one of his 3- day soil fertility courses while in country.***

So sorry I could not be a part of the upcoming meeting in November, Transforming Tropical Agriculture. I appreciate your choice of one big word in that title, as when you look at the various meanings of a transformation, there is one that certainly applies to agriculture. Transformation - a marked change for the better. Even with such educational meetings, transforming can sometimes be a very slow process.

I will give just three examples to consider here.

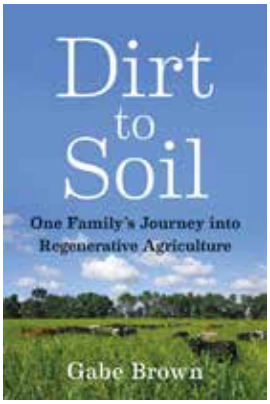
The first example concerns the use of compost and manure. Though the area is relatively flat farming country, back where I grew up there were numerous dairy and pig operations. But I recall being taught in my eighth grade agriculture class that manure was no longer worth hauling out of the barn. Just give it away to whoever will take it to get rid of it because you could buy and spread fertilizer for less money. When prices and yield potential went up, farmers felt they could make more money growing grain, and by the time I began consulting in 1973, those who were my clients had very little livestock. As we began programs to help understand soil fertility, there was little manure for use but the principles and value from using manure were still included. Though many thought this was a waste of time because, "nobody has much access to manure anymore" those who listened and learned were eventually able to make a major transformation in their farming program that others were not able to accomplish. When the poultry industry moved into our area, most farmers were not aware of its value in terms of building fertility and when contacted did not want to contract for any of it. But the farmers using our program knew how to value the manure and saved money on the cost of fertilizer the manure contained and made even higher yields as they increased both fertility and organic material to feed the soil organisms By the time others learned of its value there was virtually none available. Educational meetings, and who came to learn and who did not, made the difference.



A second example is the use of cover crops. We have encouraged clients to use cover crops since the 1970's. Most had their reasons not to do so. The seed cost too much. It was too much trouble. Not enough time to deal with all the possible negatives to get crops planted in the spring. Some were excuses, and some were very valid reasons. But in the end, everyone wanted to know how the cost related to the benefits. And normally, none of those benefits counted unless there was enough yield increase to pay for it all! Back then there was very little information of this type, with greatly varied results depending on the abilities of each individual operation. And in all the work that has been done it has shown that many factors must be considered. Some learned what worked for their soils and crops by growing various types of cover crops and learning how to work with them - still coming to meetings to see if they might find something better. Yet because of all the meetings, trials and farmer experiments, and the willingness of those who began to learn from those meetings to share their results, many are now finding they can use cover crops to increase yields of soybeans by as much as ten to fifteen bushels per acre and corn by as much as 20-30 bushels per acre. Not many years ago that was theory, but today there are farmers who grow crops on hundreds to thousands of acres who report these kinds of yields from use of cover crops. It has been meetings like Transforming Tropical Agriculture that have helped greatly in making this type of information possible and usable.

Continued on page 27

Dirt To Soil By Gabe Brown
A review by Chris Harris



This book is subtitled "One Family's Journey into Regenerative Agriculture." The theme of regenerative agriculture really is the essence of this book. Now before you readers fall asleep or turn the page, allow me to make a bold statement. This book should be compulsory reading for ALL farmers, from the multi-thousand acre ranchers right down to the mom and pop farming just a few acres. A bold statement. Yes, perhaps, but read on and see how Gabe Brown's proven farming technique has benefited him, his pocket book and most importantly of all, the health of the people who eat the food he produces.

So where to start? A much-loved British TV gardener called Percy Thrower became famous for his catchphrase on his weekly programme back in the sixties. He used to say in his west country accent, " Oi think the answer lies in the soil". What Gabe Brown has done in this highly readable book is to show that some sixty years later, long gone Percy Thrower was right. And Gabe Brown has proved this not by science or learned books, but by trial and error on his own farm, and subsequently on farms all across North America and lately, beyond.

So this is his story, and it begins as you might expect with the soil. He starts with what will sound to many as a revolutionary idea. He calls the idea "no till" meaning no ploughing. He has shown that disturbing the soil breaks the texture and damages top soil. The topsoil as we all know contains billions of microbes and bacteria and long tiny filamental roots of mycorrhizal fungi. The length of some of these micro filaments may reach a total of thousands of miles (yes, you did read that right, thousands of miles!). All these soil organisms recycle carbon from the atmosphere (is this starting to ring bells?) and provide the nutrients that plants need to develop and grow. The point being the more underground life there is, the more nutrients are available and the more nutrient dense plant growth there will be.

So what is the alternative now that we have all parked our tractors and tillers? This is where Brown introduces the concept of cover crops which are intended to keep life going over what would otherwise be bare earth or unneeded weeds. Hah! We all know about cover crops don't we? But here again Brown introduces a new idea. Instead of using a cover crop of say peanuts, millet or beans, why not plant ALL of them together? Brown, as is his normal practice, experimented on his own farm, and found that a polyculture of six, eight or ten different cover crops grew way better than a single monoculture. He also explains why.

The sharp-eyed reader will have by now realized that cover crops have other significant benefits. Using what is essentially a field-wide mulch means weed suppression that in turn means no need for herbicides. It also means a major reduction and ultimately discontinuance of costly fertilizers. Brown points out that fertilizers actually damage soil, because they allow plants to take up nutrients directly through their roots, thereby bypassing the underground nutrient uptake which is so important for organic soil content improvement. The other advantage is that cover crops can be grazed by animals or harvested as feed. And all the time the unseen filaments are spreading underground, gathering nutrient-forming aggregates that hold water instead of the water draining away, and generally increasing the organic composition of the topsoil. All of this is recorded in Brown's trial (and error) history of work on his and other farms.

Introducing revolutionary concepts needs careful and complete explanation backed by the practical experience of this farmer and a growing number of farmers if they are to be credible. This book lends great credibility to the concepts of no-till and polyculture covercrops.

So is this all this book has to offer? By no means. The last couple of chapters make sobering reading for those of us concerned with the direction food production is proceeding on a national scale, not only in Gabe Brown's homeland (USA) but even more so here in Belize. It will be very hard for major farms to convert overnight, indeed perhaps ever. But here is an opportunity for smaller farmers to make a significant change to their profitability and to the quality and yield of the produce they grow.

Reviewers often describe books as "I could not put this book down". OK I admit it, I **did** put this book down, twice actually. But during both reading sessions my cup of tea went cold, untouched. I really enjoyed reading this book and I already have plans in place to implement what I have learnt. Anyone want to buy a rotavator/tiller?

Neal Kinsey... Continued from page 26

The last example is one that might not have come about without farmers meeting together with different ideas about how to farm. About one-third of our clientele uses some type of organic fertility program; the other two-thirds use some type of conventional fertility program. At meetings both groups are welcome to come and learn the principles they may find to be helpful. We strive to help all types of growers do their best with the program they employ and many growers representing both types of programs are often present.

During the last big spike in fertilizer prices, several of our local clients had already heard at our meetings about how the use of rock phosphate could at times be used to substitute for commercial P fertilizer. When commercial P went up, rock phosphate did not increase accordingly in price. In many cases it then required less money to build up the P levels with soft rock than pay more for a corresponding amount of commercial P. By listening to ideas at meetings which many thought would never apply to their farms, they saved money, maintained or increased yields and learned when such materials could continue to work better for them.

To me, this is how farmers transform their farms. It involves learning as much as we can about what others are doing to change our land into better soil, to grow better plants and increase yields for better income potential. Keep up the good work!

AG BRIEFS

REGENERATION BELIZE

Regeneration Belize and Regeneration International will present the 2nd Annual Tropical Agriculture Conference, on 11-12-13 November 2019 at the NATS grounds in Belmopan. Admission is free and all farmers are encouraged to attend. **See page 9**. Email regenerationbelize@gmail.com or visit Regeneration Belize's Facebook for updates.

On 19th of March, 2019 **a biochar workshop** was hosted by Regeneration Belize (RB) and presented by Christopher Nesbitt, Director of Maya Mountain Research Farm and recent recipient of the Commonwealth Innovation Award (see pg 3).

Forty-nine persons from various ag sectors such as Ministry of Ag, CARDI, SIRDI, RB members and other interested folks gathered at The Bluffs, mile 1 ¼ , Cristo Rey Rd, Cayo District to learn some biochar basics. Nesbitt, protégé of world-renown biochar author/ expert Albert Bates, shared a power point then loaded up the home-made biochar furnace fabricated by Cayo's AMS welder Art Wagar. After burning for several hours the biochar burner was doused with water to stop the pyrolysis (burning without oxygen). Biochar increases the carbon in soil. It has an extraordinary amount of surface area for its mass, making it ideal housing for microbes, vastly improving soil fertility.

The Mayan Alliance for the Bees of the Yucatan Peninsula, has asked their Agrarian Prosecutor's Office to declare a state of emergency, after massive fatalities of bee colonies, attributed to both deforestation and aerial spraying of pesticides. A spokesperson for the Mayan Alliance for the Bees stated that "Since these [soy and milo fields] are transgenic [GMO] monocultures, and they are very large, they use more pesticides.... killing everything in the surrounding areas".

"If the bee disappeared off the surface of the globe, then man would have only four years of life left. No more bees, no more pollination, no more plants, no more animals, no more man."

Albert Einstein

Local and Regional Fuel Prices

★Same

	Cayo, Belize	Quintana Roo, Mexico	Peten, Guatemala
REGULAR	↓$10.00 Bz/Gal	↓ $7.78 Bz/Gal	↓ $7.77 Bz/Gal
PREMIUM	↓$11.23 Bz/Gal	↑ $8.36 Bz/Gal	↓ $8.14 Bz/Gal
DIESEL	↓ $9.89 Bz/Gal	↑ $8.40 Bz/Gal	↓ $7.18 Bz/Gal

During the week of June 25-29, 80 participants representing 19 countries participated in the **IUCN/SSC-Crocodile Specialist Group (CSG) Regional Meeting** at The Placencia Resort, Placencia, to discuss country status updates of conservation, management and research issues in the Central America and Caribbean region. The theme for the CSG's meeting was "Regional Conservation through Collaboration." The meeting aimed to bring together and provide networking, collaboration and support opportunities for key stakeholders and experts. The meeting showcased current knowledge on topics such as crocodilian management (i.e. human-crocodile conflict, scientific research, population survey techniques, habitat monitoring), sustainable use, and policy within the sub-region that will not only be beneficial for regional crocodilian conservation, but also for long-term management of biodiversity within crocodilian habitat.

The Belize National Library Service and Information System recently hosted meetings at various libraries all over Belize, which presented the *El Pilar and Forest Garden Exhibit*; Dr. Anabel Ford and master Maya forest gardener Mr. Narcisso Torres brought plant samples and showcased the 20 most valuable Maya forest garden plants. Dr. Ford also shared **a thought-provoking video on 'countermapping', featuring Jim Enote, a traditional Zuni elder, farmer and director of the A:shiwi A:wan Museum and Heritage Center in Zuni, New Mexico.** Countermapping challenges the notions of what maps are about. If you watch one video today, make it this one. https://www.globalonenessproject.org/library/films/counter-mapping Another video, about Belize's El Pilar Maya site, can be found at: https://vimeo.com/163885061 *Parents: take your kids to our public libraries for exciting, educational, and safe summertime (or anytime) activities. Reading opens minds.*

REDD+ (Reduction of Carbon Emissions from Deforestation & Forest Degradation) launched in Belize at the San Ignacio Hotel on 23rd May 2019. Minister Omar Figueroa shared the Forest Strategic Action Plan for 2019-2023 and discussed the REDD+ Project. More details about this in our online word press version.

The Belize Bureau of Standards (BBS) and BAHA (Belize Agricultural Health Authority) celebrated World Food Safety Day and World Accreditation Day with an excellently attended forum on 7th June in Belize City. Members of various GOB bodies including PCB (Pesticides Control Board), Min of Health, BAHA, BTB (Belize Tourism Board) and several key agricultural producers including BelCar, BPA (Belize Poultry Ass'n), Running W Meats and Marie Sharp's Fine Foods participated. Recurring comments at the meeting pertained to the illogical situation whereby Belizean producers monitor exports for residues and contaminants, yet we have no formal protocols in place to monitor many imported and domestic foods, notably fruits and produce, for the domestic consumer, including our tourists.

For Information on the status of the

IGUANA CREEK BRIDGE

waters rising or falling, out of water, under water, go to iguanacreekbridge.blogspot.com

The Iguana Creek Bridge crosses the Belize River near Black Man Eddy Village, off the George Price (Western) Highway.

Old but Still Interesting News-History

The USDA (United States Department of Agriculture) and WR Grace Company were issued a patent by EPO (European Patent Org) in 1994, for the Indian subcontinent's neem tree (Azadirachta indica), to control fungus. This patent was revoked in 2000, under pressure from the Research Foundation for Science Technology & Ecology (RFSTE), led by Dr. Vandana Shiva, former Belgian Health Minister, Ms. Magda Alevoet and IFOAM (International Federation of Organic Agriculture Movements). After a lengthy appeal, in 2005, 11 yrs after the initial patent, the EPO upheld the revocation of the patent. The reasoning for the revocation was that it was proven that the fungicidal properties of neem were understood and widely used in India for over 2,000 years; USDA and WR Grace had presented the patent application posing as the original discoverers of neem's anti-fungal properties.
This type of patenting is known as **Biopiracy**; Dr. Vandana Shiva's book, *BIOPIRACY* is aptly subtitled "*The Plunder of Nature and Knowledge*".

Why was glyphosate, the active molecule in RoundUp™, created? In 1961, the Stauffer Chemical Company patented glyphosate in the US as a 'descaling agent'; its primary use was in cleaning calcium and other mineral buildup off of boilers, pipes and ships etc. It works because glyphosate is a 'mineral chelator' – that is, it binds minerals such as calcium, magnesium and heavy metals, starving weeds and plants not designed to withstand glyphosate. In 1970 it was discovered to be an herbicide by Monsanto scientist John Franz so an additional patent was registered to cover this use. In 1974 Monsanto began marketing glyphosate as RoundUp™. In 1985 the EPA (US Environmental Protection Agency) classified glyphosate as a 'Class C Carcinogen having "suggestive evidence of carcinogenic potential". Effective lobbying by Monsanto resulted in a change to that EPA classification in 1991, from the Class C to a Class E, which suggests "evidence of non-carcinogenicity for humans". RoundUp™ and other glyphosate products became and currently remain the world's most used pesticide. This is also Belize's #1 imported pesticide of any type. In 2015, the World Health Organization (WHO) body, IARC reclassified glyphosate into group 2A, "probably carcinogenic to humans". Monsanto continues to fight this; however, recent court cases have come out against Monsanto, awarding punitive damages up to $1 B USD (one billion US $) per litigant, who have claimed that use of glyphosate products resulted in them contracting and suffering from Non-Hodgkins Lymphoma. Over 1,400 lawsuits await litigation. In 2016 Monsanto was purchased by Bayer for $66B US$.

Please go to our website, agreport.bz for an expanded Ag Briefs in the wordpress version. More exciting ag news there include: An update on the BAIMS (Belize Agriculture Information Management System; Sorrel as a hospital disinfectant; Use of Ozone for fresh fruit pathogens; Freshfruit component 'rutin', fighting effects of viper venom; Guatemalan intensification of palm oil farming & resulting family migration patterns; Belizean soybean oil export to Jamaica; Chitosan (shellfish coating) shines up fruits & produce; Tamarind's surprising health benefits, including removal of fluoride from bones; A new Ramon (Brosimum alicastrum – aka maya nut) cooperative in Western Belize; and more....

Central Farm History...Continued from page 11

A veterinary officer, Mr. R. M. McKenzie, was appointed in June, 1958 and took up residence on Central Farm. In addition to clinic services he was in charge of the Livestock and Pasture Investigation Unit. There were four separated herds of cattle being maintained on an experimental basis: (1) Red Poll, consisting of 24 cows, 8 heifers and 3 bulls, (2) Brahman, consisting of 20 heifers and 3 bulls, (3) local, consisting of 32 cows of mixed origin, mostly Jersey and Holstein, and (4) dairy, consisting of 18 cows: 13 Jersey and 2 Red Poll. During early 1959 100 acres of bush were cleared and windrowed. Twenty-two acres were planted with Pangola and divided into four paddocks. One hundred and seventy-seven acres were sowed with Jaragua seed. Twenty-four acres were planted in Guinea grass. Some 3 miles of fencing was put up. The 25 acre block of coconut plants was drained in 1958. Seventy calves were born.

There were a number of resignations in 1960, including the agricultural chemist, the veterinarian, and the farm manager. Mr. D.P.H. Tucker was appointed to be the succeeding agronomist, Mr. S.D. Wilkie, the veterinary officer. Most of the year was spent preparing pastures for grazing trials that were to start in 1961. But 1961 was a disaster; Hurricane Hattie hit the country and all work had to be scaled down.

In 1962 Mr. M.K. Chopin, acting chief agricultural officer, and the headquarters of the Veterinary Section were moved to Belize City with Mr. Chopin acting also as veterinarian officer as Mr. Wilkie resigned. Education Officer Mr. Hill left the country in 1962 as well. The herds at Central Farm continued to show improvement during the year. The calf crop for 1962 amounted to 113 head.

The research division continued conducting a limited program of research into the major economic crops. It was also decided to farm the two national crops, corn and beans, on a commercial basis at Central Farm. During the year the staff conducted an increasing amount of advisory work on citrus, coconuts, pasture and vegetables.

The year 1963 saw the appointment of Mr. E.W. King, formerly attached to the Uganda government as chief agricultural officer; he assumed duties in December. Mr. D.P.H. Tucker resigned at the termination of his contract and Mr. O.O. Orio, formerly farm manager at Never Delay Estate, was appointed livestock officer. Because of a lack of an agricultural chemist or agronomist, no crop research work of significant importance was carried on that year. Research was limited to work on livestock improvement and pasture management carried out under the supervision of the livestock officer.

In 1964 Central Farm continued to be seriously understaffed. Only two specialist officers were stationed at the main agricultural research and development centre of the country. During September the services of an agronomist were secured, and all the essential research work in crop and farm management began again. Throughout 1964 the Department of Agriculture was unable to secure the services of a veterinary surgeon, soil chemist, plant pathologist, or entomologist. During September the Central Farm School of Agriculture, which had been closed since 1961, reopened. In support of the livestock experiment program, another 120 acres of land was cleared and by the end of the year 50 acres had been established as pasture. Breeding of pigs for sale to farmers continued and for the year 59 boars and 48 gilts were sold to farmers for breeding purposes.

In 1965 research programs for crops, livestock and farm managers were expanded. A farm planning unit was set up at the beginning of the year to help the more willing and co-operative farmers over the hurdle of subsistence to commercial farming. The school of agriculture held thirty instructional courses during the year. With the arrival of a Food and Agriculture Organization (FAO) livestock advisor, a vigorous culling of the Brahman and Red Poll herds was undertaken. Jamaica Black and Herefords were imported. On the last day of 1965 specialist staff at Central Farm consisted of the agricultural education officer, an agronomist, a veterinary officer and a livestock officer.

The overall picture of the Department of Agriculture changed in 1966 with the resignation of the education officer whilst on leave in Canada and the contract completion of the agronomist. The Education Section, responsible for crop trials that began in 1965, continued in 1966. The object of their research was to determine the best varieties for different seasons and localities of the major crops including corn, sorghum, rice, beans, and forage crops. Their focus was yield, quality, economic viability, and good crop husbandry and management: (a) devise and establish suitable crop rotation, (b) maintain a close relationship with the extension staff so the results of trials could be put into practice promptly, (c) work with private industry whenever possible, (d) conduct trials at agricultural stations throughout the country, and (e) provide technical advice, lectures, and dissemination of information useful to farmers. The land of individual farmers or groups of farmers was used extensively by the research staff and extension officers for trials and demonstrations as an effective means of teaching good farming practices.

Plans for the future are focusing on livestock: breeding good stock of beef and dairy cattle for sale to farmers. In 3 -4 years the offspring of the Brahman and Brown Swiss that were recently imported for breeding will be for sale to farmers. The program for pigs is a three-way breeding of Large White, Hampshire and Duroc to breed pigs best suited for the climate of Belize.

Ultimately Central Farm will function as the central research station, playing a vital role in the country as it so much depends on its agriculture.