The Belize Ag Report

Belize's most complete independent agricultural publication

Rainfall... pg 14

BE ON THE SAFE SIDE.

Always wear your Personal Protective Equipment (PPE) when using pesticides.

Available at the PCB Secretariat Office.
Mile 64, Central Farm, Cayo District.

PESTICIDE USERS,

when using pesticides,
Protect Yourself!
Protect Others!
Protect the Environment!

GROW SAFE Belize

A campaign by the Pesticides Control Board to promote best practices in pest & pesticide management.

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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 and small. We invite opinions on issues, which are not necessarily our own. Belize Ag neither solicits nor accepts political ads.

From the Field

The Sack is back...

After a year off from printing, The Belize Ag Report is indeed back, with passion for sharing useful ag info and plans for 2 issues per year. Although substantially less than our early years of 5 per year, hopefully one spring and one fall issue is a do-able plan. The mathematicians among you will note that 2024 should have been our 15th anniversary; we'll claim that 15th next year.

The local media are singing the praises of our just concluded National Agriculture and Trade Show (NATS). I well recall attending the 1973 show, as I met my future husband there at that **August** show. Soon after, GoB rescheduled the show to close to the Labour Day (May 1st) holiday weekend. Why? A great many of the southern farmers were unable to reach Belmopan in a timely fashion in August, due to the inadequacies of our roads and bridges during the rainy season. But now, with our vastly improved roads and bridges all over our fair land, why do we continue to hold our largest event during the most sweltering season of the year? Please cabinet, consider rescheduling NATS.

Readers: be sure to enjoy John Carr's article gracing pgs 12-13; find his daughter Leisa's first contribution on pg 28 and John Roberson, Jr's *Old Iron* column on pg 18. Every warm-blooded Belizean, owners of warm-blooded farm animals/pets and enthusiasts of Belizean mammalian wildlife, should study Dr. Roxanna Alvarez of BAHA's article (pg 20) describing the return of screwworm to Central America. If those pests return to Belize, the ramifications could affect everyone, not just the livestock industry.

The Belize Pesticide Control Board (PCB) shares import data: 2014 to 2023 (pg 23). All are up, up, up with glyphosate fighting for 1st place with mancozeb. Imports of pesticides as well as processed foods (often containing residues of toxic pesticides), continue to grow, as are the incidences of many metabolic illnesses. Diabetes in Belize was recently disclosed to exceed 13%. What might the true figure be, including those not yet diagnosed? Connect the dots.

Space does not allow us to brag about all the fine articles in this issue. Please be aware though that we do invite and value contributed articles on any ag-related topic. Without our passionate writers, freely sharing their experiences and messages, and also, without our generous advertisers, there would be no Belize Ag Report.

One of the most frequent questions is "How do we get a copy of the BAR?". Since the BAR is free, and made possible because of our loyal advertisers, we distribute it through them. Also find it online at agreport.bz.

Beth Roberson, Publisher

Letters to the Editor

Know your farmer – know your food

Dear Editor,

This letter is to express our deep concern about the impact of glyphosate and other toxic chemicals on the health of Belizeans. Although the PCB has listed these pesticides on their restricted use list, they are still widely used throughout the country; PCB has no power of enforcement.

Glyphosate formulations, especially, have been researched in hundreds of studies that show serious adverse effects on the environment, including water, on agriculture, and especially on health. As an endocrine disruptor glyphosate has an adverse impact on human health through food which can lead to metabolic diseases.

The specific concern Pro-Organic Belize has for Belizeans is that exposure to glyphosate and glyphosate consumption from food has been shown to develop insulin resistance making it a severe concern to those with type 2 diabetes. Indeed, there is a direct correlation between the use of glyphosate and the incidence of not only diabetes but birth defects, cancer, autism, miscarriages, Parkinson's disease, non-Hodgkin's lymphoma, intestinal disorders, chronic kidney disease (as was clearly proved among farm workers in El Salvador) and many others.

According to a study published in the *Antioxidants Journal*, type 2 diabetes in Belize is the foremost cause of death. The prevalence in the adult population increased from 10% to 17% since 2010. The national prevalence is highest of all countries in Central and South America, and fifth direst in the world. In the study it was found that glyphosate exposure resulted in a rise in H_2O_2 formation, LPO and a reduction in antioxidant levels that results in impact on membrane integrity and insulin receptor efficacy in the liver. Furthermore were reduced levels of mRNA and protein expression of insulin receptor, glucose transporter-2 with concomitant increase in the production of proinflammatory factors leading to pro-inflammation and cirrhosis in the liver which results in the development of insulin resistance and type 2 diabetes.

With such direct evidence, we believe that the Ministry of Health, along with the Ministry of Agriculture, Food Security and Enterprise, should make a concerted effort to ban the use of glyphosate as Mexico and many other countries have done. Bayer, the company that bought out Monsanto, the largest producer of glyphosate products, is a large corporation and pressures governments to not allow these bans but it is our hope that Belize will take the stand that Mexico did for the sake of the health of Belizeans.

Kind regards - Directors, Pro-Organic Belize

Have you a suggestion for an article topic or have a finished article about Belizean agriculture to share?.....

Be a part of the *symphony of agricultural news* in the Belize Ag Report.

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Guest Editorial

By Ed Boles, PhD Aquatic Ecologist

Update on Vulcan Materials Company's Efforts to Mine Limestone Aggregates from White Ridge Hills west of Gales Point Village, Stann Creek District

Vulcan Materials Company purchased the White Ridge Farm Company, and with that purchase, has gained control of White Ridge Farm, including the coveted White Ridge Hills, locally known as Sugar Hills, in the Stann Creek District. This multi-billion dollar company set its sights on these limestone hills that forms the western panoramic vista of Gales Point Village. This historic Creole settlement will be the most immediately impacted community should this Goliath aggregate mining company someday get permission to blast, pulverize, and ship Sugar Hills to the southeastern US for use as road fill.

Vulcan's interest in Belize peaked when the company was encountering pressure from the Mexican government because of the way it was operating its Calica mine just south of Playa del Carmen. After repeated but unsuccessful encounters with Vulcan to get the company to abide by environmental guidelines, the Mexican government refused to renew the mining permit. In response, Vulcan sued Mexico in the World Bank International Center for Settlement of Investment Disputes for $1.1 billion US and won. Mexico is contesting the decision but at significant legal costs involving international lawyers.

The closure of the Calica mine prompted Vulcan executives to move forward with their plans to acquire White Ridge Farm, dredge and build a deep-water harbor to accommodate and turn 228 m or longer vessels with 13.5 to 14 m draft, build a conveyer bridge across the landscape and the largest Hawks Bill Sea Turtle nesting beach in Belize to carry crushed stone to waiting vessels. They also plan to dredge a six-mile long shipping lane within the inner channel leading to the opening in the Mesoamerican Barrier Reef east of Belize City.

Vulcan representatives visited Gales Point Village two years ago to convince people that their operation would provide badly needed jobs. However, the cost of having a large strip mine in operation with continual blasting can disrupt local hydrologic systems in the Southern Lagoon area and threaten the large concentration of Caribbean manatees, as well as Hawksbill Sea Turtles, Central American River Turtles, American Crocodiles, and other fauna. The conveyer bridge carrying crushed material over the sea turtle nesting beach would likely disrupt use of the beach by turtles. An operation of this scale would convert the area, currently considered a prime area for development of tourist facilities, into an industrial landscape that would drive away tourism investment. When Vulcan executives faced angry people who did not want the company to set up operations in Belize, they told the attending crowd that they were going to "cut and polish the Jewel" and assured everyone that they would "take those hills."

Spokes persons for the current Belize government have explicitly stated that no strip mining shall occur in this area, and Minister Cordel Hyde confirmed that decision on May 4, 2022. The current leader of the opposition party (United Democratic Party), Shine Barrow, is promoting Vulcan as a strategy for economic development for Belize. However other members of the UDP were not in favour of engaging Vulcan and indicated they would also push to deny the company a mining permit.

The scale of the project and the removal of karst features/aquifers within the coastal area would also be in violation of the Blue Bond Belize has signed, protecting coastal lands from inappropriate development. It is feasible that Belize could loose tens of millions or dollars if the Blue Bond were to be canceled because Vulcan was allowed to operate in Belize, not to mention the magnitude of environmental damage that would occur and the loss of revenue generation potential from canceled tourism development in the area. Karst ecosystems are growing in conservation importance, not just from the biodiversity limestone-based tropical forests harbor, but also because of the vital role of karst as water-bearing rock. This area is certainly worth more to Belize as an intact ecosystem, a water source, and a scenic view than a source of aggregates for export to the United States.

This is not an issue just for Gales Point Village or even for the Stann Creek District. This is a national issue. Vulcan is a large, powerful, and aggressive company run by lawyers accustomed to having their way. They are determined to exploit Belize and now that they control the very property they are wanting to strip mine, they will likely work constantly to get around the obstacles standing in their way, seek out people in power willing to help them get what they want. They are here for the long term, which means we must remain vigilant and informed of Vulcan's actions within Belize. Indeed, we must be aware of any large international companies looking for a way to access and exploit our resources for their own use, disrupting our plans for the development of Belize. Otherwise we run the risk of entering a new era or colonialism by corporations. Once they set up operations in Belize, we will never be able to get them out without facing international law suits. We do not have the finances to defend ourselves even if we had a fare chance of winning.

Our best defence against the growing interest of Vulcan and other companies like them is awareness. We must stay informed, share information, and press our government officials to make decisions for the benefit of Belizeans over outside corporations coveting our natural resources. Because this is a serious threat to all of Belize, it is a national concern all of us need to be involved in for the sake of not just ourselves, but for future Belizeans.

Publisher's Note: Vulcan Materials Company has been involved in much international litigation. How would Belize fare against a $12 billion USD company?

"A culture is no better than its woods."

W.B. Auden

Guest Editorial

By Bill Smithback

Biofuel: A Current Impossibility in Belize

Biofuel is gaining popularity in today's global push for sustainability and the search for cleaner energy sources, but it is not a novel product. Brazil has been using it for decades. After oil embargoes and subsequent price increases in the mid-1970s, Brazil started the first national fuel alcohol program[1]. Farmers throughout the country were encouraged to grow sugarcane for the express purpose of making bioethanol and the government worked with refineries and auto-manufacturers to implement the program. A mere decade later every new car in Brazil was powered by ethanol. Now cars in the country are built to run on either gas or ethanol, though ethanol is often half the price of gas. Brazil is now the largest grower of sugarcane and 2nd largest exporter of ethanol in the world, exporting 645M gallons in 2022[2]. As a byproduct of this ethanol production, the bagasse is used to supply 15% of Brazil's electricity (similar to the process Belize Sugar Industries uses to provide electricity to Belize).

Biofuels are liquid fuels typically derived from plant materials and are most commonly bioethanol or biodiesel. Bioethanol is made by processing, fermenting, and distilling common agricultural crops like corn or sugarcane, or targeted non-ag crops like switchgrass (*Panicum* spp.). Bioethanol can be mixed with gasoline at a rate of 10% and used in gas-powered vehicles or at a rate of up to 85% in flex fuel vehicles. There is an added advantage of up to 90% lower emissions in flex fuel versus gas vehicles.

Biodiesel is made through a chemical process (transesterification) whereby oils are combined with alcohol and a catalyst and the resulting product can then be used in diesel vehicles, after the addition of certain chemicals. It may also be distilled to achieve an impurity-free fuel that can be used in diesel vehicles without additives. Common sources for biodiesel are corn, soybeans, sunflowers, or even used vegetable oil from restaurants.

For a country like Belize, whose most imported product is refined petroleum ($255M in 2022)[3] and where 100,000 acres are already in sugarcane production, biofuels seem like an amazing opportunity. Yet, current laws make it financially unfeasible. The newly revised (2020) Customs and Excise Duties Act -Chapter 48, states unequivocally that "Undenatured ethyl alcohol of an alcoholic strength by volume of 80% or higher; Ethyl alcohol and other spirits, denatured, of any strength: Bio-ethanol" will be taxed at "$180/Imperial gallon" [Schedule II (Section21) 14 – 2207.10.10][4]. While most countries offer incentives or tax breaks for finding more sustainable ways to do things, Belize has decided to quash the biofuels market before it can even begin.

So, before you start exploring new biofuel markets like jatropha (*Jatropha curcas*), or determine bioethanol yield per acre benefits of sugar cane versus corn, make sure you have customers willing to pay $200 per gallon for their fuel, so you can at least cover your taxes.

1 Rapid Transition Alliance

2 Statista

3 Observatory of Economic Complexity

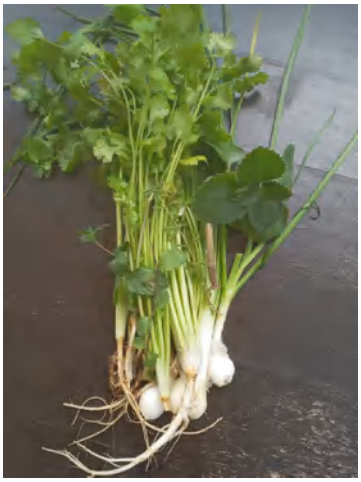
4 Belize Customs and Excise Duties Act (2020 Revision)

Above references are live links in the online version

BEYOND THE BACKYARD

Fresh Culinary Herbs

By Jenny Wildman



Nowadays every supermarket carries a wide variety of dried herbs and spices from across the globe, some packaged in Belize and offered at surprisingly cheap prices considering their long journey. Most are not required for traditional cooking and will therefore probably remain on those shelves past their prime. Locally grown herbs and spices can be easily found at markets such as San Ignacio and Belmopan. The convenience of being able to purchase herbs at reasonable prices and the lack of space to grow them has led to the decline of personal kitchen gardens. An additional reason for the decline may also be that they need attention and as we now live in a busier world there is not much time to lovingly tend a garden.

Herbs can be used for flavouring, food, medicine and scent. The most popular herbs that have been grown at home are peppers, cilantro, culantro, oregano, thyme, basil, mint, lemon grass and parsley. Our favourite food enhancers, habaneros, ginger, turmeric and annatto (as recado) are always available at the market and roadside stands. The use of different leaves as herbs such as celery, spinach, loroco, purslane, and moringa for seasoning and garnishes has broadened as information on taste and health benefits are shared.

Many herbs are included in recipes for stews, soups and sauces but the use of fresh culinary herbs without cooking also comes with certain threats. In the US the Food and Drug Administration (FDA) regularly tests cilantro, parsley, and basil for microbes and pathogens E.Coli, Shigella, and Cyclospora because people annually have become sick from contaminated produce, particularly in the warmer summer months. The consumption of fresh leaves may not appeal to everyone but dislike for some people may actually be the result of their genetics. The human OR6A2 gene which detects aldehyde chemicals is shared by a significant number of those of East Asian and European descent. Like Julia Child and Ina Garten, who have publicly admitted to detesting cilantro, they say that it tastes like soap, soil and crushed bugs. In Belize, Mexico and most of Central America and the Caribbean we love cilantro, putting it in just about everything and are often willing to pay handsomely for a bunch when wanting to make conch ceviche. Since most of our visitors have European roots, restaurateurs should be prepared for the frequent request “no cilantro please” and actually consider not including it in recipes where it cannot be removed. People have reported the same reaction to culantro but since it is usually cooked it is less likely to be detected. Crushing the leaves before use releases the enzymes and therefore much of the aroma. Cilantro is the fresh leaves of coriander and is in the same family as celery and parsley which, however, do not seem to have the same negative effects. Cilantro grows very well in gritty sand and is usually sold with its roots in tact, bringing home dirt, pesticides, possible bacteria and has probably been handled by many unwashed hands. All produce should be washed before use but it should also be inspected and cleaned before putting it into the fridge, the pot or plate. So gently but thoroughly wash herbs under running water or swirl in a bowl of clean water and baking soda and do not store in the coolest part of the fridge.

Whether you are considering planting a garden of fresh culinary herbs for personal or commercial use the same basic principles for growing and for food safety apply. Firstly pick a site with good drainage away from any threat of flooding, fecal or chemical runoffs from nearby sources with at least a thirty-foot distance from any septic leach lines. Raised beds are recommended. Fencing may be necessary to avoid physical damage by animals but should not restrict beneficial insects and pollinators.

Gardeners should strive to prevent any cross contamination. They should have adequate toilet facilities and hand washing stations and designated areas for eating or smoking. They should also be well trained in the use and storage of any chemicals and tools and any signage should be in their language. Tools for harvesting made of stainless steel with synthetic (not wood) handles are ideal and easy to clean. Cleaning tools should be done after each use. Washing produce should be with clean safe water and any packaging done on sanitized surfaces in well-ventilated areas. The transportation of produce should also be considered when planning a garden. Using clean containers and not allowing them to touch any other surfaces reduces any possible microbial contamination. Taking the steps to assess potential risks helps ensure success in the production of delicious fresh culinary herbs and keeps us safe, satisfied, healthy, wealthy and wise.

For comments and info you would like to share...contact jenniferjanewildman@gmail.com

New Off-Grid Cassava Vodka Distillery In Belize

By Ben Bloodworth

Maya Mountains Distillery is an entirely off-grid distillery being built in the Cayo District south of Belmopan. Unlike every other distillery in Belize that produces rum from sugarcane, this craft distillery will make vodka from cassava. Coming from a background in the United States of environmental restoration and wildland fire, the co-founders, Ben Bloodworth and Dawna Capaldi, have a vision of a green future in Belize. The idea for a vodka distillery began more than seven years ago and slowly evolved into the establishment of the only commercial off-grid distillery in the Americas, and one of the only ones in the world. The property was purchased in 2021 and, after a year and a half of design and permitting, distillery construction began in August of 2023. The distillery is almost complete; the goal is to be distilling by May 2024.

Located a mile and a half backabush, and thus more than a mile from access to utilities that most distilleries take for granted, Maya Mountains Distillery depends on energy production off-

grid. Electricty for operations is provided by a 22 Kw solar system employing 48 solar panels and three inverters to provide 3-phase power. However, even this sized system is not nearly enough to heat a 1000-liter still. The energy for distilling will be provided by a biomass boiler. The boiler will be powered by biomass pellets made onsite from sawdust from a local Mennonite 8-horse sawmill.

Once the fully off-grid status of the distillery was recognized, a commitment was made to be the most sustainable distillery in the world. Maya Mountains will be the only commercial off-grid distillery operating in the Western Hemisphere. But, there are a couple of amazing ones in Australia and New Zealand (Swiftcrest and Island Gin, respectively). So to be "the most sustainable in the world", decisions were made in packaging and product sourcing to assure that environmental impacts are negligible. The vodka will be bottled in 100% recycled glass (with a customer-based recycling program once established) with sustainably hand-harvested carbon-negative cork closures and 100% post-consumer waste labels. Product (cassava) will be sourced from small local farms, not a commercial farming operation. Both rainwater and water from an onsite limestone well will be used in the process of creating a crystal-clear spirit that reflects the purity of the environment from which it originates.

The founders have also decided to start a *1% for Belize Fund* (fashioned after 1% for the Planet), in which they are hoping to involve other Belize businesses. Monies will go to Belize conservation projects selected by a committee through a set application process. The goal is that Maya Mountains Distillery will truly take nothing from the environment but give back to the beautiful country of Belize.

As for the cassava, the founders plan to purchase the tubers from farmers in a similar model to that established by Marie Sharp in her acquisition of habaneros. The Caribbean Agricultural Research and Development Institute (CARDI) is involved in helping to determine the best cassava strain for future vodka production. Eventually, cooperating farmers will need to commit to a staggered planting schedule so that the distillery can get 300-400# of cassava every week. However, implementation of this concept cannot begin until the distillery is in full operation and true production needs can be determined. In the meantime, once the equipment is operational and final licensing is obtained, cassava will be needed. If you are a small farmer, or know of small farmers, already growing cassava that will be available for harvest in May, June, or July, please contact Ben at ben@mayamountainsdistillery.com.

To assure that this dream of sustainability, and potentially a model for future distilleries in the US and Europe, is accomplished, an IndieGoGo campaign has been launched. Ben and Dawna would greatly appreciate both your watching the video available on this link to see the distillery build and sharing this link to get their crowdfunding campaign distributed far and wide.

The Most Sustainable Distillery in the World! | Indiegogo

Editor's Note: ***Ben Bloodworth grew up in Georgia but lived all over the United States. He obtained a BS in Biology from Furman University and an MS in Environmental Science from Alaska Pacific University. He worked for almost 30 years as a wetland and restoration ecologist for the States of Alaska, Mississippi, and Utah in restoration and wildfire management and finished his US career working for a nonprofit organization in western Colorado. He and his partner moved to Belize two years ago to start Maya Mountains Distillery.***

Your Own Rainwater System

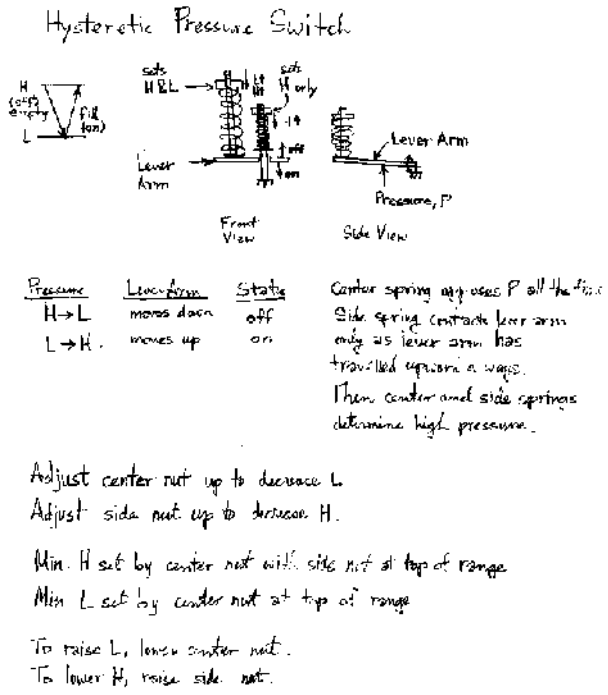
By Dennis L. Feucht
Cayo, Belize

Distilled water is freely available from the sky whenever it rains. This article presents the components of a rainwater system, how they work, and how to put them together to supply clean water.

The first component is the *water collector*. The most common is a roof or flat top of a cistern. Three-inch diameter pipes connect roof gutters or drains to the second component, the *storage tanks*, shown below-left. A plastic mesh is placed between the exit pipe and the entrance hole in the tank (center) to catch leaves or twigs from the roof (right).

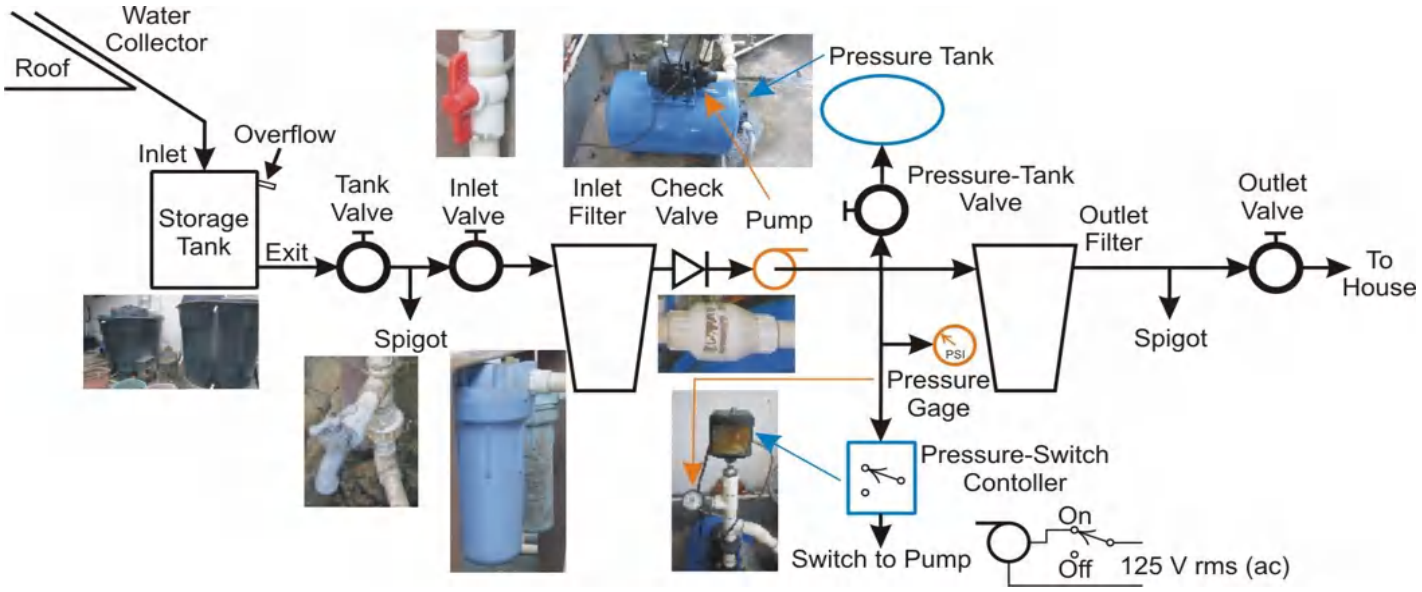
The exit port of the tank at the bottom should connect to a ¾ inch schedule 40 PVC pipe followed by a quarter-turn valve for selecting tanks or shutting off the exit during tank cleaning. From the valve, PVC pipe connects optionally to a spigot for direct access to tank water, then through another quarter-turn valve to an *inlet filter* canister with a filter, typically 10 μm in pore size. In the short path from sky to filter, there is little opportunity for pathogens to enter the water; however, more costly 1 μm filters filter out more, and clog more quickly, requiring more frequent changes.

After the inlet filter is the *check valve*. This component allows water to freely flow to the pump inlet but not in reverse. It is needed because when the *water pump* - the next component – stops pumping, pressurized water is within it, even at the inlet port, and will be pushed back into the tank unless the check valve prevents it. The pump for a residential system is usually ¾ horsepower (about 500 watt) in size. The exit port of the pump enters more piping that, off to the side with PVC T connections, is a *pressure gage* and the *pressure switch* - the controller that determines whether the pump is on or off. A functional diagram of the switch is sketched below. The high (H) and low (L) pressure settings are adjusted as shown. When the water pressure sensed by the switch decreases to the L value, the pump is switched on. Pressure increases until it reaches the H value and switches the pump off. If there is a leak or some other malfunction that keeps the H value from being reached, the pump will continue to run and might overheat. A timer can optionally be placed to limit how long the pump runs. The pump, heard running within the house, can be detected to be running too long. Ordinarily this is not a problem, but it can and does happen.

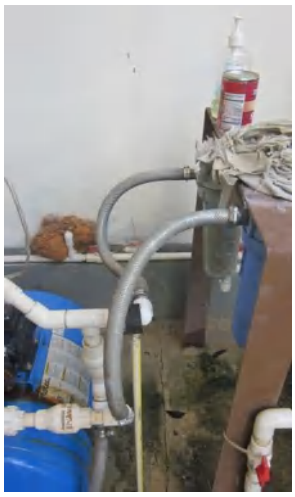


Also connected by pipe to the pump exit port is another T intersection that sends another pipe to the *storage tank*, with another quarter-turn valve in series for isolating the tank. The other outlet of the T intersection goes to the *outlet filter*, then to another valve and into the house water distribution lines (each branch having its own valve). These various valves are not required for the system to operate but can be indispensable in isolating components while diagnosing system faults such as unknown leaks. After the outlet filter and before the house valve, an *outlet spigot* can be quite useful for accessing pressurized water at the water system, which can be indoors but preferably is in a sheltered outdoor venue such as a carport or under the roof stairs. A schematic diagram of the rainwater system is shown on the next page.

A subtle problem that can develop over time is pipe connection leaks. They usually occur where threaded connections are made between PVC plastic and metal pump ports. As temperature varies, expansion of the two dissimilar materials opens gaps in the pressurized connections, causing leaks. To prevent them, wrap sufficient pipe ("Teflon") tape on the threads to cause them to somewhat disappear. When screwed in, the tape compresses, and the seemingly excess tape maintains a tight long-term joint fit.



PVC pipe components are glued together and modification or repair can be arduous. Consequently, flexible tubing secured by adjustable clamps have become popular. My system is a hybrid of piping, with flexible lines at input and output, as shown below-left, connected to the filter canisters.



The geometry of the piping and components can also cause long-term stress on connections that can lead to leaks or even blowouts. Long, cantilevered sections (below-left) stress plastic parts, and over time, they are "cold-worked" and fail. To relieve stress, a plastic tie-wrap strap was added to pull the vertical column to the left.

To remove pump fluidic connections, screw-separable components called *unions* are added to inlet and exit sides of the pump, as shown upper-right. The inlet side has a white union and on the exit side, it is gray. In the photo on the upper-left is also shown another strain-reliever - a ½-inch pipe supporting the elbow from the T connection going downward to the pressure tank and the flexible tube farther back, connected to the outlet filter. In the geometric design of your water system, choose component configurations that produce stress.

Another rainwater system (our guest house) is shown to the left. It follows the above diagram but is somewhat more compact and has a vertical tank. I prefer horizontal tanks (as in the house system described above) because the tank port is more accessible. On either tank configuration, the pump can be mounted on the tank.

Maintenance is not difficult or time consuming. Change filters whenever they change from white to black, usually every 4 to 6 weeks. Collection tank inlet mesh should be cleaned out at the same time, or more frequently in the rainy season. I route tank overflow to a garden ag tank with a hose that fits into the overflow pipes. I also collect it in tubs that I use for toilet flush water, to reduce filtered water flow. Multiple tubs need ag tank hoses that require filling with water. Seal the hose end with a thumb before moving it to the destination tank or tub.

A final note is that occasionally air will enter the pump inlet port and cause an air lock in the pump. If it is not pumping, pull the electrical plug and screw open the air release on the pump. You will see water bubbling out. The plumbing is being cleared of air.

Editor's note: Dennis Feucht lives in The Mountain Pine Ridge, Cayo, and has been an electronics engineer for nearly half a century, specializing in instrument design and power electronics, including off-grid electric system inverters. He has written 16 books and over 200 articles on electronics design including an inverter series at How2Power.com and has a website at innovatia.com. He is on the University of Belize Engineering Advisory Council.

Belize: A Proud Past, a Steady Present and an Optimistic Future

By John Carr

A Proud Past - I will start with a quick history of Belize agriculture in the 1900's. There were a few cattle and chickens; in river areas and the ocean, fishing provided food and a few dollars to sustain families. Milpa-slash-and-burn was the main method of farming to produce food and earning a little bit of money. Small markets sprung up in the villages and everybody went there to buy what they needed in order to survive. A survival tactic which was like having savings in the bank was to keep five or ten cows to provide emergency cash for such an event as a sick grandma or the birth of a new baby in the family. A very small demand made it difficult to get a fair price if the seller was under duress. Primitive sugar cane production, ground food (cassava and coco) gardening, deer, peccary and other jungle animals was the basis of the average diet. The commercial production of citrus, bananas, coconuts and other tree products took us into the 1960's and 1970's.

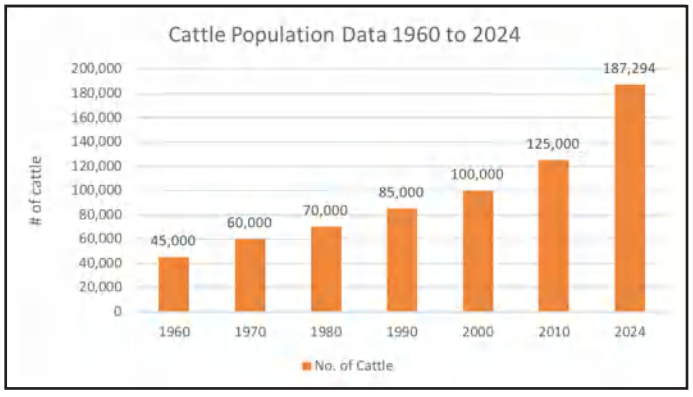
We invested in Banana Bank in 1973 (51 years ago). Its history started in 1890 as a mahogany logging outpost belonging to the Belize Estates Corporation. In the beginning all the sawing was done by hand and the big trees were pulled to the river by six or eight steers. When we moved to Banana Bank we found scattered over the property the remnants of the logging era: the cross cut saw, wooden ox yokes, dozens of metal pinions called "dogs" used to lash the logs together to form rafts when thrown in the river to float to Belize City, brands of iron to stamp the logs BEC, and a large number of bottles. In about the late 40's there were no more logs and the whole operation moved to Gallon Jug.

A Stable Presence - When I moved here in 1977 with my wife and two daughters, there was a bright sun rising on the horizon of agriculture. I had been the builder and manager of a 15,000 head commercial cattle feeding operation in Western Kansas and was full of dreams for being a part of the cattle industry in Belize. In that same year the Belize Livestock Producers Association (BLPA) was established and I soon found some fast friends with like minds of improving and growing the industry. The association met in Belize City at a union hall. It was located in Belize City so members from the northern districts would be included.

In the early 1980's BLPA applied to USAID for financing to move the BLPA headquarters to a location near the agriculture show grounds. The government offered us almost one acre by the show grounds but before we started construction, they decided to put a

race track there. We were upset about this but it turned out to be a good thing because they gave us 30 acres where the current BLPA office is, just outside of Belmopan on the highway going to Belize City. USAID informed us that they did not finance an office building so ingenuity kicked in; out of this setback the bright idea sprang up to build a livestock auction facility that would, of course, need an office. I and several members of BLPA including John Roberson, Joe Friesen, Abdala Bedran, Landy Orio, Elston Wade, Dito Juan, Colin Aquar, Fred Hunter, Leslie Sharpe and Minister Marin were some of the charter members. There were many more, too many to mention, who played a very important part in a fledgling industry. BLPA funding paid our way to several auction-type facilities in Mexico and the United States to see some state-of-the-art facilities. The BLPA office and facility is still in operation today. The success and importance of the livestock industry in Belize is evidenced by packed-out crowds at the annual BLPA meetings held at our facility.

A Bright Future - It is high noon in the cattle industry in Belize. We have met in the middle of a dusty street at 12:00, pistols in the holster. We will take 10 paces and turn to draw on all the challenges that face the cattle industry in Belize today. Marketing is always the biggest challenge. Belize consumes about 10% of the marketable cattle from Belize ranches. That means we have to export the other 90% and that market is either in Mexico or Guatemala. We have



Graph by Baneza Godoy

ever present health issues, animal rustlers, and adverse weather, just to name some of the bullets that come at us from our high noon challenger. Our Belize problem is that we need to market our cattle and Guatemala and Mexico provide a service by buying our cattle. If, however, they don't pay us the price we want, we are out of choices as to other markets. We are committed to the Guatemala/Mexico buyers. On the bright side, and in all honesty, they usually pay us reasonable prices but we are .50 to .75 short if we consider a more competitive market situation. Instead of crying, we should be grateful that we have these outside markets to push our cattle to. Our ranchers have improved the quality by introducing better breeding bulls and heifers and planting and managing better grasses. We used to wean calves at 350 lbs. at nine months and now they are 550 lbs. and sometimes 600 lbs. at 9 or 10 months. The biggest contributor to the increase in quality comes from buying better bulls and in some cases artificial insemination.

If there were not hope and financial gain the situation wouldn't be growing as it is. Here is the cattle population data from 1960 to 2024: 1960 - 45,000 hd.; 1970 - 60,000 hd.; 1980 - 70,000 hd.; 1990 - 85,00 hd.; 2000 - 100,00 hd.; 2010 - 125,000 hd. Currently, the BLPA represents over 5,200 cattle producers nationwide with a total herd of 187,294 animals. This is a direct quote from the BLPA website.

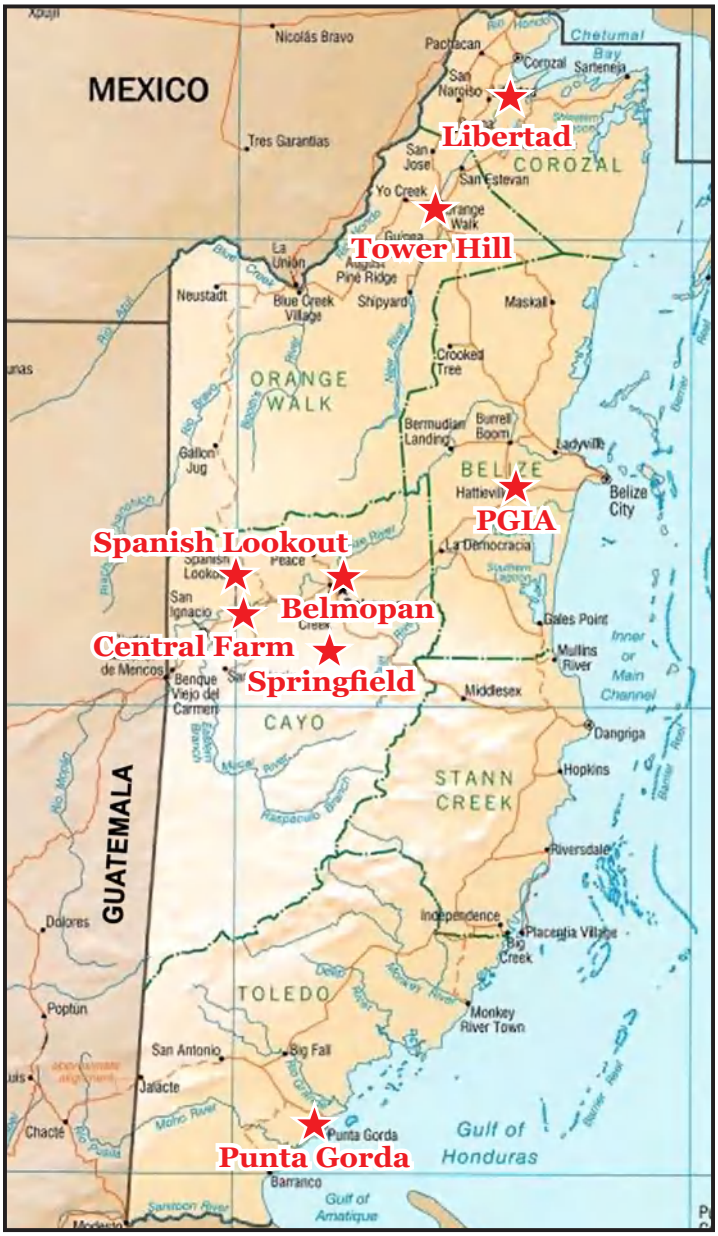
The cattle livestock future is very bright. It takes management, good pastures, good breeding stock, good markets, and a supportive government that keeps the gates open. BLPA and its membership are very important to the industry. And the Lord is blessing the cattle industry.

Publisher's note: After a long break from our publication,The Belize Ag Report is delighted to have an article by our former Assistant Editor, John Carr, gracing our pages. John was a key player in many important development phases of Belize's livestock industry since his arrival here in 1973. He shared his knowledge and experience in cattle and row crops (notably corn) since our first issue in 2009, when our 1st issue's cover headlined: "John Carr Speaks and Belize Ag Listens". John created the format for our Ag Prices at a Glance column, and quite rightly proposed it as our centerfold. Thank you, John; welcome back.

Rainfall 2021, 2022 & 2023

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.

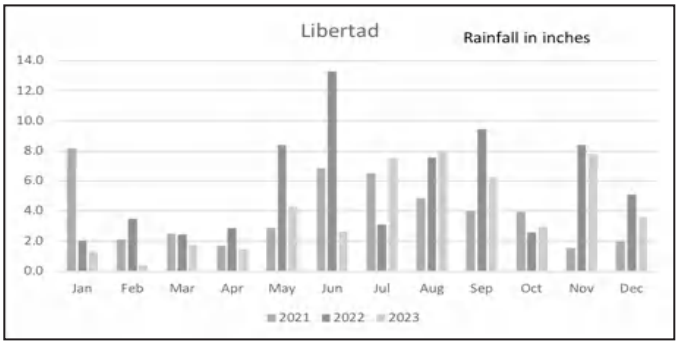
All of the rainfall charts and graphs for this article were created by Dottie Feucht.



Rainfall - Libertad
Corozal District

Libertad rainfall courtesy of Belize HydroMet

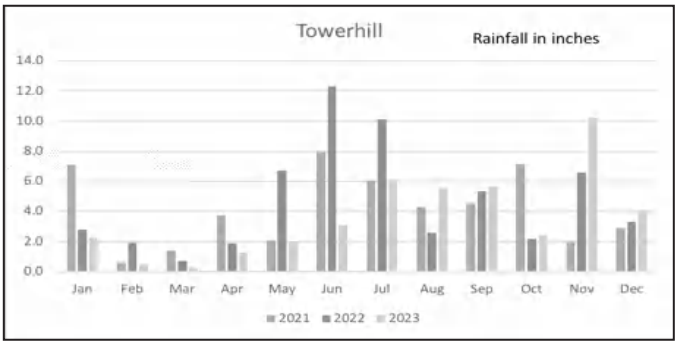
Month	2021 Rainfall in.	2022 Rainfall In.	2023 Rainfall In.
Jan	8.2	2.0	1.3
Feb	2.1	3.5	0.4
Mar	2.5	2.4	1.7
Apr	1.7	2.9	1.4
May	2.9	8.4	4.3
Jun	6.8	13.3	2.6
Jul	6.5	3.1	7.5
Aug	4.8	7.6	7.9
Sep	4.0	9.4	6.3
Oct	4.0	2.6	2.9
Nov	1.6	8.4	7.8
Dec	2.0	5.1	3.6
Totals	**47.0**	**68.7**	**47.8**



Rainfall - Tower Hill
Orange Walk District

Tower Hill rainfall courtesy of Belize HydroMet

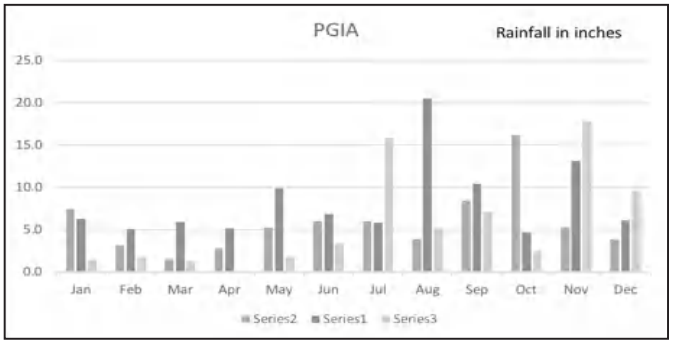
Month	2021 Rainfall in.	2022 Rainfall In.	2023 Rainfall In.
Jan	7.1	2.8	2.25
Feb	0.6	1.9	0.46
Mar	1.4	0.7	0.27
Apr	3.7	1.9	1.28
May	2.1	6.7	2.00
Jun	7.9	12.3	3.09
Jul	6.1	10.1	6.12
Aug	4.3	2.6	5.51
Sep	4.5	5.4	5.65
Oct	7.2	2.2	2.42
Nov	2.0	6.6	10.20
Dec	2.9	3.3	4.06
Totals	**49.7**	**56.4**	**43.30**



Rainfall - Phillip Goldson Intl Airport
Belize District

PGIA rainfall courtesy of Belize HydroMet

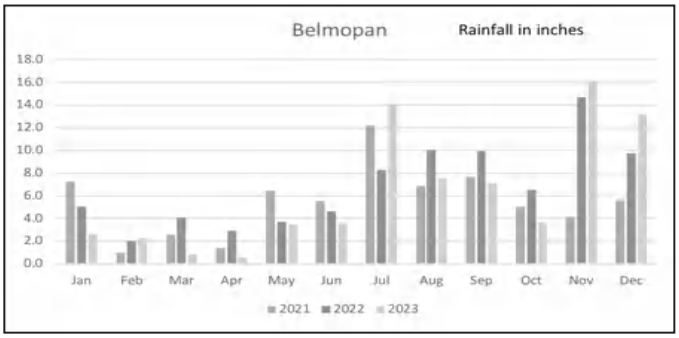
Month	2021 Rainfall in.	2022 Rainfall In.	2023 Rainfall In.
Jan	7.5	6.3	1.43
Feb	3.1	5.1	1.83
Mar	1.5	5.9	1.33
Apr	2.8	5.2	0.05
May	5.3	10.0	1.85
Jun	6.0	6.9	3.40
Jul	6.0	5.9	15.82
Aug	3.9	20.5	5.20
Sep	8.5	10.4	7.13
Oct	16.2	4.7	2.51
Nov	5.3	13.1	17.83
Dec	3.9	6.1	9.65
Totals	**70.3**	**100.2**	**68.04**



Rainfall - Belmopan
Cayo District

Belmopan rainfall courtesy of Belize HydroMet

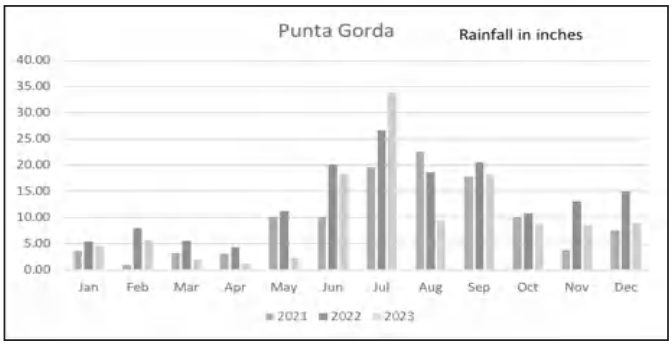
Month	2021 Rainfall in.	2022 Rainfall In.	2023 Rainfall In.
Jan	7.3	5.1	2.61
Feb	1.0	2.0	2.24
Mar	2.6	4.1	0.83
Apr	1.4	2.9	0.57
May	6.5	3.7	3.46
Jun	5.5	4.6	3.57
Jul	12.2	8.3	14.04
Aug	6.9	10.1	7.51
Sep	7.7	9.9	7.15
Oct	5.1	6.5	3.68
Nov	4.2	14.7	16.15
Dec	5.6	9.7	13.15
Totals	**65.8**	**81.6**	**74.96**



Rainfall - Punta Gorda
Toledo District

Punta Gorda rainfall courtesy of Belize HydroMet

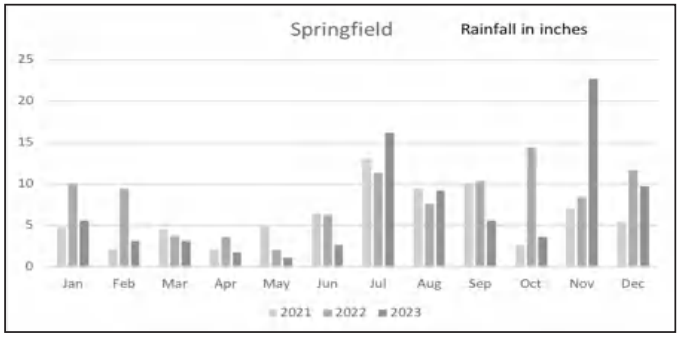
Month	2021 Rainfall in.	2022 Rainfall In.	2023 Rainfall In.
Jan	3.69	5.42	4.6
Feb	0.92	8.05	5.7
Mar	3.29	5.52	2.0
Apr	3.17	4.39	1.2
May	10.11	11.24	2.3
Jun	10.16	20.15	18.3
Jul	19.60	26.61	33.8
Aug	22.54	18.68	9.4
Sep	17.93	20.54	18.2
Oct	10.16	10.89	8.8
Nov	3.84	13.07	8.5
Dec	7.60	14.98	8.9
Totals	**113.02**	**159.55**	**121.7**



Rainfall - Springfield
Cayo District

Springfield rainfall courtesy of Belize HydroMet

Month	2021 Rainfall in.	2022 Rainfall In.	2023 Rainfall In.
Jan	4.7	10.0	5.6
Feb	2.1	9.4	3.1
Mar	4.5	3.7	3.1
Apr	2	3.6	1.8
May	4.9	2.0	1.1
Jun	6.4	6.3	2.6
Jul	13	11.3	16.2
Aug	9.4	7.6	9.2
Sep	10.1	10.3	5.6
Oct	2.6	14.4	3.6
Nov	7	8.4	22.7
Dec	5.4	11.7	9.7
Totals	**72.1**	**98.7**	**84.3**



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SPANISH LOOKOUT
COMMUNITY LIVESTOCK STATISTICS
for the years 2022 - 2023

Animal Type	End of 2022
Dairy Cattle	2 ,206
Beef Cattle	22,991
Layer Hens	189,598
Breeder Hens	61,451
Broilers	963,100
Horses	319
Hogs	3,567
Sheep	260
Goats	67

Animal Type	End of 2023
Dairy Cattle	2,184
Beef Cattle	23,485
Layer Hens	217,099
Breeder Hens	58,770
Broilers	962,415
Horses	254
Hogs	4,118
Sheep	177
Goats	38

SPANISH LOOKOUT
COMMUNITY CROP STATISTICS
for the years 2022 -2023

Grain Type	Acres 2022	Bags 2022
Yellow Corn Summer	29,659	1,554,658
Yellow Corn Winter	4,100	181,399
Corn for Silage	212	
White Corn Summer	756	38,736
White Corn Winter	1,260	51,945
Milo Summer	-	650
Milo Winter	1,700	56,374
Red Kidney Beans	5,454	48,108
Blackeye Peas	4,474	37,407
Soy Beans	11,388	187,253
Rice	2,954	124,085
Other Crops	1,006	3,016

January - June 2023	Acres	Bags
Yellow Corn	3,472	121,708
Corn for Silage	18	
White Corn	1,397	61,620
Milo	2,824	81,330
Red Kidney Beans	2,471	13,095
Blackeye Peas	1,481	14,017
Soy Beans	11,768	145,435
Rice	508	12,281
Other Crops	992	3,954

July - December 2023	Acres	Bags
Yellow Corn	32,237	1,223,560
Corn for Silage	256	
White Corn	1,857	72,360
Milo	41	148
Red Kidney Beans	-	-
Blackeye Peas	20	90
Soy Beans	855	9,240
Rice	2,738	140,551
Other Crops	-	-

Spanish Lookout 2024 Expo

Directors: Norman Dueck, Victor Reimer & Jimmy Braun

The Business Chamber of Spanish Lookout held its 2024 Expo on 15th-16th March. The expo was a rousing success with more than 45,000 attendees over both days. They hosted over 150 different companies, from all across the country in 225 booths. That did not include the 60+ food and drink booths.

This biennial event (every 2 years) is a family-friendly affair, with no alcohol, and offering free entrance and free parking. A highlight for them is to provide new small businesses a platform where these entrepreneurs can showcase their products and services.

Looking ahead to 2026, the Business Chamber of Spanish Lookout "will continue along this path, where we are a safe business-oriented event, helping all businesses across the country. Hopefully we will have vendors from neighboring countries as well."

Belize Dairy Association
Always Fresh

Calling All Dairy Farmers

Milk processors need quality milk to produce UHT (long shelf life) milk. Milk production in 2023 was in somewhat of a decline from 2022. A decrease in the number of calves being born, excessive rain last year and now the heat continue to jeopardize production to meet market demand. The opportunity is open to dairy farmers to sell milk to the dairies and to new beginners to become dairy farmers.

Ernie Thiessen
Chairman, Belize Dairy Association
BelizeDairyAssociation@gmail.com
(501) 674-9807

Old Iron

By John Roberson, Jr.

The story of Old Iron, the antique tractor at the National Institute of Culture & History (NICH) in Belmopan, begins in about 2009 when I was asked by my friend, John Woods, to assist in their first effort to pave the road from the Guacamallo bridge to the incredible Mayan site of Caracol. As we were working, I started hearing the men talk about some old abandoned tractors off in the bush. This got an immediate hold on my curiosity as I am a lover of old iron and only dreamed that one day I would find another of the many antique tractors abandoned by their owners after they served their purpose logging. I began to inquire about these old machines. I soon found out the tractors were not that far away from where we were working! After a bit of cajoling, I was able to locate a couple of curious men that were willing to walk with me with the intention of locating these antique machines. After work one afternoon we began walking and the chatting we overheard proved correct. We had walked only a short distance when we came upon **three** old tractors; my heart raced as I saw them! Two of them appeared to be just as they were parked. The third one was in pretty bad shape and looked as though it may have been cannibalized for parts in order to keep another one running. I later found out there was only one of that particular type of tractor so my theory of robbing parts was incorrect.

I couldn't locate the serial number but later investigating on Google discovered that it was a Pre-WW I Holt 120 tractor, the most advanced tractor of that time. I also read the most fascinating story of the two men, Benjamin Holt and A.C. Best, who saw the need for tractors with endless tracks. And they were so right. They merged their companies to form the Caterpillar Inc. company, which is a huge multinational company today.

I was elated to find that the Holt tractor in the bush was much more complete than I previously thought.

I hurriedly went to Belmopan to obtain permission to move the tractor and it was delivered to the archeological institute - National Institute of Culture & History (NICH) museum in Belmopan where it still sits. I was also happy to inform the NICH staff that there were two more tractors I would be bringing out as soon as I could. Unfortunately, when I returned to the Chiquibul Forest, those two tractors were gone!!! All we could find were mini piles of iron that looked like the slag of a cutting torch. I never found out what happen to those machines. Sad, but we got the very best one of that group.

With all the talking I have done to so many people about this tractor, someone sent me a photo claiming it to be *that* tractor traversing the Vaca Plateau. I can't be sure but it could be because the logging trailers are like the ones used in that era and the bush in the background certainly looks like that era.

I've recently been in touch with several antique machine enthusiasts who have agreed to assist in getting this precious tractor running again. I realize this undertaking must be difficult or impossible to believe but please remember this machine was built over 100 years ago so there is nothing on it or in it that our available knowledge and tooling cannot reproduce; at least, that is our hope! We are well aware of what we will be getting into and we are looking forward to this challenge. I look forward to receiving a nod of approval from NICH so we can get to work! I can already imagine watching this Grand Ole Lady being driven in an Independence Day parade in the not-too-very distant future.

I have been asked many times why these beautiful machines were just abandoned by their owners and how they reached the Vaca Plateau in the first place. I am way too young to have heard any stories about why the tractors were abandoned. I can only guess that the technology was advancing so rapidly that it would cost more to ship them home than they would be worth in their well-used condition. It's similar to the rapidly advancing cell phones technology today; I've been told that if I left my flip cell phone at a shopping mall in the United States, it would be there the next day when I went back to look for it.

How did they ever reached the location where were being used? As I understand it, there were no roads in good enough shape to haul tractors of this weight, and there were no lowboys to carry them on. Perhaps someone reading this article can offer clues but without some additional knowledge I can only assume they were driven or walked from the port where they landed to their logging destination. That, in itself, was an incredible feat! I think that an engine of that era and 120 horsepower would burn at least six gallons of gas per hour. Moving at 3-4 M.P.H. on a journey of at least 100 miles would take at least 30 hours and burn 180 gallons of gas. It's difficult to even fathom that, much less how the tractor, weighing 26,700 lbs., was offloaded from the ship in that era. When we compare the Holt to a new D4, which we now consider a small tractor at 130 horsepower, weighing 29,000 lbs. and burning about 2.5 gallons of diesel fuel per hour, we gain a new perspective on how Herculean a task these men accomplished.

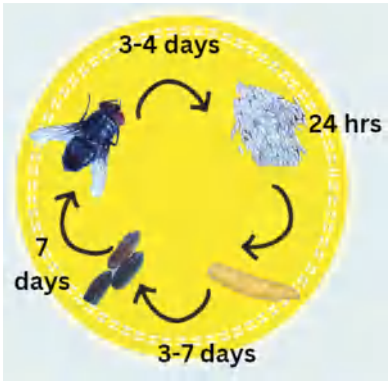
New World Screwworm Back in Central America Let's Keep It Out of Belize!

By Dr. Roxanna Alvarez

In early July of 2023, Panama declared a State of Zoosanitary Emergency due to the re-emergence of New World Screwworm (*Cochliomyia hominivorax*). This was closely followed by the report of a case in a dog in Costa Rica. That infestation rapidly progressed to other species. Although considered "far away" by many, Belize Agricultural Health Authority (BAHA) closely monitored the situation and installed preventative measures, inclusive of veterinary inspections of animals being imported from affected countries.

At the start of April 2024, Nicaragua issued an animal health alert due to the presence of New World Screwworm (NWS) disease in cattle, raising the number to three affected countries in Central America.

NWS disease is caused by a parasite that can affect all mammals, ***including humans***. Female flies of the Calliphoridae family and Chrysomyinae sub-family, are attracted to wounds and exposed mucous membranes where they lay eggs. Each female can lay an average of 350 eggs more than once, making this a very prolific pest. After a period of 12 – 24 hours, the larvae emerge and feed on the skin and underlying tissue of the host. It is important to note that larval stage 1, 2, and 3 burrow downwards and feed on wound fluids and live tissue. This causes a condition known as traumatic myasis, which can be fatal. The image below, shows myasis on a dog; the image below shows larvae feeding on a wound.



Below, see a bovine with a large wound.

Belize became free from the NWS in 1992 and has maintained this status since then. The possibility of a re-introduction into Belize is a potential threat to the livestock, small stock, avian industries, wildlife, and humans. To ensure Belize remains free from NWS, BAHA is:

- continuously monitoring the regional zoo-sanitary situation,
- informing the public of the risks associated with NWS and the illegal importation of animals,
- surveilling animals with wounds,
- inspecting animals that are imported through all points of entry,
- training technical officers, private veterinarians, Ministry of Agriculture, Food Safety and Enterprise (MAFSE) livestock officers, association veterinarians, other stakeholders, and
- participating in regional initiatives.

While NWS disease is of national concern, the fight to keep NWS out of Belize is a personal one. ***What can you do?***

1. **Inspect** your animals regularly
2. **Monitor and Report** cases of infestations by fly larvae to:
   - BAHA Central Farm 824-4872
   - BAHA Orange Walk 302-1388
   - Your local livestock officer
3. **Comply** with regulations, especially those related to the importation and movement of animals
4. **Participate** in training and share correct information with others.

The health, safety, food security, and livelihood of all Belizeans would be endangered in the event of an NWS infestation. It is our collective responsibility to ensure that we safeguard Belize against New World Screwworm.

For further information, email the Animal Health Department at animalhealth@baha.org.bz or give us a call at 824-4872 or 302-1388.

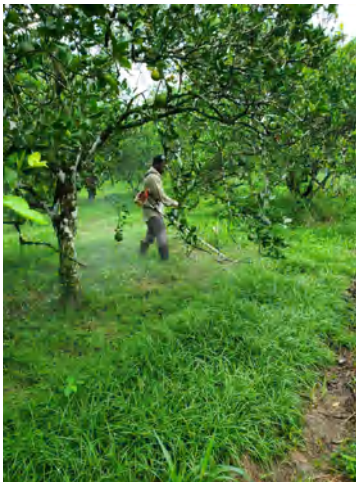
All it takes is one fly... KEEP NEW WORLD SCREWWORM OUT OF BELIZE!

Editor's Note: Dr. Roxanna Alvarez VM graduated from the Universidad de Granma, Cuba in July 2023 as a Doctor in Veterinary Medicine. She joined the Belize Agricultural Health Authority in February 2023 as the Technical Director of Animal Health. She is Belize's Chief Veterinary Officer.

San Miguel, A Healthy Citrus Grove
By Feucht/Roberson

Have you noticed how healthy San Miguel's citrus grove is? Driving by the rows and rows of healthy-looking trees and well-kept areas between the rows along George Price Highway in Esperanza, we wondered how they maintain such a healthy-looking grove so we interviewed the former manager, Edward Flowers, about it. He said that they stopped using glyphosate years ago when they found out how it destroys the soil and the trees as the leaves turn yellow, fruit drops prematurely and the Asian citrus psyllid, which thrives on the diseased leaves, ends up causing HLB, the dreaded greening disease. He said ever since they started focusing on making the soil healthy the trees responded with better health producing healthy fruit.

The maintenance program they use to keep the soil and trees healthy and control disease started by testing the soil and the leaves to find out what nutrients were missing. They worked with a university in Costa Rica and a lab in Honduras to gain an understanding of how best to achieve their goal of improving the soil and trees of the grove. They separated their 300 acre grove into 18 test plots and applied various nutrients as identified in the soil analysis results. Application, which included both soil and foliar, took place over a 3-month period to start. Data was collected on the soil, the leaves and the roots. The results of the tests provided the basis of their maintenance program which is carried on regularly. The healthy soil not only feeds the trees the nutrients they need but ensures the quality of the fruit which is the primary focus for commercial citrus groves. The fruit is tested at the citrus factory for its Brix value; the higher the Brix number, the higher the quality. Mr. Flowers said that the yield is also good: typically 2.65-2.75 bags per tree.



Mr. Flowers, who has spent most of his life concentrating on growing citrus trees, now owns his own citrus farm as his retirement endeavor.

Belize O'x (Ramon) Group
By Oscar F. Moralez

Following the April 2019 NATS, where Mrs. Ana Eloisa Morales of Paradise Farm won Lady Farmer of the Year, the seeds were planted for the creation of the Belize O'x (Ramon) Group. Another Mrs. Ana Morales – Mrs. Anna Edith Morales of the El Salvador Ojushte (Ramon Seed) Project, came to visit Mrs. Ana Eloisa Morales to share information and provide assistance.

The purpose of the Belizean cooperative is to promote ramon, or Maya nut, as a nutritious and valued agroforestry food, as it was in ancient Mayan times. To achieve this, they plan to build ramon nurseries and processing facilities which can dry and process ramon seeds collected from the wild to start, eventually adding cultivated nuts from trees planted by co-op members. Belize Enterprise for Sustainable Technology (BEST) has recently provided the Belize O'x (Ramon) Group with a grant, which will enable them to purchase materials to build two 24' x 50' nurseries, and two small dryer tunnels. One facility will be in San Antonio and the other will be in Selena Village, both in the Cayo District.

Ramon or Maya nut

For more information on how to become involved, contact chair Oscar F. Morales at 661-2413 or oscarfmoralez@gmail.com.

Publisher's Note: Ramon, Brosimum alicastrum, and sometimes called 'Maya Nut' is often confused with breadnut, Artocarpus altilis, because of their names, not due to similarity of the trees or their fruit. See pics of breadnut below. The foliage from ramon trees has always been valued as a supplement to ailing stock or cows who have just calved. It is often planted close to livestock corrals to provide this nutritious feed plus shade.

Breadnut - not ramon!

Pesticides Importation Trends for Belize (2014-2023)

Miriam Ochaeta Serrut (Registrar of Pesticides) and Nonato Canto (Technical Officer)

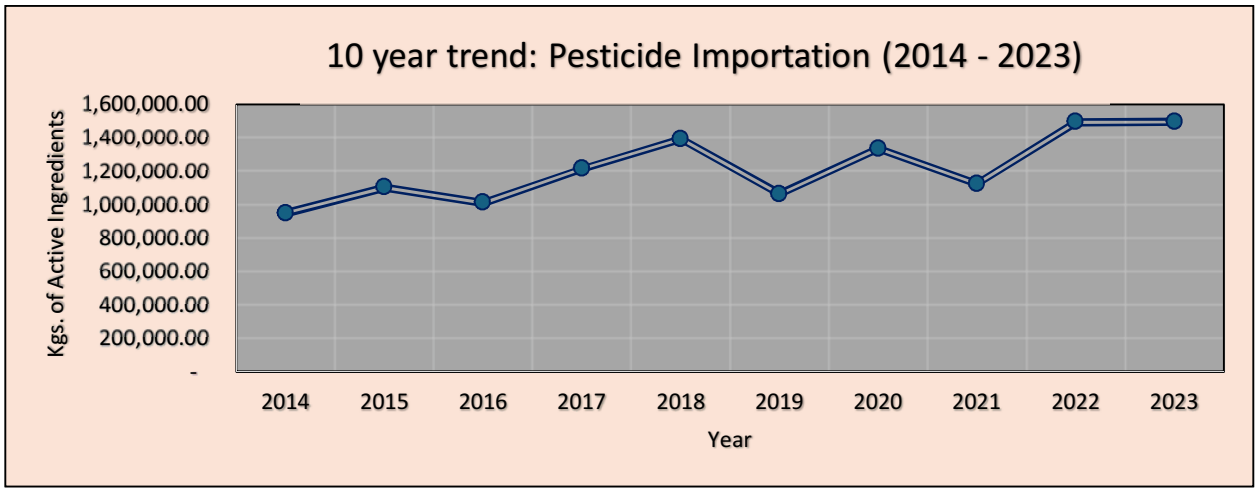


Figure 1

Pesticide imports data is oftentimes used as a proxy for actual pesticide use.

In Figure 1, a 10-year trend of total pesticide imports spanning from 2014 to 2023, is presented in kilograms of active ingredient. This includes pesticides used in agriculture, public health, and household use. Table 1 below further classifies the 10-year imports data for the same period, for agricultural-use pesticides and other agricultural-use substances regulated by the Pesticides Control Board of Belize, by their use. When compared with trends over time in crop production and areas planted, pesticide imports data could be used to analyze pesticide use intensity in crop-growing regions.

Table 1

Data on pesticide importation - kilograms Active Ingredient.										
Classification by use	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**
Insecticides including Insect Growth Regulators	56,986.32	46,042.19	43,320.86	43,949.99	40,533.37	41,170.72	54,163.96	43,928.93	65,681.46	73,589.02
Fungicides	217,534.74	184,093.31	179,267.52	156,388.36	189,021.66	221,193.91	200,642.02	240,954.08	316,250.74	245,958.41
Agricultural Spray Oils	230,615.20	413,307.84	298,120.81	500,009.04	690,663.22	409,021.65	417,334.20	368,810.40	532,336.00	574,310.21
Herbicides	351,644.57	388,245.16	453,555.70	445,143.19	418,653.68	354,373.51	558,601.50	373,651.63	407,370.65	512,162.47
Adjuvants	61,747.93	48,593.00	17,655.03	56,331.08	22,533.47	25,242.21	97,007.92	90,717.04	162,419.69	79,813.66
Others including rodenticides, molluscicides, soil sterilants, plant growth regulators	2,728.63	1,012.83	1,969.54	1,518.48	18,185.57	3,562.16	210.05	468.85	247.86	496.62

Pesticides Importation Trends for Belize

Pesticides approved for use in Belize are classified as general-use or restricted-use pesticides. General-Use pesticides includes pesticides used in public health (professional and household-use). The percentage of Restricted-Use Pesticides (RUPs) imported into the country for the past four years is shown in Table 2.

Table 2

Total Imports: Kgs. Active Ingredient			
	General-Use	Restricted-Use	% of RUP
2020	765,631.86	569,061.66	42.63
2021	598,269.91	524,769.68	46.72
2022	900,081.20	593,364.21	39.73
2023	839,167.44	655,346.31	43.85

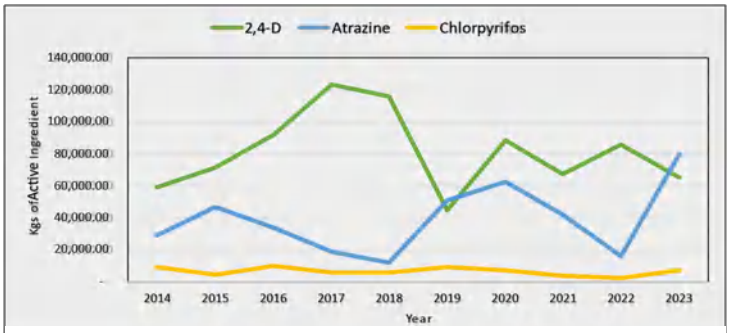


Figure 2

The chart in Figure 2. shows the ten-year trend in the importation of three restricted-use pesticides: Herbicides: 2,4-D, atrazine, and Insecticide: chlorpyrifos. The Pesticides Control Board has commenced the pilot of a mechanism for the periodic review of registered pesticides using these candidates.

Importation data and charts for other herbicides of interest: paraquat and glyphosate.

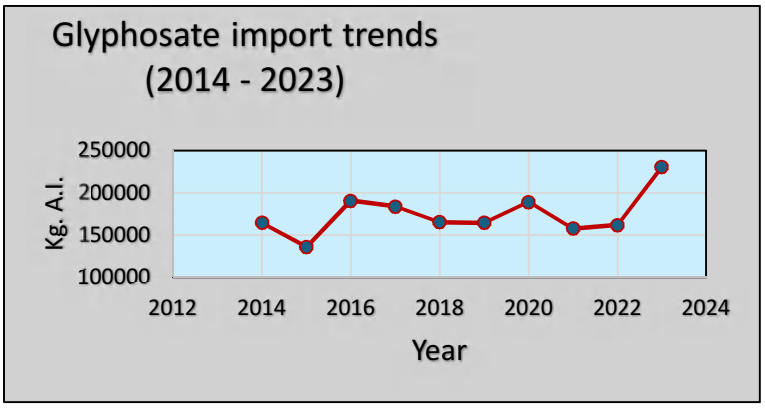


Figure 3

Importation data: Paraquat and Glyphosate (2014 to 2023)		
	Kgs. Active Ingredient	
Year	Paraquat	Glyphosate
2014	17,711.86	164,553.23
2015	23,506.40	135,770.95
2016	32,052.80	190,449.47
2017	34,326.40	183,963.17
2018	36,506.40	165,128.87
2019	21,175.60	164,600.71
2020	50,955.20	189,112.89
2021	37,429.60	157,826.63
2022	44,735.80	161,770.04
2023	43,793.80	230,880.25

Table 3

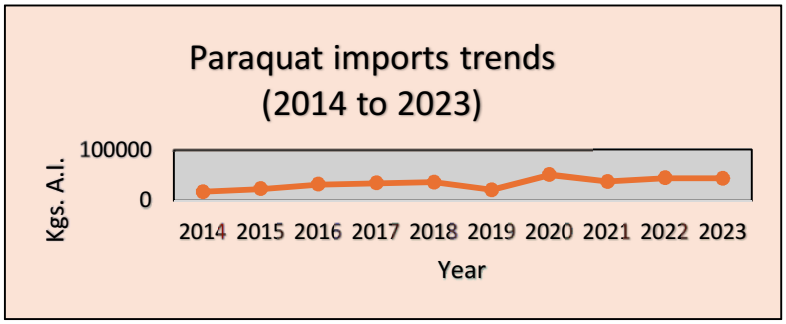


Figure 4

Over the past ten years, mancozeb (fungicide) and glyphosate (herbicide) have taken the top ranking among the top ten most imported pesticides. Except for the years 2019, 2021 and 2022 when mancozeb was the most imported, glyphosate has been the most imported pesticide in Belize during the ten-year period 2014 to 2023.

Continues on page 24

Continued from page 23

Pesticides Importation Trends for Belize

Top ten most imported pesticides 2021 to 2023 (Kgs. Active Ingredient)					
2023		2022		2021	
glyphosate	229,584.25	Mancozeb	266,238.12	Mancozeb	197,752.04
Mancozeb	213,766.60	glyphosate	161,770.04	glyphosate	157,826.63
atrazine	79,665.08	2,4-D	86,121.36	2, 4-D	67,495.10
2,4-D	65,520.39	paraquat	43,119.80	atrazine	41,957.86
diuron	45,716.00	diuron	29,120.00	paraquat	36,457.60
paraquat	37,193.80	ametryn	28,426.00	ametryn	26,000.00
sulphur	37,068.00	Malathion	26,204.00	Malathion	17,975.20
ametryn	21,110.00	sulphur	23,225.00	diuron	13,853.93
Malathion	10,760.00	atrazine	16,375.10	fenpropimorph	10,348.80
chlorpyrifos	7,160.60	pendimethalin	10,983.83	pendimethalin	6,421.35

Table 4

For more information, contact us at pcbinfo@pcbbelize.com

Project FUSARIUM TR4
OIRSA - TaiwanICDF

New Banana Varieties in Belize

By Carl Lin

Misael J Pérez, Eric Lin, and Eric Chen

Fusarium Tropical Race 4 (TR4) is a soil-borne fungus that affects bananas. Here in Central America, we don't have it yet, but it's coming close. (See Belize Ag Report, Issue 43.) TR4 is a threat to global banana production, and by extension, a threat to food security for the 400 million people in the world that produce bananas. In Belize, it would definitely be detrimental to the banana industry.

In response to the looming threat of Fusarium TR4, the Organismo Internacional Regional de Sanidad Agropecuaria (OIRSA) sought assistance from Taiwan, leveraging its expertise and foundation in the fields of banana disease resistance breeding and plant pathology. Taiwan International Cooperation and Development Fund (ICDF) is playing a central role in this initiative, working in conjunction with various Belizean entities, including OIRSA, Belize Agricultural Health Authority (BAHA), Banana Growers Association (BGA), and the Ministry of Agriculture Food Security and Enterprise (MAFSE). The project started in July 2022 and will be end on 31st October 2025. The aim of the project is to assist Belize and Guatemala in establishing a comprehensive regional epidemic-prevention network before the disease invades the area. If an outbreak does occur, the network will enable countries to have more active and effective monitoring and testing mechanisms in place to contain the epidemic. The project also introduced several banana varieties from Galitec, Honduras for the healthy seedling production needed for plant varieties' protection and the alternative for Belize's current cultivation varieties in case of TR4 invasion in the future.

The varieties Taiwan ICDF chose for the introduction include Gran Enano, William, and Formosana. Gran Enano and William are commercial varieties in Central America; Gran Enano is resistant to hurricanes due to its low plant height and William possesses high-yield characteristics. Formosana from Taiwan is the only non-GMO disease-resistant variety in the world. In the cultivation in Mozambique, the Philippines, and Hainan Island, China, Formosana bananas have been thriving.

At the nursery established at Central Farm, the three varieties went through a hardening phase. After three months, in partnership with BGA, the bananas were planted in the field for adaptability trial, especially to see how Formosana would grow in Belize. The plants are growing well. The stems of the best plants of Gran Enano and William are being used for tissue culture at the lab of the University of Belize/Central Farm (UB/CF). After successful plant development, they are taken to BAHA

for virus testing using the protocol developed at National Taiwan University. The protocol reduces testing time from 3 days to 2 hours. Subsequently, healthy seedlings are transferred to the nursery or provided to local farmers for experimental cultivation.

In addition to establishing the detection capabilities for TR4 and major banana diseases in both Guatemala and Belize, the project also supports the banana industry by inviting agricultural authorities for training in Taiwan, assisting in improving the efficiency of the OIRSA epidemic monitoring system, organizing international forums, and publishing relevant literature. The trained technicians and upgraded laboratory will play a crucial role in the future prevention and control of Panama Disease.

Tissue Lab

Belizean farmers are also vital participants in the prevention of TR4. Taiwan ICDF is partnering with OIRSA, BAHA, BGA, and the Minister of Agriculture to conduct workshops with farmers so that we can prevent and control the invasion of Fusarium TR4 in Belize. This training program introduces farmers to the background and objectives of the project and Taiwan's prevention experiences and focuses on biosecurity measures and symptom recognition. The aim of the training is to enhance local farmers' awareness and vigilance towards Panama Disease as a means of preventing it in the future. The project team is planning to expand farmer training programs to all regions, working together with farmers and relevant departments to promote and enhance Belize's banana industry.

Currently, there are over fifty members involved in the project; they are distributed across the project center at Central Farm and various collaborating organizations. The continuity of the project and the nursery at Central Farm will be technologically transferred to MAFSE upon its completion. The ultimate success of the project will be contingent upon its ability to successfully resist the invasion of TR4. In the unfortunate event of an invasion, the plan is for Formosana to be used to mitigate industry losses and enhance Belize's competitiveness in the international banana market.

The collaborative project between ICDF and Belizean entities is a significant effort to safeguard Belize's banana industry from the impending threat of Fusarium TR4. Through the introduction of Formosana and active farmer participation, the project aims to enhance the resilience of the banana sector and secure the livelihoods of local farmers. While several tasks remain to be done, the initiative is a vital step towards securing Belize's food security and agricultural sustainability in the face of emerging threats.


Banana Plots

Editor's Note: Carl Lin, an agronomy student from Taiwan, interned for six months in Belize on the ICDF's Regional Project for the Prevention and Control of Fusarium Tropical Race 4 in Central America. He's back in Taiwan to complete his bachelor's degree. Carl likes everything about Belize and says he hopes to become fluent in Spanish to communicate effortlessly with the warm-hearted people in Central America in the future.

Belize Cacao Industry Challenges

Many folks, not regular followers of cacao or chocolate news, nevertheless were surprised earlier this spring when the price of [dry fermented] cacao beans on the international market soared up by 73% in less than a month.

Local cacao prices have also risen, but not to the advantage of small cacao farmers who built Belize's sterling reputation for high grade cacao. Lower profit margins for the small farmer leads them to explore other revenue streams. Weather challenges, an increased presence of monilia (fungus) and higher general production costs all factor in; yet many opine that the strongest element changing Belize's local cacao industry is from the expansion of relative newcomers who, at some level, serve as middle-men between farmers and processors.

Local farmers currently receive between Bz$1.30 to 1.40 for wet beans, and up to Bz$4.50 for dry (unroasted) fermented beans. Contract prices to smaller farmers by the middlemen/processors are lower. Prices for dry fermented beans from this new sector range between Bz$7.00 to 9.00/lb.

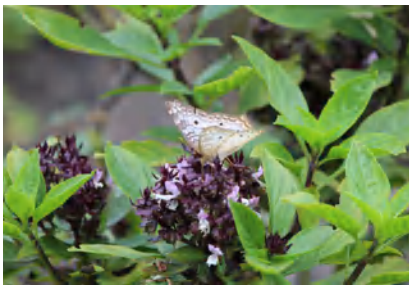
Toledo Cacao Growers Association (TCGA), a non-profit formed in 1984, was instrumental in helping establish Belize's cacao industry. TCGA offered members improved plants from their nurseries, technical assistance and international marketing coordination. Currently TCGA is undergoing re-organization, with plans to restore many of its former functions. Presently, no official 'GOB Cacao Policy' is in place.

**The ICCO (International Cocoa Organization: icco.org) was established in 1973 as an inter-governmental organization, under the auspices of the UN. Note that there are more cocoa-importing country members than producing/exporting countries. Twenty-seven of the 29 importing members are in the EU (USA - not a member) and Belize is not one of the 22 exporting members. By and large, exporting members are African, with a few South American countries participating.*

Growing Herbs Outdoors

By Gary Reimer

In the ten years I have grown potted plants for sale in the nursery I learned a few basic truths about herbs and a number of opinions. Every Mennonite cook wants a parsley plant near her back door. Drops from Cuban oregano leaves relieve earache. Everybody knows the aloe vera plant and if not by that name then by "Savila". Even though the aloe is not considered an herb, it is a well-known home-remedy for sunburn and other ailments. When someone needs an herbal remedy for fever they take the fever grass, which also goes by the name lemon grass when people need it to repel mosquitoes. I also learned that pizza is better with Italian oregano and basil – chiefly basil. But basil always struggles to survive during humid, cool, winter conditions. When someone asks for mint they often say 'mojito' in the same breath.



All the above and an intense love for growing things prompted me to plant a row of herbs as an experimental project. Right in the hottest summer the potted plants were transplanted to the first ridge in my garden.

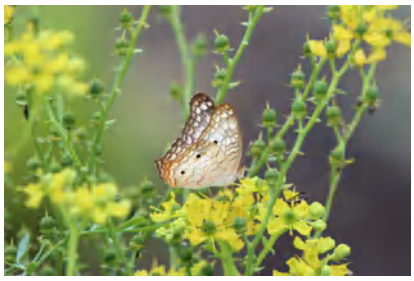
The soil left a lot to be desired. It was black clay top soil with patches of white clay. Yes, white clay with nothing more than some trace minerals and a base to offer; at least no macro nutrients were available. The one benefit that came with the black topsoil was a small amount of organic matter. But unless this would be supplemented with more compost or manure these benefits would be gone by next year too. For now the row was tilled and ridged, and the soil was workable.

Two parsley plants, Italian oregano, an herby verbena a.k.a. *Lippia alba* (further referred to as local sage for ease of use, though running the risk of confusion) and a rue plant went in first. I added more heirlooms: Cuban oregano, yerba buena – a herby spearmint, epazote, and a clump of chives. Then I put in a selection that I knew to be more delicate: common sage, thyme, marjoram, and lemon balm. The specimens in my collection I was most excited about were two types of lavender – French and English - and rosemary.

This nearly excessive row of herbs measured close to thirty feet and lay at the front of the garden. Other veggies and some flowers grew in the main part of the garden but this herb collection was to be on my front burner, receiving special care and attention.

Soon the most vigorous plants announced themselves – local sage and parsley. The local sage just stretched out her arms in all directions, sprouting roots wherever her branches touched the ground. Immediately I knew this plant was fine with non-amended soil. And the parsley grew leafy very quickly, almost as big as celery.

The losers were indeed those delicate selections, and they lost largely because of intense heat, partial drought, and possibly the high light intensity of direct sunshine. Mint and Cuban oregano soon showed that they were willing to grow wherever I planted them, basically, but their preference would be some cool, moist compact soil, and there to be left alone.



I kept my fingers crossed for the rue plant. After hearing so many rumors about the nature of this plant and watching a number of rue plants die overnight in my experience, my interest in this one was properly piqued. Here it rooted firmly in that same poor soil and it grew. Soon it blossomed a bright yellow, attracting peacock butterflies, and its leafy shrubby branches sheltered a tiny grassquit nest. Eventually I risked taking tip cuttings for propagation at the nursery and still it grew. Rain, sunshine, wind, and poor soil were all in its favor. But one day, after I had left off pinching old seed heads and taking cuttings for a while, the rue plant gave up the ghost. I was loath to see this pungent herb go. I had been so intrigued by its almost repugnant smell, its silvery leaves, and enigmatic character.

The lavenders and rosemary succeeded. They thrived in the ridge on which they stood because they were well-drained, well-ventilated, and in full sun. The poor soil did not bother them a mite.

Only the English lavender *(Lavandula angustifolia)* with its short dense growth habit succumbed to the extended rainy season. It started with crown rot and went on with root rot, till I had to pull it up and discard it.

French lavender ended up being a personal favorite. It was my favorite for foliage, for its soothing scent, and for its delicate flavor in cupcakes that my wife baked. This lavender branched densely and formed a relatively tall bush. With time it even pushed out a few purple flower spikes.

Countless times I have heard stories of failures with rosemary. Customers would say that their rosemary plant rotted or dried up. The occasional report of a large, robust specimen charmed me. There had to be a way to succeed. Some customers had sturdy plants in buckets outdoors. Some reported vigorous shrubs in sandy spots in urban backyards. My rosemary plant grew right beside the lavender. It closely resembled English lavender with its narrow leaves, but rosemary leaves are a much more silvery white. Its leaves were loaded with strong essential oils, ready to be released upon touch. Its piney smell was a sensation. Again, rain or draught did not majorly affect it. The full sun location, raised garden row, and breezy site made it grow and hold on. I began clipping tip cuttings for propagation and my wife tossed an occasional rosemary sprig into a chicken roast or pot of soup. It looked like the making of my elusive, robust rosemary shrub.

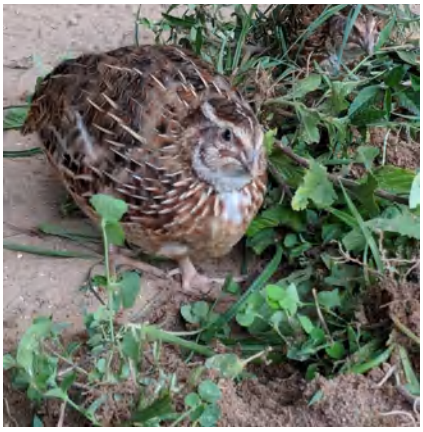
Basil did very well in full sunshine. The draught of summer did not kill it. Instead, this was the season of its best immunity and health. The sun prevented any downy mildew from developing. The poor soil condition resembled the natural habitat of the native basil that grew wild in my backyard. Inversely, the basil in my care at the nursery struggled in the loose rich soil, moist conditions and partial shade from the shade house in which I grew them. Many succumbed to Basil Downy Mildew.

Many discoveries lie ahead, awaiting my curiosity. The local sage still holds my respect and wonder today. I will keep learning about its various uses and fascinating growth habits. I will give another go at the tender, delicate herbs. A shadier spot may suit them better. I am not sure that I will ever till up my first herb row again. I may sprinkle some compost or add some aged manure on the surface every year, and replace plants as needed.

And I will go on to try other herbs. There are so many more types of mints out there, and they are my teasers now. I grew one peppermint with exceptional success in an old water trough that I filled with topsoil. But will I be able to do it again? Summer is coming and I would love a full cup of cool, refreshing peppermint tea on a hot, sunny day.

The Dollars and Sense of Quail

By Leisa Carr-Caceres



My relationship with quail began in 2020 right after the pandemic started. The actual reasons were two-fold. #1) I had always been curious, as many years ago a family member raised them and had said it was amazing. #2) Now I had the time to "trial and error" learn. I posted on my social media my interest in acquiring a few birds. I got 5 birds: 3 adults and 2 chicks. I quickly learned there is not much information about raising quail in hot and humid climates so answers to my piling up questions were hard to find. Luckily, I did find a few forums on social media, which I joined, and found many helpful contributors willing to answer my concerns. I highly recommend reading through all the comments and applying what makes the most sense. This word "sense" is the segway into the meat of this article.

I named my first quail pair Dennis and Meg. They were my champions. I didn't know it at the time, one-on-one is not healthy for the female as males are aggressive breeders, but Meg and Dennis were amazing, and they gave me a fertilized egg every single day. Very soon – I was in business. (Recommended male/female ratio is 1 roo for every 4 or 5 hens). Quail take only 17 – 18 days to incubate. Females start laying eggs as soon as 6 – 8 weeks. Chickens take 21 days to incubate and start laying eggs in 20 – 24 weeks. By the time markets started opening back up in 2020 I was ready to offer quail eggs for sale. I would go every Friday to the Blue Moon Farmers Market excited to sell quail eggs. To my surprise and delight, not only was there a market for the quail eggs but for live birds as well. I was selling the eggs for $6 a dozen and later on, I decided to get a little creative, and so I made some netted crochet baskets for the eggs (also reuseable plastic containers) and sold 16 eggs for $10.

Now to get a little bit more technical and talk more about the dollars and sense of raising quail, allow me to expound. Apart from the fact that initially there is little wait time to actually see

your very first egg, I'd like to make a comparison. Care for quail is like caring for cats. Given the right environment, you can feed them only once a day (or go away for the weekend) as they do not overfeed themselves and overall they are low maintenance (again, given they have proper enclosures, watering and feeders). Two pounds of feed (turkey feed) provides 1 pound of quail eggs. Converting that to cash means about $1.50 feed produces about 3 dozen eggs = $18 (farmers market price) but as you can see it gives you a margin where you can give a wholesale price as well. Now this begs the following question…….

Why are quail eggs so much more expensive than chicken eggs if they are so much smaller? Well for starters, availability of course. They are hard to find and people who love them will be delighted when they do find them. The eggs go great in gourmet salads (pickled) and of course are considered a delicate hors d'oeuvre. But beyond that…….

And some people who are allergic to regular chicken eggs can actually consume quail eggs because they have ovomucoid protein which is a natural anti-allergen property. Quail eggs are high in vitamin B as well and don't carry a salmonella risk at all (great raw in power drinks). This is due to the fact that quail eggs have an increased amount of lysozyme - an antimicrobial enzyme - which kills harmful bacteria. Basically, quail eggs do taste the same as chicken eggs; however they do not have as potent "eggy" smell and the yolks are creamier, almost like silk.

Now to be fair, we cannot just talk about all the wonderful things about quail without pointing out the challenges. There is a tremendous learning curve. You really want to research what the challenges are before you launch into raising quail, but I will mention a few here. They are picky eaters. Their diet is high in protein (between 24% and 32%). Unfortunately in Belize we can find only turkey feed which has 21% protein. Mealworms are a great source of protein and quail love them, however, can be fed only in moderation. A second challenge is everything must be perfect (humidity, temperature etc.) to get a high hatch rate. Thirdly, quail are somewhat hard to keep alive, not due to illness but rather they certainly can get themselves into amazing predicaments that cost them their lives and they are easy prey, even for rats and ants (yes, I said rats and ants, not to mention opossums, snakes, foxes, dogs, cats and more). Additionally, just as they are fast to start producing, they are quick to stop. Anything that upsets them may cause them to stop laying eggs for a couple of weeks. The lack of 16 hours of light and 8 hours of darkness can also upset their laying consistency. So, all of these things must be taken into account when you initially create your quail environment. They must be in a proper enclosure (best if dotted with small plants or tunnels so they can hide) allowing approximately 2 sq.ft. per bird, hole tight so nothing can get in or out.

There are many types of quail and these pictured are called Coturnix (jumbos) or Pharaohs. Also known as Japanese or Common quail. These are the largest of quail and for the most part the ones used for commercial purposes. They can weigh up to 14 ounces (live). Quail are also a meat delicacy. I have worked with a few chefs who for special occasions offered quail as a meal and the price I gave for dressed meat was $25/lb. At that time I compared it to the commercial price of lobster. Are quail worth it? Absolutely! The meat is a flavorful, tender dark meat and very nutritious. Many simply wrap it in bacon and toss it on a grill. It is considered one of the highest dollar menu items in many restaurants.

Thinking about raising quail? You will be thrilled and entertained. You will learn so much, but do not believe everything you read (online) as most information is directed towards raising quail in colder climates. Whether you want to raise quail as a business, hobby, garden décor or project for your child, they are certainly a commitment, but a rewarding one. Just look at those eggs! Each and every one is personalized especially for you!!

I currently do not offer eggs or live birds but certainly am available for you to "pick my brain" about quail. Find me at Banana Bank or on my Facebook Page under Leisa Beliza https://www.facebook.com/BelizeanCraftandColors

Editor's Note: Yes! Leisa Carr-Caceres is the daughter of Carolyn and John Carr. She manages the hotel, the horse camps and other events at Banana Bank Lodge. In her spare time, she creates custom stained glass items.

Effective Microorganisms™ (EM™) An Economic & Ecological Alternative for Soil & Water Bio-Renovation

By William Usher, M.Agr. Ing.Agr.

For over 40 years, Effective Microorganisms™ in the form of a liquid agricultural microbial inoculant has been used in agricultural applications with great success. Today it is used and manufactured in 60 different countries including Belize. The founder and developer of the original inoculant, EM•1®, is Dr. Teruo Higa, who discovered that selective beneficial microorganisms can co-exist in a form that will allow for their *effective* use in sustainable agriculture and environmental management. EM•1® is not a chemical; it is a cocktail of living biological organisms produced through a fermentation process and consists of water, molasses, lactic acid bacteria, yeast and phototrophic bacteria.

Bio-renovation Process

The process of bio-renovation is shown in Figure 1; the inoculated microbes act specifically on organic matter and accelerate the decomposition of organic matter within soil or water. The EM™ microbes work by

1. separating or decomposing the organic compounds such as proteins, sugars, fat, and fibers
2. suppressing pathogenic microbes through the creation of an anti-oxidative environment where the pathogenic microbes do not survive, thereby reducing the negative effects of the pathogenic microbes in the soil or water. The process is called *competitive exclusion*.
3. producing beneficial substances such as vitamins, antioxidants, amino acids, enzymes, etc., for the living organisms in both the soil or water and the plants. These metabolites are an integral part of the bio-renovative transformation of the soil or water where EM Technology™ is employed.

Adding EM Technology™ to an oxidative environment allows opportunistic microbes, or beneficial microbes naturally within the said environment, to work in synergy with the beneficial EM™ microbes being added to that environment. In tandem, these beneficial microbes bio-transform such environment to one of an anti-oxidative environment, thereby tipping the balance from a once harmful environment to a now healthy one.

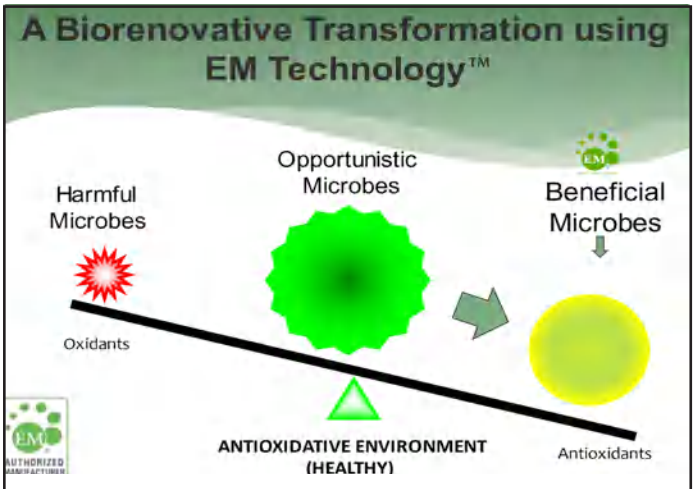


Figure 1: EM™ shifts the balance of beneficial microbes in the environment

Benefits of EM•1® Microbial Inoculants

In Agriculture Production Management:

Figure 2 shows the dramatic difference in tomato plant growth between a plant treated with EM™ and one not treated for nematodes. EM™:

- Reduces fertilizer cost
- Reduces herbicide cost
- Promotes soil aggregate formation and soil compaction resistance
- Maximizes conversion of organic matter into soil humus
- Helps improve soil structure and porosity
- Increases nutrient availability
- Improves seed germination and root development
- Improves crop quality: size, color, and shelf life
- Increases beneficial native microbial populations
- Indirectly can reduce operational cost.

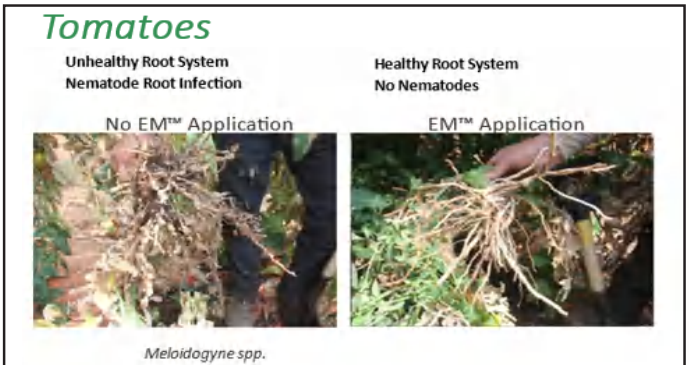


Figure 2: Nematode control in tomatoes using EM Technology™(Chile)

In Livestock Production Management:

Figure 3 references a dairy farm in Peru that increased milk production from 7, 600 to 10,000 liters per day after using EM™ technology. EM™:

- Improves feed conversion rate
- Reduces endo- and ecto- parasites (i.e. mastitis in dairy cows, foot pad dermatitis in broilers)
- Increases beneficial microbial populations within the digestive system of animals
- Reduces the emission of methane gas from ruminants
- Reduces noxious odors in livestock installations (i.e. sulfur and ammonia gas emission)
- Indirectly can reduce operational cost.

Figure 3: Increase milk production as a result of EM Technology™ use (Peru)

In Solid & Liquid Waste Management:

Figure 4 shows how sugar cane wastewater changed from polluted brown to fresh water blue after 12 weeks of EM™ treatment. EM™:

- Reduces noxious odor (i.e. sulfur and ammonia gas emission)
- Improves chemical and physical properties of water, eg, biological oxygen demand (BOD), chemical oxygen demand (COD), total soluble solids (TSS), dissolved oxygen (DO), nitrate and phosphate etc.
- Reduces certain pathogenic organisms, eg, coli forms, sulfur and ammonia producing bacteria
- Increases beneficial microbial populations, i.e., phototrophic bacteria, lactic acid bacteria, yeast
- Increases decomposition rate of organic matter
- Reduces sludge
- Improves water clarity and quality
- Indirectly can reduce operational cost.

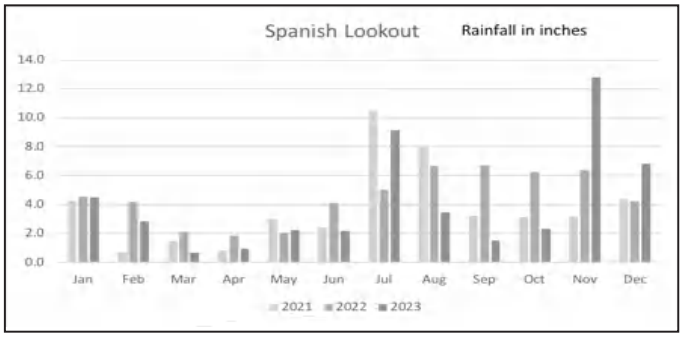
Figure 4: Sugarcane wastewater management using EM Technology™(Belize)

Continued from page 15

Rainfall - Spanish Lookout
Cayo District

Spanish Lookout rainfall courtesy of the David J. Thiessen Family and Ms. Eileen Reimer

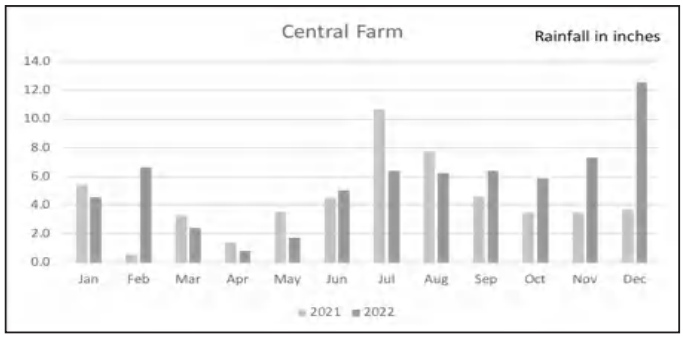
Month	2021 Rainfall in.	2022 Rainfall In.	2023 Rainfall In.
Jan	4.2	4.5	4.48
Feb	0.7	4.2	2.85
Mar	1.5	2.1	0.68
Apr	0.8	1.8	0.95
May	3.0	2.0	2.23
Jun	2.4	4.1	2.18
Jul	10.5	5.0	9.13
Aug	8.0	6.7	3.44
Sep	3.2	6.8	1.5
Oct	3.1	6.2	2.33
Nov	3.2	6.4	12.79
Dec	4.3	4.2	6.82
Totals	**45.0**	**54.1**	**49.38**



Rainfall - Central Farm
Cayo District

Central Farm rainfall courtesy of Belize HydroMet

Month	2021 Rainfall in.	2022 Rainfall In.
Jan	5.4	4.6
Feb	0.6	6.7
Mar	3.3	2.4
Apr	1.4	0.8
May	3.5	1.7
Jun	4.5	5.0
Jul	10.7	6.4
Aug	7.7	6.2
Sep	4.6	6.4
Oct	3.5	5.9
Nov	3.5	7.3
Dec	3.7	12.6
Totals	**52.3**	**65.9**



Butterfly Farming at Green Hills Butterfly Ranch

By Robin Greaves, Managing Director

Conservation is the primary objective of Green Hills butterfly ranch located in the Mountain Pine Ridge of Cayo. Our 250 acres of forest and the 800 acres of adjoining forest that we manage have a very rich biodiversity: hundreds of species of trees, shrubs, and other vegetation, and multitudes of mammals, birds, amphibians, reptiles, and invertebrates, many of which are endangered. Invertebrates make up the largest numbers of species, numbering many thousands of species. All five of the native cats - the jaguar, mountain lion, jaguarundi, ocelot, and the margay roam the forest. Other important animals include tapirs, herds of peccaries, large numbers of coatimundis, agoutis, gibnuts, ant eaters, howler monkeys, and deer. The snake population is very healthy, with about 50 different species of snakes recorded on Green Hills. Green Hills is a recognized birding hotspot.

The butterfly farming operation focuses on indigenous species that can be bred in captivity, exported to the US, and perform well in butterfly exhibits. The larval host plants for the butterflies are available on our property in large quantities so we can produce unlimited amounts of butterflies. Our whole farming operation is very compatible with the natural ecosystem. We export live pupa from Belize to the United States and to Europe, which enables school children in urban environments to visit butterfly houses and come into contact with butterflies from the rainforest, which they would normally be unable to do.

The other main activity that we carry out at Green Hills is education which we believe is a very powerful conservation tool. By educating Belizean school children, we instill in them at an early age a love and appreciation of the natural world; the large numbers of students who visit Green Hills regularly as part of their school curriculum are becoming lifelong conservationists. We also educate tourists who visit Green Hills about the importance of the conservation work that we're doing, the active guarding and preservation of the forest, re-wilding of previously cleared areas and the production of vast amounts of forest tree seedlings.

The economic activities of tourism and live pupa export being very labor intensive generate significant employment opportunities

in rural areas of Belize enabling us to employ large numbers of local people in a conservation oriented profession. All of our economic activity is foreign earnings based which contributes to the economy of the country as a whole. We educate our staff about the importance of conservation and about all of the natural flora and fauna of Belize, and just by virtue of farming butterflies they're gaining an appreciation of the wild; it evokes a feeling of conservation and a love of the natural world.

Around Belize, we have set up many separate butterfly producers. We pay them directly for their pupa which are added to our production. We are currently working with about 40 species of butterflies. The export of butterflies to butterfly houses in the US and Europe generates income which is largely plowed back into the conservation of the tropical forest. The whole activity of butterfly farming is a fundamental part of our conservation activity. It is important to us that our enthusiasm and dedication for conservation be passed on to the many visitors to butterfly exhibits in the First World.

Robin Greaves: Managing Director, Green Hills Butterfly Ranch, Patron Member, IABES International Association of Butterfly Exhibitors & Suppliers. Member TITAG The Terrestrial Invertebrate Taxon Advisory Group.
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www.greenhillsbelize.com

Interview: Green Hills Butterfly Ranch

By Dottie Feucht

As mentioned in the article, the focus of the Green Hills Butterfly Ranch (GHBR) operations is conservation. Every student who visits the ranch is instructed on the importance of conservation. The business of GHBR is the export of butterfly pupae to zoos and museums all over the world. The Belize Ag Report editor interviewed Robin Greaves, managing director of GHBR, about these topics.

BAR: Do you have student tours?

GHBR: Yes; we have an agreement with the Ministry of Education; all students are welcome to visit the GHBR, free of charge, by appointment only, 100 students at a time. GHBR is open year around from 8:00 – 4:00.

BAR: What is the cost for tourists?

GHBR: We charge $US 20 for adults, ½ price for children. This price subsidizes Belizean students.

BAR: How many people do you employ caring for the butterflies, shipping them, etc.

GHBR: We employ 17 local Belizeans full time at GHBR and 10 at our satellite operations in Columbia River, 7-Mile, and Maya Centre.

BAR: What country purchases the most butterflies? How many do you ship weekly?

GHBR: The US is our biggest customer; the UK is second. We ship about 5000 pupae per week but that number is increasing from both new customers and standing orders. The survival rate is 98%, the same rate as at the GHBR and much higher than the 5% survival in the wild.

BAR: How many species do you have for sale to other countries?

GHBR: We have a portfolio of 25 species but only about 20 are available at a time. Butterfly hatching is seasonal, just as many other jungle creatures. Customers choose the species they want to have flying around in their butterfly enclosures. Butterflies live only a month or so.

BAR: What other countries produce/raise butterflies? The same or different species?

GHBR: The Philippines, Kenya, Ecuador, Costa Rica, Peru, Columbia and a few more. Like Belize, each country produces butterflies from its environment.

BAR: What is the worldwide trend of the butterfly business?

GHBR: The butterfly business is growing exponentially for 3 reasons: (1) It has one of the lowest maintenance costs to zoos. (Think of all those large animals in zoos that have to be fed and their enclosure maintained.) (2) It is reported by zoos to be the most popular exhibit by visitors. (3) Visitors tend to choose to visit zoos that have butterfly exhibits over those who don't.

BAR: Did your business take a downturn during covid? If so, what did you do with the surplus butterflies?

GHBR: Business definitely took a downturn; not only tourist visitors but more importantly airline service. We could not export pupae but we did retain our full employment; staff were busy building the infrastructure we needed for expansion

BAR: Is your business expanding?

GHBR: Yes; we are currently working out the logistics of providing the award-winning Konya Tropical Butterfly Garden with our butterflies. The Konya Garden, built in 2015, is the first of its kind in Turkey. The striking insect conservatory, housed within a butterfly-shaped building, is one of the longest butterfly-flying fields in Europe, allowing visitors a glimpse of these colourful creatures in their own natural habitat.

Homeschooling Resources
By Beth Roberson

Increasingly, parents worldwide are electing to home school their children, either full curriculums or just supplemental courses, such as additional math or English. Having partially home schooled my children and now assisting with my grandchildren's education, I was delighted recently to find a middle school course (grades 5 -8) on Latin America, for which I had searched high and low for decades, sending requests to established home school providers, but which I had never located **in English.**

Surprise, surprise! Dennis Reimer, manager of Spanish Lookout's Valley Printing Center, where we were sourcing music theory workbooks, showed us their book warehouse, wherein *Neighbors in Latin America* by Roger L. Berry (2008, 3rd printing 2017) including the related workbooks, lay in wait. Apparently, Mennonite schools have been using Christian Light Education's Social Studies Series in their schools for some time. We used the course, although designed for 6th grade, for a 5th and an 8th grader together, and all 3 of us learned a lot, with good retention enhanced by the excellent workbook series. The book's introduction explains their goal "to provide basic information on the geography, climate, history and people of Latin America".

The series divides Latin America into 4 sections: Mexico; The Caribbean; Central America and South America. We supplemented the subsection about Belize with several additional books: Robert Leslie's *History of Belize*, Rosita Arvigo's *Sastun: My Apprenticeship with a Maya Healer*; and parts of Franz Smith's very comprehensive *Belize Facts & Figures, 3rd Edition*. Smith's book is indeed one of the finest books to date about Belize and we especially enjoyed the section on *National Heroes and Benefactors*.

For more information on other courses, I recommend checking out Sonlight.com, an American Christian literature-centric home schooling company. They are one of the few companies who encourage parents to purchase extra workbooks, etc., enabling repeated use of the same course material. One can find schooling options for pre-K through 12th grade there.

If you found this article helpful, please let us know at belizeagreport@protonmail.com

"Reality is that which when you stop believing in it, doesn't go away."
Philip K, Dick 1928-1982

Agriculture Prices at a Glance- $$$$$

MAY 2024

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 - Guatemalan Market Prices as researched by BLPA							
by District		Dist.	Per lb	Dist.	Per lb	Dist.	Per lb
Fattened steers	H/H/H	Czl	2.50	OW	2.60	Bze	2.50
750-1100 lbs	H/H/H	Cy	2.50	SCr	2.10	Tol	2.30 - 2.45
Weaner steers	H/H/H	Czl	2.40	OW	2.50	Bze	2.30
" "	H/H/H	Cy	2.35	SCr	2.20	Tol	2.00 - 2.25
Breeding heifers	H/H/H	Czl	2.00	OW	2.10	Bze	2.00
" "	H/H/H	Cy	2.00	SCr	2.00	Tol	1.80 - 2.00
Cull cows	H/H/H	Czl	1.00 - 1.40	OW	1.00 - 1.65	Bze	1.00 - 1.50
" "	H/H/H	Cy	1.40 - 1.80	SCr	1.25 - 1.55	Tol	1.25 - 1.40

BELIZE DAIRY CATTLE - provided by The Belize Dairy Association			
Dairy heifers, breeding age by the head	S/L	5,500.00	2,500.00 - 3,500.00

U.S. CATTLE		
U.S. price - corn fed - 1000-1200 lbs	H	US$ 169.72 / 100 wt
U.S. price - feeders 600-800 lbs	H	US$ 247.00 / 100 wt

BELIZE HOGS - Provided by Belize Pig Council		
Weaner pigs - 25-30 lbs - by the head	H	125.00
Butcher pigs 160 - 230 lbs, per lb	H	2.25

BELIZE SHEEP		
Butcher lambs - live per lb	S	2.50
Mature ewes - live per lb	H	2.00

BELIZE CHICKEN			
Wholesale dressed, per lb (Sp Lkt)	H	2.72	Large Birds 2.60
Wholesale dressed, per lb (Bl Crk)	H	2.70	
Broilers - live per lb (Sp Lkt)	H	1.33	
Broilers - live per lb (Bl Crk)	H	1.43	
Spent hens (Sp Lkt)	H	1.00 - 1.35 / lb	
Spent hens per 4 lb bird (Bl Crk)	H	1.00 / lb	

CITRUS		
Oranges per lb solid, estimate only	H	18.00 / box (2023 price)
Grapefruit per lb solid, estimate only	H	18.00 / box (2023 price)

COCONUTS		
Green Coconuts, bulk	S	0.30 - 0.60 / per coconut
Dry Coconuts, bulk	S	0.35 - 0.50 / per coconut

GRAINS, BEANS & RICE			
Belize yellow corn, bulk (Spanish Lookout)	L	$33.00 / 100 lbs (2023 price)	
Belize yellow corn, bulk (Blue Creek)	L	$27.00 / 100 lbs (2023 price)	
Belize white corn, bulk (Cayo District)	L	$32.00 / 100 lbs	
US Corn, #2 yellow	L	US$4.43 / 56 lb bushel	
US organic, #2 yellow corn feed grade	L	US$6.10 - 8.15 / bushel	
Belize soy beans (Spanish Lookout)	L	50.50 / 100 lbs	52.00 / 100 lbs payments
Belize soy beans (Blue Creek)	L	56.00 / 100 lbs	
US soy beans	L	US$ 12.30 / bushel	
US organic, #1 feed grade soy	L	US$ 19.50 - 20.00	
Belize milo (Spanish Lookout)	L	21.00 / 100 lbs	
Belize milo (Blue Creek)	L	23.00 / 100 lbs	
Red kidney beans (Spanish Lookout)	-	N/A	
Red kidney beans (Blue Creek)	-	N/A	
Black eyed peas (Spanish Lookout)	H	112.00 / 100 lbs	
Paddy rice per pound (Spanish Lookout)	-	N/A	
Paddy rice per pound (Blue Creek)	-	N/A	

SUGAR/HONEY		
Sugar cane, ton	H	60.61 (Sept 2023 price)
Bagasse, per ton	-	N/A
Honey, 5 gal (approx 60 lbs)	H	260.00+ (shortage)
Honey, specialty, 5 gal (approx 60 lbs)	H	300.00

SPECIAL FARM ITEMS			
Eggs - tray of 30, farm price	H	6.60 (Sp Lkt)	7.60 (Blue Creek)
WD milk/lb farmer base price, contract only	H	0.64 - 0.67 contract only	
Raw milk (farmer direct sales)	S	5.00 per half gal	

CACAO		
Cacao beans organic	H	4.50 / lb dried fermented beans
Cacao beans organic	H	1.30 - 1.40 / lb wet beans
US Cacao beans, metric ton (ICCO)	H	US$ 9,876.58

Wet beans lose up to 70% of their weight during fermentation, drying and roasting.

Find link to all of the Prices at a Glance pages (back to 2009) on our website: www.agreport.bz

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

45th Annual General Meeting of the Belize Livestock Producers' Association


New BLPA Directors

On a cool Saturday morning, on the 24th Feb, 2024 approximately 414 BLPA members plus 181 guests gathered at BLPA's main headquarters at Mile 47 ½ George Price Highway for their 45th AGM. Chairman Jeffrey Reimer brought down the opening gavel at 9:45 welcoming livestock ranchers who had traveled from all 6 districts to attend. The national anthem, an opening prayer by Vice-chair Arden Edwards and CEO William's Usher opening remarks preceded the video, *2023 BLPA Accomplishments*.

Guest speaker for the occasion was the Prime Minister of Belize, the Honorable John Briceño. He praised the "phenomenal expansion of the industry and the potential for further development". Noting the population projections for Mexico and Guatemala to reach 45 million and 21.3 million, respectively, by 2030, he encouraged growth of our cattle industry to accommodate both our domestic market and increased exports to our neighbors.

Exports for 2023 per the BLPA annual report were 21% above those for 2022, with a total of 40,290 head exported, generating over $70MBz in revenue. Of those, 11.6% or 4,347 head went to Mexico in formal trade and 88.4% or 34,320 head were sold as informal trade to Guatemala.


Prime Minister John Briceño

BAHA's Dr. Roxanna Alvarez followed the PM, with an articulate and passionate presentation on the return to 3 Central American countries (currently), of the New World Screwworm (NWS). Belize was declared free of the NWS in 1992, after years of efforts which included meticulous larvae collections and targeted dropping of sterile male NWS flies. She pointed out that NWS look to any warm-blooded mammal as a host (including humans and wildlife). The financial drain to Belize if it returns would be enormous. (Find article by Dr. Alvarez, pg 20).


Outgoing Chair Jeffrey Reimer

New BLPA directors elected at the AGM and new BoD officers, selected by the board subsequently are: Arden Edwards of Toledo, Chair; Peter Friesen of Cayo, Vice-Chair; Alexis Blanco of Orange Walk, Secretary; Darrel Tillet of Belize, Treasurer; Peter Fehr, Orange Walk; Franz Rempel, Orange Walk; Kent Diaz, Stann Creek; and Gerhard Penner, Orange Walk.

Notable events held in 2023 included the *1st Belize Beef Fest & Rodeo, a Sizzling Celebration of Belizean Livestock and Culinary Excellence*, held on 19th August, 2023 at the National Agriculture Show Grounds, Belmopan. The *2nd Belize Beef Fest and Rodeo* is planned for Saturday 17th August at the same venue. See ad this page.

Farmer field schools on Voisin pasture rotation management were held in Orange Walk, Belize and Cayo Districts during November-December 2023, for 66 trainees. Chair Jeffrey Reimer expressed his confidence in the increased carrying capacity of Voisin pasture models, which use smaller paddocks with rotation. CEO William Usher observed "night and day differences between those that implemented [and in those that did not].. in 60 days, you can see the difference." For years, carrying capacity in Belize was estimated at 1 head per acre. Voisin experts estimate that the 37 acre farm at BLPA headquarters, could hold 90 animals under the Voisin system.

Current BLPA membership stands at 1,135 active members, with 463 in Orange Walk; 292 in Cayo; 171 in Toledo; 102 in Belize; 71 in Corozal; and 36 in Stann Creek.

The future is bright for Belizean ranchers, who can increase yields without increasing de-forestation, enabling increased cattle exports to the rapidly expanding markets in Mexico and Guatemala.

Find the following charts, from BLPA's annual report: Farmers registered in the BLR by district; Distribution of farmers by animals owned; Distribution of animals by district on **pg. 39.**

Coyotes, A New Source of Conflict with Domestic Animals in Central America

By Rafael Hoogesteijn, Director, Jaguar Conflict Program, Panthera

The coyote (*Canis latrans*) is a newcomer to Central America. With the spread of deforestation and the increase of roads, coyotes have slowly conquered new areas and countries south of the US and have even crossed the Panamá Channel. If a road is opened in the Darién Forest that separates Panamá from Colombia, he will follow that road and spread in all South America also.

The coyote is a more difficult animal to handle regarding predation on domestic animals than jaguars or pumas. I have no personal experience with coyotes (yet), but have seen them in Costa Rica, seen their depredations in Panamá and read a lot about them in the specialized journals of the US.

The same systems that we apply in Panthera to prevent predation by felines, can be applied to coyotes, including the use of specially built electrical fences (with a design that does not allow cattle to go out nor the predator to go inside) and the rational use of very tame water buffalo herds (of the milking breeds like the Murrah and the Mediterranean). We also have used autochthonous (Creole) breeds that defend themselves and the cattle that are with them. We have used the Sanmartinero in Colombia, the Pantaneiro in Brazil (both breeds to prevent feline attacks), and have seen their successful use against coyotes and other predators in Panamá (Guaymi or Guabalá cattle) and Arizona in the US (Raramuri cattle from the Tarahumara Indians, imported from semi-desert areas of northern Mexico).

Regarding electrical fences, we have used four modalities: 1) fencing the small or middle-sized farm completely; 2) fencing the maternity paddocks; 3) building electrically fenced night enclosures, and rounding up and closing all the herd in these night enclosures, provided with mineral troughs; 4) fencing along the riverine forests, so the cattle have no access to the forests or the rivers inside; the predators maintain their transit along them without entering the cattle paddocks.

In the US they have used also the Fladry system (small flags around fenced areas that move with the wind) and foxlights (night predator deterrent) with good results on the short term. Predator control is a short term solution that doesn't work for felines; they increase from reproduction rates and newcomers entering from the surrounding areas. Results are worst when eliminating a problem jaguar that predates on wildlife and occasionally on cattle that a newcomer entering predates only on cattle. Coyotes have higher reproductive rates than felines making total control even more difficult; it works only short term, entering a vicious cycle of dead cattle, dead predators and unsatisfied farmers.

There are four ways that we recommend to control predation all of which work at the same time as a group but don't work individually: 1) increase the wildlife prey-base with no hunting so that having an ample natural prey base the predators don't need to prey on cattle, goats, sheep, horses, swine or poultry; 2) maintain the forest areas and forested corridors so the predators have an ample supply of wild prey; 3) increase the productivity of your herd with better feeding/management so that the better production offsets the possible losses caused by predation; 4) diminish the vulnerability of your cattle or other domestic species with the implementation of anti-predation techniques.

Dear reader, if you want to solve your problem, please access the Panthera Brasil web-page: https://pantherabr.com.br/. There is ample material - written manuals and demonstrative films - on anti-predation techniques to show you how to proceed; the material is in the three languages: Spanish, English and Portuguese.

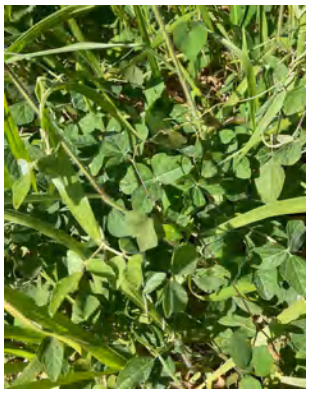
In the US which is a very well-organized country, the methods to completely exterminate coyotes have failed. They are very hardy, intelligent, wary, prolific and they can increase their reproduction rates if needed, so the best way to deal with the problem is to diminish the domestic species vulnerability. And of all methods, the specially designed electrical fences, well built with reliable materials and well maintained, allow you a pleasant and tranquil night's sleep without having to worry about the welfare of your animals.

Use Purple Bush-Beans for Your Cattle

By Engr. Nana Mensah B.O.F.F

Purple bush-bean (Macroptilium atropurpureum), or siratro, as it is commonly referred to in many parts of the world, is a perennial legume native to Central and South America as well as the Caribbean Islands. These beans are packed with nutrition valuable to cattle. Most farmers think only of growing grass and pure carbohydrate when they prepare their farms for cattle raising. But this is not a balanced diet for cattle. They need protein, carbohydrates, *and other nutrients* in the same way we humans need a balanced diet. Any farmer raising cattle should consider leguminous protein. Purple bush-beans are perfect for cattle feed, supplementing gramineae, the large and nearly ubiquitous family of monocotyledonous flowering plants commonly known as **grasses,** as a balanced diet for both goats and cattle.

Ecological Adaptation



Purple bush-bean is a species that thrives in a range of soils from clayey to sandy, which are well drained and tolerant to acidic and alkaline soils (pH 5.0 – 8.5). It can do well in moderate salinity and drought. This legume crop is a nitrogen fixer to the soil; it can be used as a green manure for a fodder crop and also for rotational grazing, leaving 14 – 28 days of rest between rotations. To extract and use purple bush-bean, you can cut it and haul it or preserve it in the form of hay.

You can easily establish a protein bank with high densities of 30,000 plants/acre as an option for accelerating the adoption of purple bush-bean planting. To reduce establishment costs, increase availability of high-quality seed, and provide affordable good quality nursery seedling stock, establish your own nursery for seedlings to transplant at the beginning of the wet season. Obtain seeds along the Western Highway, the road right behind the airstrip in Belmopan, along the road going to Mount Pleasant. Another way to plant is to get the seeds and broadcast them where you want them to grow; then you don't need to spend money on weed control and fertilizer applications. First grazing in the area should commence 3 months after planting, when plants have reached a height of two feet.

Nutritional Value

Purple bush-bean is very good to use in association with grasses such as Guinea and Mombasa. In general, the purple bush-bean provides high protein content; the protein of the test plant#39 accounted for about 16%. With a diet of purple bush-bean and dry matter in an association with a gramineae, the animal can assimilate an extra amount of 20% carbohydrate. In addition to protein, the purple bush-bean is a good source of calcium, potassium, manganese, and amino acids that include aspartic acid and proline for the needs of your cattle.

Production Value

Cattle farmers can improve productivity of both beef and dairy by using purple bush-bean in their pastures. However grazing management is important for both the cattle and the growth of the beans. For example, if the grazing area is seventy to ninety percent purple bush-beans, then cattle should be allowed to graze there for 2 or 3 days, then moved to another area for 30–40 days. If the beans are not so dense, then you can graze them in that area daily but still on a rotational area basis. Doing so would yield milk production of 3.2 liters per cow per day and also help the animal gain a live weight of 0.7 pounds per day during the rainy season.

BLPA Charts...Continued from page 37

Table 5: Distribution of Farmers by District

DISTRICT	PERSONS	%
01 - Corozal	1,281	18.82
02 - Orange Walk	2,268	33.31
03 - Belize	463	6.80
04 - Cayo	1,939	28.48
05 - Stann Creek	170	2.50
06 - Toledo	687	10.09
TOTAL: 6,751.00	**6,808**	**100**

Table 6: Distribution of Farmers by Animal Owned

RANGES	ANIMALS	PERSONS	%
0 - 50 Animals	44,747.00	4,677	67.02
51 - 100 Animals	22,683.00	326	4.67
101 - 150 Animals	14,088.00	115	1.65
+ 151 Animals	108,965.00	260	3.74
TOTAL	**190,483.00**	**5,378.00**	**77.16**

Table 8: Distribution of Animals by District

DISTRICT (6)	QUANTITY
01 - Corozal	10,529
02 - Orange Walk	96,629
03 - Belize	8,680
04 - Cayo	55,750
05 - Stann Creek	6,527
06 - Toledo	12,323
TOTAL:	**190,438**

BELIZE LIVESTOCK PRODUCERS' ASSOCIATION

"Imagine yourself producing 5 beef cattle on 1.5 acres, rotating daily within 30 paddocks and selling at market weight of 600 lbs every 3 months while making at least $15,000. a year extra from your backyard...."

William Usher, CEO of Belize Livestock Producers Association
Tune in for more on this in an article by WIlliam the next Belize Ag Report Issue #47, Fall 2024.

The Belize Ag Report Announces the Rosita Arvigo Award

During Dr. Rosita Arvigo's half century in Belize, she has contributed to numerous achievements benefiting both current and future generations. She continues to serve as a role model for others, who also share useful information or products in the fields of traditional healing, conservation and agriculture.

The announcement of the 1st Rosita Arvigo Award's recipient will be made in November 2024. The award consists of a selection of Rosita's books and the honor of being publicly recognized for achievements similar to hers, and of course related to agriculture.

Rosita left the USA and relocated to a remote Mexican Nahuatl Indian village in 1970, where she was exposed to their traditional healing methods. In 1981, she and her husband Greg Shropshire, a fellow D.N. (doctor of naprapathy) purchased a 35 acres of uncleared jungle along Cayo's Macal River, having selected Belize because "medical freedom and traditional healing were still honored."*

Her apprenticeship in the 1980s, with well known Maya Healer Don Elijio Panti in San Antonio [Cayo District] is detailed in her classic book, *Sastun: My Apprenticeship with a Maya Healer*, written in 1994 and published by Harper Collins.

Even before that publication, Rosita and Greg played several key roles, having established the Ix Chel Tropical Research Foundation (ICTRF), "fulfilling our dream of creating a bridge between science and traditional healing for the benefit of mankind".** In 1988 the Belize Ethnobotany Project, a collaboration between ICTRF, The New York Botanical Garden and the Belize Center for Environmental Studies, increased knowledge and respect for both traditional healing and medicinal plants locally and worldwide. Surveys were made and the implications, environmental and financial, of more traditional farming vs. forest land use for collection of medicinal plants were considered.*** They held 5 country-wide traditional healers conferences in Belize, funded by US AID and helped organize the Belize Association of Traditional Healers (BATH) in 1992.

Rosita and Dr. Michael J. Balick, director of the New York Botanical Garden Institute of Economic Botany, coordinated efforts in which Belize was one of largest donors of plant specimens to be tested for anti-cancer and anti-AIDS compounds. Her grand opus, *Messages from the Gods: A Guide to the Useful Plants of Belize*, was co-authored by Balick. Rosita's other books include: *Rainforest Home Remedies:The Maya Way to Heal* and *Spiritual Bathing*, co-authored by Nadine Epstein, *Rainforest Remedies: 100 Healing Herbs of Belize*, *Medicinal Plants of Northern Guanajuato, Mexico* (in English and Spanish), and 2 fiction books, *The Oracle of Ix Chel* and *The Island of Women*.

In Rosita's Acknowledgements to *Sastun*, she writes: "To Maestro Dr. Elijio Panti, "*el mero*", for his faith in me, for not letting me get too serious, and for placing the pearls of an unbroken chain in my hands". Our publication, in a small way, wishes to promote those same 'pearls'. ****

Although now technically retired, Rosita's life is full of podcasts, interviews, lectures and teaching classes locally and internationally.

By Beth Roberson

1)**Sastun:My Apprenticeship with a Maya Healer*, 1994, pg 3

2)** Ibid, page 177

3)***https://www.sciencedirect.com/science/article/abs/pii/S1572557X02800320

4)****Ibid, pg xi

Rainforest Remedies -
Saving Plants That Heal People
By Eva Maria Sengfelder

"Would you like to take the Rainforest Remedies over", my teacher and friend, Dr. Rosita Arvigo asked Tobias and me one day in early 2015, and we said "Yes". I have been learning from her since January of 2006. I have assisted many of her classes and interned with her, before I took the teacher training in 2012, when I started to teach Dr. Rosita's work.

The work that Dr. Rosita is teaching comes from a long tradition of Maya healers. Dr. Rosita combined her knowledge of Don Elijio Panti's teachings, together with her physician's understanding of human physiology and medical herbal training to formulate a unique set of remedies. True to the traditions they sprang from, these address many of the common physical and spiritual ailments that Don Elijio Panti treated within his practice of 65 years.

For every ailment on earth the spirits have provided a cure. Our job is to find it.

Don Elijio Panti

Herbal remedies have been passed down orally by traditional Maya healers for centuries. Rosita was Don Elijios apprentice for 13 years. Don Elijio was almost 90 years old, when she met him 40 years ago. She and her husband, Dr. Greg Shropshire had opened a healing clinic in San Ignacio as family physicians of alternative medicine. She brought herbs from North America to Belize but she knew that she needed to learn the local herbs, and she was looking for someone who could teach her. When she asked people in town, she heard very often, "You have to meet Don Elijio Panti, "El Mero" he is the best. Before she could find him, he appeared on her clinic doorstep, looking for Flor de Tilo, the linden flower, that would help him sleep. She provided him with the linden flowers, and gave him a massage. He invited her to visit him in San Antonio. This fortuitous meeting was the beginning of a long and tender relationship. Rosita was visiting and helping him one day of the week for a whole year, but Don Elijio was very hesitant to teach her, although he didn't have an apprentice. He was afraid, that all the knowledge would be lost, in case she had to go back to her country.

After a year had passed the Maestro had a dream in which the Maya Spirits told him that it would be ok to teach "the Gringa" because she had a pure heart. When she arrived early one day, he was ready to harvest his corn that he had planted and cultivated in the jungle on a hill all by himself at 90 years old. She convinced him to let her help him. From her years she had spent in a very remote area in Mexico, she was experienced in harvesting corn. Don Elijio, very impressed that a Gringa was able to harvest maize with such skill and after the dream he had, agreed to accept her this day as his apprentice with the promise that she wouldn't let the knowledge die when he was gone. This was a lifetime commitment which she bears every day! So began her thirteen-year apprenticeship. During these years, she spent four days and three nights every week learning from the Maestro about herbs, treatments, prayers, massage, sting ray spine acupuncture and various forms of Maya spiritual healing.

Don Elijio had an encyclopaedic knowledge of thousands of plants and Rosita knew she had to find a way to preserve this. Thankfully she found Dr. Balick from the New York Botanical Garden, who was searching for plants who might have anti-cancer and anti-aids activities. Dr. Balick, an ethnobotanist, came to Belize to meet Don Elijio. He recognized him as a healer of the greatest calibre, an authentic Maya Shaman. This was the birth of a nine years research program. Many of the traditional healers of Belize were interviewed and more than three thousand plants were sent to the New York Botanical Garden to scientifically record them and make them available for future generations. Don Elijio's knowledge of medicinal plants, their names, uses, myths and preparations was astounding. He contributed more than 500 plants to this research program, all from his memory, learned from his traditional oral education.

Dr. Rosita an Dr. Balick worked closely together, eventually co-authoring the popular book: "Rainforest Remedies, 100 Healing Herbs of Belize" and "Messages from the Gods – A Guide to the Useful Plants of Belize", published in 2015 and winner of the prestigious award.

The intention was to make the information easily accessible, so that mothers, grannies, students and healers could all benefit.

In 1992 Rosita created formulas to help people with common ailments. Her goal was to keep them very safe, but potent and effective. "Rainforest Remedies - saving plants that help people" was born.

Rainforest Remedies embodies the principles of the economic value of preserving the rainforest for its healing plants. By offering employment to the local community and validating the economic value of the vibrant living plants of the rainforest, it leads the way in helping to educate the local community about the unique resource at their doorstep. Many plants are harvested from land that's scheduled for clearing and development. Dr. Arvigo calls this work "salvage botany", using valuable medicinal plants that would otherwise be destroyed.

In 2015, we, Eva and Tobias Sengfelder, took up the reins of Rainforest Remedies, and now grow, gather, and produce these formulas. Many of the herbs in Rainforest Remedies products are sustainably wildcrafted at our Arco Iris Permaculture Farm and the surrounding area.

All of the medicinal plants used in Rainforest Remedies whether through "salvage botany", permaculture farming or wildcrafted are always gathered using traditional methods and prayers. Don Elijio used to

Continues on page 43

Common Confusion Between Industrial Hemp and Marijuana in Belize

By Karin Westdyk

Industrial Hemp in Belize

The 2017 amendment to Belize's Misuse of Drugs Act effectively eliminated industrial hemp from the list of controlled substances, thus opening the door for industrial hemp cultivation. Licenses to grow, process, or export industrial hemp were offered through BAHA. 36 licenses were approved but it seems that only 3 farms have actually grown industrial hemp in Belize: one producing oils and seeds, one producing CBD medicinals, and one in the south managed by a group of Mayan farmers.

Soon after this amendment, Belize INVEST, a unit of BELTRAIDE, reported receiving several hemp investment interests seeking to develop hemp-based products such as oils, protein-rich powders, textiles, and CBD medicinals, among others. Several more in Belize expressed interest in developing hempcrete for building as well as textiles and other products. But all were concerned about protecting their investments and waited for official government sanctions that would have come had there not been opposition to the 2022 bill which included both marijuana and industrial hemp in its text.

The opposition to the Cannabis And Industrial Hemp Control And Licensing Act of 2022 raised by the churches is actually focused on recreational hemp, or more commonly called marijuana. Though industrial hemp and marijuana are both derived from the cannabis plant, industrial hemp is not by any means marijuana. Industrial hemp is not psychoactive. There are chemical differences with industrial hemp containing very little tetrahydrocannabinol (THC) while recreational hemp has a much higher level of THC which is what causes the "high" in those who consume it either by smoking or eating it. It is also grown very differently; indeed, industrial hemp and cannabis could not likely be grown together as some might fear. Hemp traditionally grows very tall and thick, while marijuana, only about half as tall, needs space and lots of sun.

It seems obvious that including industrial hemp in The Cannabis And Industrial Hemp Control And Licensing Act of 2022 has confused and discouraged the development of what could one day be a thriving industrial hemp agro-economy in Belize.

In 2021, the global industrial hemp market was valued at USD 4.13 billion and is expected to reach USD 16.75 billion by 2030. This market is driven by the surging use of industrial hemp in various industries. It is interesting to note that before petroleum became the basis for the world's industrial chemicals, during the early years of the industrial revolution methanol, charcoal, tar, pitch, ethyl acetate and creosote – all fundamental ingredients used throughout industry – were derived from industrial hemp. Many environmentalists believe it may well be again a solution as we witness the massive environmental problems associated with petroleum mining, its products, its waste and its pollution.

Industrial hemp is considered the best phytoremediation plant to improve degraded or contaminated soil, eliminating the need for toxic chemical herbicides and pesticides (that do much of the degrading). At the Regeneration International Conference held in Belize in 2018, André Leu, visiting director of Regeneration International, pointed out that there is no better rotation crop than industrial hemp due to its ability to crowd out weeds eliminating the need for glyphosate, a widely used herbicide in Belize classified as a carcinogen by the International Agency for research on Cancer (IARC).

Industrial hemp is extremely versatile; (1) it provides the strongest fiber for textiles, paper, and rope, (2) as a fuel derived from both its seed and cellulose, it burns cleaner than petroleum based fuel at a cost far less than gasoline, (3) it is used for making effective non-toxic medicine, many personal care products, and mold-resistant, water-resistant building materials, and biodegradable plastic, and (4) its seed and oil are used in highly nutritious food products. Hemp grain is for sale in numerous local health food stores throughout Belize, and has been for decades.

According to The Minister of Home Affairs and New Growth Industries Honorable Kareem Musa, investment in developing and establishing processing equipment and manufacturing centers for industrial hemp is needed along with the specific industrial hemp seeds that will thrive in the tropics. All this is possible but *until a majority of Belizeans understand the difference between marijuana and industrial hemp, this process is on hold while a large part of the rest of the world moves forward.* Perhaps educating Belizeans who do not understand that industrial hemp is a different variety of cannabis and is not recreational marijuana is the next step for Belize to join the movement.

Recreational Cannabis (Marijuana) in Belize

Until the 1980's Belize was one of the top exporters of recreational cannabis (marijuana) to the US, but during the 1970's and 1980's the US War on Drugs became a global campaign and the Belize government was strongly encouraged to establish eradication efforts. In 2014 the US government led another campaign, this time with a massive eradication program involving the US military working with the Belize Defense Force, the Belize Coast Guard, and National Police Force. An estimated nearly 30 million dollars' worth of marijuana was destroyed in this effort. Two years later a United Nations study reported that Belize was still one of the highest users of recreational cannabis, ranking even higher than Jamaica.

It was believed by many that restrictions on recreational cannabis were obsolete, ineffective, and unjust. In 2017 the Honorable John Briceno, then the leader of the opposition, called for decriminalization and research toward legalization. Former Senator Lisa Shoman openly called for legalization, claiming there was no rational excuse to refuse to move past decriminalization to legalization of personal use for adults. A Breaking Belize News article quoted her as saying. "Tax it. License it. It could be a powerhouse boost for tourism. And it is a viable cash crop for the Jewel."

The Controversy

In October, 2017 an amendment to the Misuse of Drugs Act was passed decriminalizing possession of up to 10 grams or less of marijuana on private premises; 4 and a half years later in March of 2022, both houses of the Belize National Assembly voted in favor of the Cannabis and Industrial Hemp Control and Licensing Bill which would legalize recreational cannabis use, establish a national nursery for seeds and cannabis plants, and create a Cannabis Control Commission to issue licenses to

authorized individuals or businesses to cultivate, consume, market, transport and distribute cannabis.

Like many other countries, it seemed that this bill provided the legal basis for Belize to develop a lucrative agro-businesses with both industrial hemp and recreational cannabis. However, the National Evangelical Association of Belize objected and since then, the church leaders led a concerted campaign to squelch the efforts toward legalization by encouraging their congregations to sign petitions opposing the bill. The pro-legalization arguments were that decriminalization would greatly alleviate the costs in the Belize criminal justice system -- from arrests to sentencing to imprisonment -- and would allow the justice system to focus on more serious crimes. It was also argued that the use of recreational cannabis could not be deterred and that a legal supply chain would greatly increase revenues for Belize, produce many employment opportunities, and regulate production and safety of the product. It was argued that although the use of recreational cannabis was decriminalized, it was not legal to buy it, sell it, or grow it leaving it in the hands of criminals and allowing criminals to reap all the profits.

In August of 2022, the process toward legalization was paused after the churches gathered enough signatures to require a referendum. The referendum was supposed to take place in September but was put on hold after concerns from the banking community were also expressed regarding corresponding banking relations with US banks. According to the Referendum Act, a referendum must take place if 10% of registered voters sign a petition in opposition. On receipt of the petition, the Governor General's office passed the signatures to the Chief Elections Officer for verification and enough of these signatures were vetted to meet the threshold.

Kareem Musa, the Minister of Home Affairs and New Growth Industries, is a strong advocate for legalization of cannabis and for building a healthy hemp economy in Belize. He points out that with the cannabis industry, banking is not an essential component as the cannabis industry has always been cash-based and that community banks and credit unions could well be an option for depositing cannabis derived dollars without involving the large international banking institutions. This option has been explored in the US where legalization of recreational cannabis has already taken place in 21 states and there are now lists of cannabis friendly national and state banks as well as credit unions.

Advocates for legalization also claim that decriminalizing without legalization will only strengthen the criminal elements involved, claiming that if you cannot buy it, grow it, or sell it millions will be lost to this element, whereas millions could well be derived from a stable government-regulated cannabis industry that could be used for education, many infrastructure needs, or helping the poor in Belize.

Until there is a referendum, efforts to develop a recreational cannabis economy in Belize are on hold. The cost of the referendum is estimated to be between 4 and 5 million dollars which is another reason that the referendum has not yet taken place.

Since the legalization of recreational cannabis was an addendum, it seems that one way forward for industrial hemp is to drop the amendment regarding marijuana and pass the bill for industrial hemp and pursue the recreational cannabis issue independently.

Editor's Note: Karin Westdyk has been an author, environmental journalist and activist most of her adult life. After relocating to her small farm in Cayo District in 2008, she has continued learning and supporting causes in which she believes. As an active member and director of Pro-Organic Belize, she serves in POB's pesticide-free produce project; she writes informative articles in The Belize Ag Report and was a featured speaker at Ministry of Agriculture's initial Hemp stakeholders forum, hosted by GoB and CARDI, in 2018. Her newest children's book, Fidgywumper Saves the Seas, addresses the problems of plastic pollution in our oceans and waterways.

Rainforest Remedies...Continues from page 41

say: "It's simple my child; if you don't thank the Spirit of the Plant before you take it from the earth, it will not heal the people." Mature plants are gathered, while young and tender plants are transplanted at Arco Iris's nursery. Once these have grown, they're either replanted in the wild or grown on the farm for harvest. Many plant harvesters are young Maya people from the community that now show renewed interest in traditional medicine. Herb knowledge that otherwise would have been lost, is now very much alive. By doing this sacred traditional work we are able to support their families and the education of their children. Many of the herbs in Rainforest Remedies' formulas are unique to Belize and Central America. The extremely competitive environment that is the rainforest, creates uniquely powerful plants that grow in highly nutrient rich, virgin soil, bathed in specialized micronutrients. These micronutrients, along with a full spectrum of trace elements drawn from virgin soil make these wild herbs valuable, concentrated foods. The medicinal plant tinctures contain bio-active compounds to assist normal metabolic functions of the body. Practitioners of Dr. Rosita's work have used these formulas for 40 years with great success. The herbs are shipped to the US, Canada, the Czech Republic, Italy, Germany, Israel, just to name a few, to help people all over the world with their ailments. We are very happy that the students of the Faculty of Health Sciences of the University of Belize started to study pharmacy natural products and we congratulate them with the hope to see them use our Belizean herbs in their future businesses.

Editors Note: Eva Maria Sengfelder grew up in Germany where she trained and worked as a social worker before she moved to Belize in 1995. Having been trained by Dr. Rosita Arvigo as a massage therapist and spiritual healing practitioner in 2006 and an educator in 2012, she teaches Dr. Rosita's abdominal therapy to body-workers and the traditional spiritual wisdom of the Maya.

Online Regenerative Ag Course Scholarships for Belizean Faculty and Students

By Beth Roberson

South Seas University, SSU, advertised its online course on Regenerative Agriculture on the Regeneration International (RI) site. Not surprising, since the professor for the course was none other than Dr. André Leu, D.Sc., B.A. Com., Grad. Dip. Ed., longtime officer of International Federation of the Organic Agriculture Movement (IFOAM), as well as one of 3 founders of Regeneration International. Dr. Leu traveled to Belize from his farm in Queensland, Australia, to spend a week here in 2018, speaking daily at Regeneration Belize's (RB) 1st Tropical Agriculture Conference and visiting farms. Hence many in our local ag community remember him. Since he came, he authored what should be one of the bibles in every agriculture curriculum, *Growing Life: Regenerating Farming and Ranching*.

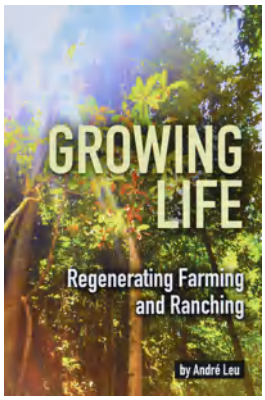
We, at the Ag Report, responded to the note indicating that small farmers might qualify for discounted tuition, inquiring further. After a positive response from SSU, we connected with donors, enabling 13 scholarships which included: 3 teachers, from UB CF, Mopan Technical High School and Tumul K'in Learning Center; 8 students from Mopan Tech and Tumul K'in; UB CF's farm manager; and 1 extension officer from Friends for Conservation & Development (FCD).

There were 6 weekly sessions, from 26th February to 1 April, with ample time for Q & A after each. The sessions closely mirrored the chapters in *Growing Life,* reviewed in this issue.

The civic minded sponsors included: Atlantic Bank, Running W Meats, Remax VIP Maya Beach, David Anderson, Gordon Glenn, Innovatia Labs, The Bluffs, Cedar Bluff Ranch, Bal Singh, Curtis Brager, Arden Edwards, John Plamondon, Trey's Barn & Grill, Dancing Cedars HomeSchool, and the Belize Ag Report. Thank you sponsors.

Book Review: *Growing Life* by André Leu

Reviewed by Dennis L. Feucht



Australian farmer, Regeneration International (RI) founder, and Regeneration Belize speaker André Leu has written a 210-page paperback book, *Growing Life: Regenerating Farming and Ranching*. The book describes a revolution under way in farming that emphasizes the importance of caring for the environment in which crops are grown. The book has a foreword by Gary Zimmer, then a second nine-page foreword by Dr. Vandana Shiva, another co-founder of RI. Dr. Shiva contrasts disadvantages of chemically-driven, monoculture farming of the 20th century with regenerative advantages, not only for producing crops but for the environment. Dr. Shiva has a 47-acre organic research farm with world-wide impact. She writes: "We need to recarbonize the world with living carbon. We need to decarbonize it of dead carbon." By "living carbon" she means organic carbon compounds found in the biochemistry of plants. Dr. Shiva reminds us that Leu reminds us that "Ninety-five percent of a plant's biomass comes from CO_2 in the air and from water in the soil that is transformed by biosynthesis ..."

Regenerative farming is not a new idea. As Dr. Shiva notes, "Justus von Liebig, the father of organic chemistry, wrote a book in 1861, *The Search for Agricultural Recycling*, where he explained how the soil is living, and its life depends [on] recycling of organic matter." As early as the 19th century, Liebig observed that explosives factories for war "had to find other markets" and "nitrogenous fertilizers in agriculture increased" until at present, the basis for soil enrichment are NPK fertilizers.

The book as such doesn't start yet; there is an introduction. As a youth, Leu found his calling in Far North Queensland where he happened one day upon an organic farm, an idyllic experience that set his direction. The regenerative agriculture movement originated when related movements of organic, natural health, environment, and agroecology met at a meeting in Costa Rica in 2015, forming Regeneration International "to promote a holistic concept of regeneration". The introduction winds down by summarizing that "Regenerative agriculture improves the land by using evidence-based practices that regenerate and revitalize the soil and the environment." Sandwiched between the introduction and chapter 1 is a 3-page instruction on "Using this Book". It is not about instant recipes but instead presents general principles and "training on how to use a range of tools".

Chapter 1, "Maximizing Photosynthesis", explains how solar energy through photosynthesis in plants, which input solar energy to combine water (H_2O) and carbon dioxide (CO_2) into glucose ($C_6H_{12}O_6$), the fuel in the food system for most of life. (Our brains run on glucose.) Farming is mainly about using leaves to collect solar energy and produce the chemical reaction driven by solar radiation that is *photosynthesis*:

$$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2.$$

The products of photosynthesis are glucose and oxygen. Glucose is the building block of sugars, cellulose, and carbohydrates such as starch, and they are further transformed into hydrocarbons - oils and fats. Adding nitrogen and sulfur, they form amino acids

which combine in chains to form proteins which form the various tissues in organisms. This long process of biochemical reactions begins with leaves, which maximize solar energy collection through cash and cover crops – what Leu writes must be our primary management tool.

The biomass of plants is 95 % from photosynthesis and 5 % from soil minerals. Instead of making the 95 % the priority, "current farming practices grossly mismanage the 95 percent" and is "largely ignored in most agricultural texts and courses". Numerous damaging practices "increase production costs by destroying soils, increasing pests and diseases, poisoning our food and environment, stopping the natural regeneration of soil biology and fertility, lowering water capture and retention, and reducing yields in the medium and longer terms."

The vast majority of soil carbon originates in CO_2 from air and about a third in plants makes its way from air to soil through plant roots. This "liquid carbon pathway" feeds the soil *microbiome*, the organisms - bacteria and fungi - that are the life of the soil. Around plant roots is much of soil life, the *rhizosphere*. One of its functions is to put soil minerals into a biocompatible form for plants to assimilate. While receiving minerals, plant roots put tons of organic (carbon-based) compounds into soil, forming topsoil. Cover crops and well-managed weeds also build topsoil.

One of the important of these microorganisms are *endophytes* such as the bacteria of legumes. They convert nitrogen into organic compounds plants can assimilate and symbiotically receive glucose from the roots. The more leaves and their plants, the greater the photosynthesis and the greater the enrichment of the soil and the organic life within, which plants themselves depend on for growth and health. It was as recently as 1945 that the book *Soil and Health* by Albert Howard showed the importance of soil organisms to both soil and plant health as constituting a microbiome as a living system and not an inorganic receptacle for feeding plants. Soil organic matter (SOM) is about 58 % soil organic carbon and is one of the most neglected yet important factors in soil fertility.

Chapter 2 is about ground covers and weed management. It follows from what was presented in chapter 1 that a goal in farming is to maximize photosynthesis. This means maximizing leaf area. Leaves synthesize glucose which builds plant structure and works its way down to the roots to feed the microbiome in the soil. Yet typical farming practice is to leave ground bare except for the crop plants. "Bare ground is the best way to encourage weeds... Weeds are nature's way of healing disturbed soil." (pp. 27, 28) Bare soil increases water loss and soil erosion and wastes sunlight. The alternative: turn weeds into cover crops that increase soil fertility and health as "green manure"; covering ground is the best way to prevent weeds, especially with ground-cover species that benefit the cash crop, the crop of economic value. Multiple species of plants are often mutually beneficial. Regenerative farming is about weed *management* rather than weed eradication.

Loss of topsoil is one of the major global problems in agriculture. Common farming practices "squander this precious resource" through bad tillage, herbicide use, poor irrigation methods, overgrazing, and allowing soil to remain bare of plant cover to wash into and degrade streams and rivers. The tops of cover plants prevent rain from directly impacting soil while the roots hold soil together and act as a silt trap in heavy rain.

Weeds can have benefits to crops. Through the liquid-carbon pathway of plants (chapter 1) they feed the soil, attract beneficial insects that suppress insect pests, prevent leaching, add soil nitrogen, suppress plant diseases, deepen soil, improve soil moisture, and out-compete unwanted species. Cover crop competition with cash crops for sunlight is prevented by keeping their leaves below those of the cash crop. Cover crops shade the soil, reducing loss of water through transpiration; their diversion of soil water from the cash crop can be avoided by slashing them for mulch which covers the ground but does not divert water from cash-crop plants. Although the carbon pathway through weeds enriches the soil, if too much of soil nutrients are taken by the cover crop, the mineral nutrients in the weeds can be returned to the soil by slashing and tilling them back into the soil. It is important to know the season of flowering of unwanted weeds so they can be removed or killed by hoeing, flame or steam weeding, or tillage. The main goal is to give the cash crop the highest priority of access to sunlight and water. Soil nutrient management provides sufficient nutrients for both cash and cover crops.

A variation on cover cropping is pasture cropping, based on the growth of annual cash crops in pasture growing perennial plants, cut short to add organic matter to the soil. Yields are comparable to traditional farming but have the added advantage of providing grazing where otherwise ground preparation and weed control for four to six months beforehand deprives its use for grazing. Pasture cropping significantly improves soil carbon levels. This carbon stimulates the soil microbiome to convert minerals from the soil so that they can be assimilated by plants, thereby increasing the fertility of the soil. Other forms of grazed land are covered.

One regenerative soil scheme of particular relevance to Belize is *agroforestry*. It includes fruit and nut trees, legumes, vegetables, grains, and tubers, endemic plants and wildlife. These are some

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Teas of Belize
By Dottie Feucht

The options for making teas from plants growing in Belize are numerous. Some teas are made for a refreshing drink; others for medicinal purposes. Given the vast number of these plants, I've often marveled that some time in the past there was a brave person who first tried making and drinking a tea made from the leaves of a plant growing in the jungle. According to Rudy Aguilar, our guide for a tour of herbal tea plants, maybe leaves fell into someone's hot water and that person noted the resulting fragrance. At any rate he says herbal teas were mostly medicinal until the 1700's when they were enjoyed for taste in social settings along with well-accepted black teas.

Some leaves have a wonderful smell that is translated into a pleasing taste but others do not. The first local tea I ever tried in Belize was tres puntas. It grows all over our place; our friend, Ben, told us that when his kids, who were bare-footed most of the time, started losing weight he surmised that they had parasites of some kind and made tres puntas tea for them. It restored their health every time. He said that most bitter teas are liver cleaners. We keep some in the refrigerator and drink a 2 oz. glass of it occasionally; bitter is an understatement for that tea. Regardless of use, most herbal teas are made by steeping leaves in hot water for about 15 minutes. Experiment with the number of leaves and steeping time to suit your taste – mild or strong. The herbal teas below are from plants/trees easily grown in Belize and made mostly for taste. For a comprehensive description of plants and teas used for medicinal purposes read *Rainforest Remedies* by Rosita Arvigo, DN, and Michael Balick, PhD.

I make herbal tea using my 10-cup pan so most of the instructions are based on that amount of boiling water. Occasionally I add a bit of honey to tea while it is hot but most of the time we drink it without any sweetener.

Lemongrass – I usually cut 10 leaves from our plant, put them whole into my 10-cup pan, bring them to boiling and steep them for 15 – 20 minutes. I refrigerate the tea after enjoying a cup of the tea hot.

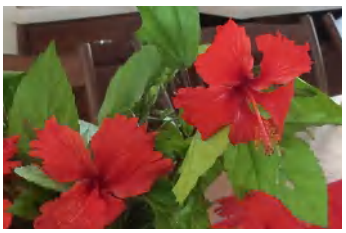
Cowfoot - Although we've never planted this woody plant with its big 7 by 6 inch (17 x 15 cm) almost heart-shaped leaf, it grows all around our place. I use only 2 or 3 leaves of this plant to make tea that tastes a bit like licorice or anise.

Mint – I discovered that the best way to harvest mint is to cut the stem, hold the top with one hand and "scrape" the leaves off with the other after discarding those that have blemishes. I use about a cup of leaves for tea.

Ginger – I use a piece of tubular ginger about the size of my thumb, slice it thinly, boil it, steep it until it's cool and make ginger-lime drink by adding water and lime juice to 5 1 quart containers. From my 10-cup pan of ginger tea I use about 1 ½ cups of tea, 3 tablespoons of fresh/ frozen lime juice for each container, fill them with water and refrigerate. If you freeze some of the drink in ice cube trays and use them in your pitcher you can keep the drink cool on hot days without diluting it. Hot ginger tea is also tasty.

Allspice – Make allspice tea with about 5 leaves. The tea tastes like the smell of the leaves. A chef once told me that the leaves baked with fish make a very tasty combination. Of course, the most common use of allspice is its "fruit", seeds that are ground fine.

Cinnamon - The inner bark of a *Cinnamomum* tree is removed from the tree and then dried until it begins to curl. The result is called cinnamon sticks, which is what is used to make tea. The length of the stick varies; use 3 – 5 3 inch sticks for tea. The sticks can also be added to hot apple juice for a tasty drink.



Hibiscus – Tropical *Hibiscus rosa-sinensis* is sometimes confused with Jamaican hibiscus (*Hibiscus sabdariffa) (see Bz Ag Rpt, issue 44)*, which in Belize is known as sorrel. Tropical hibiscus tea, made from a dozen blossoms,

is rather mild and has a very pale color. The first time I ever ate these sepals was at a pot luck when Michael Richardson (Sparkle) brought a salad full of beautiful red and pink and peach-colored blossoms in place of lettuce. Since then we have eaten these from our own bushes.

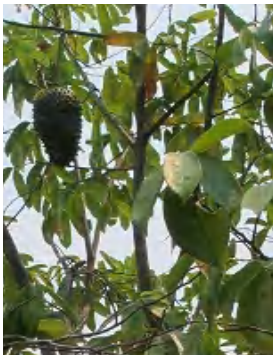
Sorrel – Although you can make sorrel tea from fresh sepals, I buy them dried at the market and use about 1 cup to make tea. Unlike tropical hibiscus, sorrel tea makes a tart-tasting tea reminiscent of cranberry with the same deep red color.

Lemon myrtle – I had never heard of this glossy green, strongly aromatic leaf bush, *Blackhousia citriodora,* before seeing it at Belize Botanic Garden. It is native to Australia but not Belize; so if you want one you'll have to visit a nursery. It grows well here and is worth growing not only for its beautiful blossoms but for one of the most flavorful teas ever - considerably more citrus flavored than lemongrass!

Passion flower – This plant, from the genus *Passiflora,* is not the same as *Passiflora edulis* which produces passion fruit, but the blossoms are very similar: beautiful exotic looking flowers in shades of purple, red, and white, and like hibiscus blossoms, last only about a day. Tea made from the dried pulp of the flower is clear and amberlike in color with an earthy flavor. It's a tea for people who have a hard time falling asleep at night. Here's how to brew it: place 1-2 teaspoons dried herb in a cup. Pour 8 ounces of boiling water over the herb, cover the cup with a small plate or lid, steep for 20-30 minutes, and strain out the herb.

Cardamom - Chai (which means tea in India where it originated) is one of my favorite non-herbal teas. It is almost always made from some form of black tea, milk and spices. Cardamom is the most common ingredient, followed by a mixture of spices to suit your taste. Cardamom is one of many spices Dr. Mathew grows on the Belize Spice Farm in Golden Stream; that's where I learned about it and bought some. There are many recipes for chai; here's one: Boil 2 cups of water and add 2 whole cloves, ½ teaspoon each of cardamom, cinnamon, ginger, nutmeg, and allspice. Simmer the spices for 5 minutes; then turn off the heat and add 2 tea bags and a sweetener. An Indian chef says that a teaspoon of sugar for each cup of chai brings out the fullest flavor of the spices. An alternative is 2 tablespoons of maple syrup or honey. Pour this concentrate through a sieve and use ½ cup for each cup of chai, filling the other ½ with heated milk. (I used almondmilk.) The left-over concentrate can be refrigerated and used with cold milk for a chai latte.

Stevia – Although the stevia plant native to Belize is not S*tevia rebaudiana*, the plant used to make the natural sweetener, it can be used to make a very sweet tea by using only about 1 teaspoon (5 gm) of leaf pieces per cup of hot water and steeping it for 10 minutes more or less depending on how sweet you like your tea.



Sour sop - Tea from sour sop leaves, about 5 leaves per cup of water, is not known for its flavor but it has great medicinal value because the leaves contain antioxidants. People drink it to boost their immune system and fight inflammation. Lab tests have shown that extract from sour sop leaves killed cancer cells. But high concentration can also damage the liver so it is best to drink the tea only once a week.

Bougainvillea – Tea made from the petals of bougainvillea has the same beautiful color as the flower itself. To make tea pick the same number of blossoms as cups of hot water, use only the petals, and steep for 5 minutes. One study that was done on bougainvillea tea reported great health benefits, such as antibacterial, antiviral, antioxidant, and anti-inflammatory. Like hibiscus the petals can also be used in salads.

Cacao Beans – The first time I ever heard of cacao beans was in Punta Gorda years ago. I watched a Maya family turn the beans into paste on a grinding stone called a *metate*. I thought the result would be powder like what I use in baking; but, no! It was paste. The family served us a hot drink made from the beans in a calabash bowl. They said they drink it daily. I was not impressed with the flavor and didn't know until this past year how nutritious cacao bean tea is – more so than either coffee or black tea. Now I make it - using a handful of the bean skins after roasting the raw beans in the oven (until one cracks) and peeling them; the peeling comes off like peanut skins. After the first hot cup I usually drink it cold from the refrigerator. You can add cinnamon and a sweetener, or, as the Maya family said, chilis.

Damiana – Damiana is a bush that grows in the wild in Belize; it has yellow flowers and fragrant leaves. I bought a package of dried leaves at Lamanai Chocolate on Hummingbird Highway; the owner has an extensive array of herbal teas, all from his jungle property. mix damiana with other teas.

Remembering Judy duPlooy

Judy duPlooy, co-founder with her late husband Ken, of the Belize Botanic Gardens (BBG) and duPlooys Jungle Lodge, passed away on the 5th of April, in Florida after a long illness. All 5 daughters were with her. She had celebrated her 80th birthday at the BBG on the 21st of January.

Judy and Ken moved to Belize with their 5 daughters in 1988, having purchased a fairly cleared property along the banks of the Macal River. Immediately seeing the potential, Ken announced that they would open up their lodge in 6 months. Having heard many similar claims, I thought, "Well, we'll see." Almost exactly 6 months later, ta da! - their duPlooys Jungle Lodge did indeed open for business. They planted hundreds of trees and plants and over the years continually made improvements to the grounds and the infrastructure. They contributed much to the development of the tourism industry in Cayo and always with a consciousness for conservation. Judy sold the lodge in 2018, thereafter concentrating her time on the gardens and her family.

As per the BBG announcement: "The garden was truly Judy's pride, joy and passion and it remains as her legacy to the country she called home for the last 36 years." Judy was a friend to many of us at the Belize Ag Report. She enjoyed the many teas of Belize and created the 'Teas at the Garden' tour at BBG.

By Beth Roberson

The Problem with Plastics and the Solution

By Karin Westdyke

Bakelite was the first synthetic plastic developed in 1907 from phenol-formaldehyde resins, but had limited use. It was a hard and inflexible material and only good to make such things as telephone cases and jewelry and was mostly abandoned after WW II with the rapid growth of plastics developed from petroleum-based fuels. The natural materials once used in manufacturing most products were subsequently replaced by plastics and since the early 1950s, we have been surrounded by plastics; it is used to make furniture, clothing, electronics, building materials and packaging. But in the last two decades the production of plastic products has greatly increased and approximately 50% of all plastics ever produced have been developed since the year 2000. Indeed, production of plastic has increased exponentially, from 2.3 million tons in 1950 to 448 million tons by 2015 and is expected to double by the year 2050.

Plastic Pollution

Today plastic pollution is found in the water we drink, the food we eat, the air we breathe, the soil we grow our food in, and even inside our bodies. As pointed out by Prof. Dr. Dick Vethaak, esteemed professor of ecotoxicology at the VU University in Amsterdam, "we are now dealing with a human health issue as well".

Approximately 10 million tons of plastic are dumped into our oceans each year negatively affecting fisheries, coastlines, tourism, marine life, and the fish we eat. Contrary to what most people believe, plastic is basically indestructible and within the next few decades there could be a larger tonnage of plastic in the ocean than there are fish. This is predicted in a report titled "The New Plastics Economy" researched by the Ellen MacArthur Foundation and the World Economic Forum. Plastic waste does not biodegrade, but instead breaks down into smaller pieces. Sea, sunlight, wind, and wave action continually work to break down plastic waste into smaller and smaller particles -- the size of one thousandth of one-one thousandth of a millimeter.

Scientists estimate that up to 200 million tons of plastic are currently in our oceans already and this is increasing every year, either from rivers and waterways flowing to the ocean or from dumping directly into the ocean. These tiny fragments are ingested by fish and other animals, making their way up the food chain to us.

Plastic microfibers, meanwhile, have been found in municipal drinking water systems and drifting through the air. When consumed in drinking water or food, these carcinogenic microplastic particles can migrate through the intestinal wall and negatively affect our lymph nodes as well as other organs of the body. They have already been found in an estimated 93 percent of humans at the top of the food chain.

The conveniences plastics offer has led to our throw-away culture, and today, single-use plastic accounts for nearly half of the plastic produced every year. Though these products, such as plastic bags, bottles and food wrappers, have very short life spans for use, they persist in the environment for centuries.

Many deaths to sea animals are caused by entanglement or starvation from plastic items. Seals, whales, turtles, and other animals are strangled, due to throw away six-pack rings or plastic bags as well as by abandoned fishing gear. More than 800 species are already known to be affected by marine plastic pollution. A veterinarian in Unitedville routinely removes plastic bags and containers from alligators that are rescued and brought in for the procedure.

Though there have been attempts to mechanically gather up larger plastic items floating in inland waterways, plastic out in the oceans is virtually impossible to recover once the plastic breaks down into microplastics and drifts throughout the water column in the open sea.

Though recycling programs have been implemented, less than 9% of plastic is actually recycled; these programs seem to be a losing battle. Compounding the problem is the fact that much of the plastic produced today is not even recyclable.

The Solution - *What we can do*

We can easily wean ourselves from disposable plastics such as water bottles and shopping bags by replacing them with re-useable versions. Bring your own bags to the store, leave some silverware at your workplace, and use travel mugs for coffee and a re-useable container for water. When ordering food out, bring your own re-useable lidded containers for your food to avoid getting it placed into Styrofoam containers.

Recycle all recyclable plastic items. Most are labelled with a 1, 2 or 5.

Support a bag tax or ban. In Belize, Oceana has started a campaign to ensure that the government meets its commitment to ban single use plastic and polystyrene products in the food sector.

Some other suggestions include avoiding products containing microbeads. Many facial products, body scrubs and even toothpaste contain these tiny beads which marine animals can mistake for food. Purchasing used items via thrift shops and online markets avoids the plastic packaging accompanying new items.

The four Rs of plastics often touted by environmental groups are *Reject, Reuse, Repurpose, and Recycle*. Here in Belize Dassia (Darcy) Regalado, who studied veterinary medicine Galen University, has demonstrated one way to repurpose plastic by turning plastic items that she finds into art projects making baskets, plant holders and paintings. She says that she began repurposing plastics because of the damaging effects it has on wildlife. Darcy is also the communications director of the National Students Union of Belize. In February 2023, Rossana Briceno, the Prime Minister's wife and special envoy for the Development of Families and Children, honored Darcy for making a positive difference by repurposing plastic trash in a very special way.

Though there are many good ideas for individuals to do, it is even more important to put pressure on the manufacturers and other companies to be smarter about their packaging; companies can be very responsive to consumer demands. In the 1990's a group of students in one New Jersey high school environmental club launched a national campaign to convince McDonalds to stop packaging their hamburgers in Styrofoam containers. They communicated with other school environmental clubs across the US and each wrote letters and conducted peaceful protests at local McDonalds restaurants carrying signs and banners, some dressing up in clown costumes wearing name tags saying Ronald McToxic. And it worked. Since then, McDonalds has been putting their hamburgers wrapped in paper or in paper containers.

But perhaps a new industrial revolution for plastics is the most promising solution for the future. Bioplastics is a new kind of plastic made from renewable sources. Agricultural feedstocks such as corn, soybeans, industrial hemp, or sugarcane all have demonstrated promising results. The starches, oils, and sugars from these feedstocks are extracted, modified, and used as the chemical building blocks for new bioplastic products. This is valuable because these feedstocks are sources of "new" carbon as opposed to old carbon from petroleum-based products. The amount of new carbon in a product can be an important measurement for the product's sustainability.

So far, industrial hemp is proving to be the best choice for bioplastics for a number of reasons: (1) it is the most environmentally friendly, (2) two crops of hemp can be grown in the same time it takes to grow one crop of corn (3) hemp can be grown on marginal land that is not suited or needed for food crops and it needs far less water, little if any fertilizers, and no pesticides, (4) as a canopy crop, it protects the soil from sunlight and erosion -- unlike corn, which leaves the soil exposed, and (5) hemp regenerates the soil while corn depletes it. In climates like Belize, there could easily be 3 or 4 harvests a year.

The Hemp Plastic Company, based in Colorado is already providing eco-friendly biocomposite and bioplastic solutions in volume, helping to reduce carbon emissions and promote sustainable production of plastic products.

The Hemp Foundation of India is a hemp plastic manufacturer & wholesaler of hemp bioplastics. In 2019, after 3 years of research and development, the company began producing and marketing plastic made from organic himilayan hemp to plastic sheeting, injection molding, packaging companies, and the automotive industries.

An Austrian company, Zellform, has developed a hemp-plastic resin called Hempstone, for use in musical instruments, loudspeakers, and furniture. Hempstone can be carved into almost any shape, making the number of applications unlimited.

Though hemp bioplastics are in the very early stages of development a report by Zion Market Research puts the global hemp packaging industry at $20 billion by 2025. In addition to being far better for the environment, the production of bioplastics from industrial hemp supports local farmers rather than big oil companies. Industrial hemp plants actually capture carbon dioxide and turn it into oxygen. For every ton of hemp produced, 1.63 tons of carbon is removed from the air. These plants also enrich the soil they're grown in. The deep roots prevent soil erosion and actually clean contaminated soil so that marginal land can be converted to farmland for growing food crops later. According to André Leu, director of Regeneration International, there is no better rotation crop than hemp as it improves the soil and eliminates the need for toxic weed killers that deplete the soil.

When we are confronted with a situation like plastic pollution and understand its devastating effects on the environment and our health, there is only one solution. We must stop making it, using it, and discarding it or find another way to make it safely.

In addition to the following references is a list of others that can be found on agreport.bz linked to this article on the web site.

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Why We Need to Ban Glyphosate

- Glyphosate consumption from food has been shown to have a substantial part in insulin resistance, making it a severe concern to those with type 2 diabetes. Nearly 45,000 Belizeans are living with diabetes.
- Glyphosate significantly increases the risk of non-Hodgkin lymphoma, and has been classified as a probable carcinogen by the International Agency for Research on Cancer.
- Glyphosate exposures can lead to risk for developing breast cancer. Breast cancer is one of the most common types of cancer in Belize and disproportionately affects more younger women in the country.
- We are exposed to glyphosate through food, drinking water, wind, and water erosion. It is found in dust within non-agricultural homes.
- Glyphosate is extremely toxic to: bees; soil microorganisms; beneficial microflora; earthworms; and will disrupt good soil biology.
- 28 countries have restricted or banned glyphosate, and Mexico has recently pledged to eliminate its use .

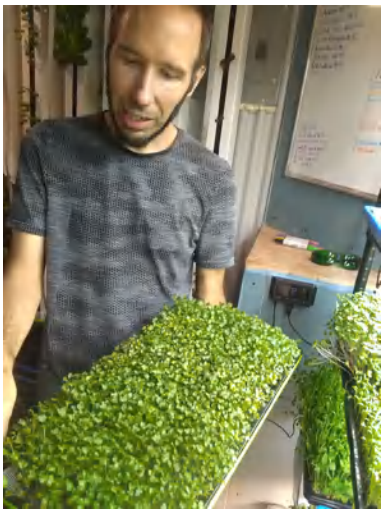
Pro-Organic Belize

www.pro-organicbelize.org
proorganicbelize@gmail.com

Mention Petition to Ban to GOB can be found on the online Annex page_
Dottie please word this

Home-Grown Sprouts, Microgreens, Lettuce and Strawberries in Belize For Health and Profit

By Mary Loan



Bill Daeger and his family moved to Belize just a few years ago. Since moving to Belize, Bill studied the art of growing microgreens and sprouts and now has a thriving operation in a small storage room in his home. The room virtually bursts with life and energy from the trays of sprouts and the hydroponics tubes filled with beautiful fresh crisp lettuce and two varieties of strawberries. Growing in the protected environment, the microgreens, lettuce, and sprouts are not affected by too much or too little sun, rain, wind, or insects. Environmental conditions are fine-tuned to achieve maximum growth. Bill explained that he keeps the sprout room cool, grow-lighted and climate-controlled by the use of solar panels. The grow room is kept cool to avoid mold in the humid environment. Once the initial investment in solar power is recovered, the microgreen room will operate at no electrical cost except system maintenance, boosting the profit margin.

To avoid pathogens, Bill uses organic seeds and water-soluble vegan fertilizer from the Master Blend company, in the United States. Magnesium, used to help grow the sprouts and lettuce, comes from Epsom salt. Some of the sprouts are grown in finely pulverized peat moss; others sprout in trays that are watered from the bottom so that no water gets poured on the leaves of the sprouts. Bill keeps track of what and when he plants and the date when the sprouts are ready for harvest for his family and for sale to certain vendors at the San Ignacio open air market and individual customers. Some of the sprouts take up to twenty days longer than others to reach harvest stage depending on the variety.

Microgreens are nutrient dense, containing higher concentrations of vitamins, minerals and antioxidants compared to their mature counterparts. Bill explains, "They provide a concentrated source of essential nutrients in a small serving. Each seed is full of all the elements needed to grow into plants. Eating one ounce of broccoli sprouts is the equivalent in nutrition to eating 1.5 lbs. of full-grown broccoli." A favorite microgreen is the carrot sprout. A single sprout carries the flavor of a carrot and is a desired salad ingredient.

Bill shared some of the benefits of eating microgreens and sprouts. "Different sprouts are used to treat specific health issues. For example, radish is good for kidney function, broccoli is high in sulforaphane and has been proven helpful in fighting and preventing cancer. Red cabbage microgreens have been found to have up to six times more vitamin C and 69 times more vitamin K than mature red cabbage. Cilantro microgreens have been shown to contain up to three times more beta-carotene than mature cilantro. In addition to their high nutrient content, microgreens are also believed to have other health benefits such as reducing the risk of chronic diseases, improving heart health, and boosting the immune system."

"I got started for my own family; we wanted to improve our nutrition and add fresh taste to our food. People heard about our microgreens and wanted to try them. Anyone can grow microgreens at home, all you need is a light, some trays and seeds."

The sprouts and lettuce are available in the Cayo District. Contact information for Bill Draeger: On Facebook at Belize Microgreens or Whatsapp at 632-0617

Look for a new addition at the San Ignacio open air market, smoked vegan gouda cheese!

Mexico Stands Firmly Against GMO

By Maruja Vargas

Mexico is winning its fight against the United States Department of Agriculture's pressure to allow GMO corn to replace the native corn in Mexico. Let Belize stand in solidarity with its closest trading partner. One year ago Belize Ag Report cited the 2020 Mexican decree issued by Mexican President López Obrador that mandated the phase-out of GMO corn by 2024 to be replaced with "sustainable and culturally appropriate" alternatives, the moves of which were for the purpose of contributing to food security and sovereignty and to the health of Mexicans. The decree also banned the use of the controversial weed killer RoundUp®.

In an interview with Reuters on 26 October 2022, Deputy Agriculture Minister Victor Suarez reaffirmed Mexico's commitment to the ban, saying it does not violate the United States-Mexico-Canada Agreement (USMCA), successor to the North American Free Trade Agreement (NAFTA), and Mexico is "under no obligation to buy and grow genetically modified corn."

The United States has refused to respect Mexico's choice, instead working tirelessly to bully the country into accepting GE corn in order to protect the short-term profits of U.S. agribusiness giants.

NAFTA eliminated the Mexican government's protection mechanisms for Mexican farmers while preserving US corn subsidies for American farmers. The results were devastating for Mexico. During NAFTA's first decade, cheap US corn flooded the Mexican market, causing the price of domestically-grown corn to plummet. The economic devastation to Mexico's agricultural sector cannot be overstated, and contributed to a 75% increase in illegal immigration into the United States.

In March 2024, what was a described as a "Mexican standoff" with the United States turned into a "Mexican smack-down" with the release of Mexico's formal rebuttal to US efforts to overturn the limits Mexican judiciary ordered on the use of genetically modified (GM) corn and the weed killing chemical glyphosate.

In a 189-page report filed with a panel of USMCA, Mexico laid out in stark terms why it has ordered that GM corn not be used for tortillas and dough that people eat and why it has ordered its farmers to stop using glyphosate. There is "clear scientific evidence of the harmful effects of direct consumption of GM corn grain in corn flour, dough, tortilla and related products," Mexico states.

Further, Mexico highlights that the US cannot produce a single academic study that shows that the long-term consumption of large quantities of minimally processed GM corn treated with glyphosate is safe to eat.

In 2013 Mexico's Supreme Court banned the planting of GM corn to protect the country's biodiversity; following that ruling Mexico filed a class-action suit in Mexican federal court against Monsanto, Syngenta, Dow and Pioneer/DuPont to protect landrace corn strains from genetic contamination and modification.

Despite appeals by the international mega-agrocompanies, a court injunction that halted GMO corn plantings on test plots in northern Mexico remains in place.

February 2023 after enough pressure from U.S. agriculture officials, farmers, and the industry's biggest lobbying groups, López Obrador issued a new decree which eliminated the previous January 2024 deadline to ban GM corn for livestock feed (imports will still be banned for human consumption). Without a set date for the complete substitution of US GM corn imports, the new rule simply says Mexican authorities will carry out "the gradual substitution" of GM feed.

In October of 2023, Deputy Agriculture Minister Víctor Suárez told Reuters, Mexico would seek deals with U.S. farmers to buy non-GM corn from them.

López Obrador insists that his country is under no obligation to import genetically modified crops under the treaty. "When deciding between health or trade, we opt for health," he said

Evidence that RoundUp®/glyphosate formulations are detrimental to health continues to mount. A recent peer reviewed study released by the U.S. National Institute of Health has confirmed that glyphosate is an underlying factor in insulin resistance, commonly known as type 2 diabetes which impacts over 70% of the Belizean population in some form, either economically or physically, significantly reducing the quality of life of the majority of our population.

https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9774325/

UPE NAI FARM TOUR
By Mary Loan

Along San Antonio Road east of the village of San Antonio, Cayo look for a sign *Upe Nai*, a small farmstand filled with native fruits and vegetables, most of them grown on Upe Nai farm by Philip and Nila Mai and their family. They grow a wide variety of crops on a few acres of land behind the farmstand. Upe Nai fruits and veggies are grown using all natural organic regenerative farming practices. Upe Nai restaurant now serves 3 meals a day of amazing Belizean food. Besides an orchard of fruit trees and healthy-looking produce in rich soil, Philip raises friendly sheep, a flock of chickens and a few contented looking pigs.

In February 2023 a hearty group of Pro-Organic Belize members were treated to a complete tour of the farm by Philip Mai, who is also an experienced tour guide with impressive birding wisdom. Philip explained the importance of staying in touch with the garden by providing lots of TLC, including fertilization, irrigation and pest and fungus control without toxic agro-chemicals. We all learned something about planting, growing and harvesting pesticide-free fruits and vegetables. Our new member, Darcy, a second-year veterinarian student, put it this way: "As someone who is versed in farming and growing with farmers, I was excited and filled with joy when I met Ms. Karin's friends who are also versed in growing produce organically. I learned so much from experts and everyone; I am looking forward in learning more."

We were also treated to a special tour of an up-and-coming butterfly enterprise by Philip's granddaughter, Rachel, who has considerable experience finding the caterpillars, feeding them and providing the proper habitat for producing butterflies.

The tour continued into the spacious outdoor kitchen where Philip shared recipes about exactly how to make fertilizers and bug repellants etc. from household ingredients.

Upe Nai restaurant, which is open all day, also has some of the best Belizean food you'll ever taste; Philip's wife, Nila, is the cook and warmly welcomes everyone who comes.

Ash fertilizer: Use one cup of ash (fine ash from wood burning stove) per liter of water. Use **only** rain water. Let it sit for 3 days, then **filter** and dilute with rain water 5:1 making 6 liters in your sprayer. (The color of the liquid depends on wood type.) Apply as foliar. This fertilizer is good for adding potassium and treating fungus on potatoes, cover crops etc.

Banana fertilizer: Put banana peels, or even 2 whole bananas, skin and all into a liter of rain water. Let it sit for 3 days, then filter, add 2 more liters of water, making 3 liters of fertilizer for your sprayer. This fertilizer is especially good for flowering trees.

Coffee and ash fertilizer: Put 1 cup of fine ash and 3 tablespoons of left over coffee grounds into a liter of rain water. Let it sit for 3 days, then filter, add 3 more liters of water, making 4 liters of fertilizer for your sprayer. This fertilizer is good as a pesticide for funhite fly, tiny spiders, mites, and white fly. It also boosts the immune system of your plants.

San Antonio Farmers Day 2023
As told by Mary Loan

On 16 March the streets of San Antonio came alive with a celebration of agriculture in San Antonio, Cayo, the hometown of the Minister of Agriculture Abelardo Mai. The community center featured talks and reports by panelists from the Ministry of Agriculture and included ambassadors and government officials.

To the tunes of a marimba beat hundreds of attendees visited the booths of several dozen local exhibitors and vendors. There was an abundance of fresh fruit and vegetables, organic coffee, salsas, jams, hot pepper sauces for sale and many plates of local cuisine were sold to the attendees. Herbalists present were happy to display and describe the herbs and plants they harvest and use. A San Antonio librarian had a display of books and extended a welcome to folks to visit the village library. Several agro-businesses and organizations rounded out this special day with their booths.

An enthusiastic farmer explained that since this event was so popular and well-attended, with even a few tourists present, it may be held as a regular farmers market event.

Giant Puffballs
By Dr. Alessandro Mascia

For most people, when asked what their favourite food is, there is usually an immediate, concise and clear answer. In contrast, asking a true mycophile to name their favourite mushroom, while still eliciting a prompt response, is likely to be neither concise nor clear. It would probably be a ramble along these lines: "Well, obviously I like boletes…I mean, I've never met a bolete I didn't like…but, you know, there's also chantarelles; obviously yellow are better; I don't buy into all that snobbiness about the blue and the white; but I mean, if you give me blue or white I'll still eat them…and obviously if we are passing through Toledo, we'll look out for oysters and wood ears, especially if it is raining (which is most of the time!)…though last time we passed through

Spanish Lookout we found these really nice puff balls which were just outside of the fence **and** nobody had taken them; now that was a good find…so yeah, boletes…and chantarelles … definitely puffballs … and …"

So after many years, I have been asked to write another article on mushrooms, which sort of makes me feel like I've been hit with the "What's your favourite mushroom?" question. I've spent a few weeks wondering which fungus I should describe and today, as I wandered into the duck and goose run, I came across some puffballs! Among mushrooms, puffballs have a number of unique charms which make them impossible not to be liked. First of all, they can get pretty big; the literature states that they can get to fifty pounds in weight. Having said that, the biggest ones I've found have been around a pound and maybe five or six inches across. Secondly, no species are known to be poisonous; by that I mean, drop-dead, kill you or very sick poisonous. Some people who are sensitive can get a laxative effect, sort of like taking a purge; but I would hardly consider that qualifying as poisonous! The only look-alike mushrooms that they might be confused with are the earthballs, but I'll get into that later. Thirdly, a lot of them tend to come out after a relatively light rain during a dry spell, like in the middle of dry season after one of those occasional rains, making them a welcome mycological addition during the time of the year when there is a mushroom drought.

Puffballs tend to be found solitary, scattered, or in groups in fields, pastures, open woods, exposed hillside, along roads and in drainage ditches. I've seen them along the road going to Spanish Lookout and in pastures visible from the highway throughout Belize. At home, they seem to come up in my duck and goose run after it starts drying up and we've moved the fowl to the other half of the run to let the grass grow back. They are really easy to identify; I mean, they look like balls, from a marble, to a baseball, to a softball, to a football, depending on the specific species. The other important distinguishing characteristic is that they have a thin skin (as opposed to a thick rind, which the earthballs have). They are usually white or grey on the outside, firm to the touch, and usually good to eat; that is, most of them are edible, but a few of them might be too bitter. However, I haven't come across any bitter ones in Belize (at least, not yet and I try my best to eat all the puffballs I come across!). The most important thing to do if you find a puffball is to cut it in half; this allows you to look at the tissue that makes up the mushroom. It should be white and firm; if it is not, then it is (1) a puffball that is getting too old and ready to release its spores (It will start to get soft, spongey and mushy as well.), or it is (2) an earthball (I haven't come across them in Belize yet.) which is identified by having a purplish or black spore mass within a rind-like or leathery skin and flesh that is still firm. Earthballs are **not to be eaten** as they do make you sick. The other reason to cut the puffball is to cut out any damaged bits and make sure they haven't already been eaten by worms, which breaks my heart every time! Once found, puffballs can be eaten in so many ways. If they are big enough they can be cut into steaks

and pan fried, roasted or barbequed. David Arora says to fry them like pancakes, cube them like tofu and drop them into clear soups, or eat them in salads. I haven't found any puffballs big enough to do any of those things. Sliced and slow fried in butter or olive oil is the way we do it and personally, I think it brings out that lovely mushroomy aroma that we crave the best. For all you trivia buffs out there: puffballs are not only eaten, but apparently when dried they have also been used as sponges and as tinder (to help start fires); Arora also mentions that they have been used as toys, dyes (as in colouring textiles), burned under beehives to stupefy bees and put on wounds to stop bleeding.

And with this, we come to the close of today's edition of "My Favourite Mushrooms!" I wish you all luck in finding this wonderful fungus; we are entering the right time of the year for it to appear. So, next time you are bored while driving along the highway, keep an eye open; you never, never know…you might be rewarded with a big flush of puffballs! Go forth and spread the spores!

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FARMING NATURE'S WAY

by Dr. Stephanie Seneff, PhD

Highlights

- Noni trees are a medicinal fruit tree that is native to a large area across Asia and Australia.
- Noni was popular among the ancient Polynesians for its many beneficial phytochemicals and its ability to ease pain topically.
- Steve and Richele Frailey have been cultivating Noni trees on a certified organic farm in Kauai since 1982.
- Steve believes in using nature's own methods in agriculture, and he uses no cow manure, no organic fertilizers, no organic pesticides, and no added minerals.
- Steve's farming methods are primarily based on mulch, earthworms, and rock dust, and his trees are very healthy, producing fruit all year round.

If you should have the good fortune to spend a vacation in the Garden Isle of Kauai, Hawaii, be sure not to miss the free two-and-a-halfhour tour of the Hawaiian Organic Noni Farm on the North Shore. Steve Frailey and his wife Richele have been harvesting Noni (Morinda citrifolia) on this farm since 1982, when they purchased just 20 acres to begin their adventure.

Steve had studied organic farming methods in Missouri in the 1960s, and he had been harvesting fruits on his organic farm in San Diego before coming to Kauai. His Noni farm, now nestled in 70 acres of a beautiful deep valley and a bluff overlooking the ocean, is one of the best examples you will find of how to grow food not only organically but also using basic principles derived from nature.

And the organic Noni Fruit Leather that is his primary product is rich in phytochemicals called iridoids, metabolites that have been shown to have neuroprotective, hepatoprotective, anti-inflammatory, antitumor, hypoglycemic, and hypolipidemic activities. Micronutrients include vitamin C, vitamin A, niacin, manganese, and selenium, but its iridoid phytochemical, deacetylasperulosidic acid, is believed to be a key contributor to its medicinal value.

Steve discovered that Noni trees were growing wild in his valley when he originally bought the land. At the time, he was unaware of their rich history. He learned that the trees had originally been brought to Hawaii by Polynesians from the Marquesas Islands in French Polynesia.

The Polynesians had valued the fruit for its medicinal properties to help heal skin irritations, arthritis and many other ailments for over 2,000 years. In times of famine, the raw food was eaten to nourish the body. In fact, Noni is native to a large area from

Figure 1: Noni trees can grow up to 40 feet tall. They thrive best when they are in an area with full sun exposure.

South Asia to South East Asia to Australia and across the South Pacific Islands. All traditional cultures valued it for its extensive medicinal properties.

Scientific research has identified over 165 beneficial compounds in the raw pulp of Noni. However, Noni fruit is tricky because of fermentation that destroys most of the potency and benefits. The fruit goes from a ripe mature fruit to a fermented fruit very quickly. One of the effects of fermentation is to reduce the number of sulfur-containing esters in the fruit, as these are converted into volatile compounds and lost. In fact, Dr. Brian Issell conducted cancer research for 10 years at the University of Hawaii using only pure non-fermented Noni fruit. According to Dr. Issell, "If fermentation is allowed, then a different chemical profile is present." In other words, Noni's potency and beneficial compounds are destroyed through fermentation.

Steve's challenge was how to prevent the fruit from fermenting. His quest was a 50-year journey of research and development, ultimately building a unique low-heat (below 115 degrees F) dehydration process. To be FDA compliant, Steve had independent lab tests conducted in California that showed that their unique process locked in the 165 beneficial compounds found in the raw pulp of Noni. The Lab tests showed that his Noni Fruit Leather has a 2-year shelf life not refrigerated and is 14 times more potent than fermented Noni juice.

Using only mature ripe non-fermented Noni that is grown on the certified organic family farm and keeping the drying temperature below 115 F preserves the maximum beneficial qualities without the use of additives or preservatives. The maximum beneficial qualities without the use of additives or preservatives. The raw ripe fruit has a unique taste unlike any other fruits, with a distinct blue-cheese-like flavor, which gives it the nickname "cheese fruit." The dried form's flavor is distinct but not nearly as cheesy, and it is highly concentrated in lignans, polyphenols, and flavonoids that support antioxidant defenses.

On the tour, Steve recommended a book by a Japanese scientist and farmer, Masanobu Fukuoka, titled "One-Straw Revolution," that he had read many years ago and that was foundational to his own farming practices. The basic principle of the book is that the best forms of cultivation mirror nature's own laws. In addition to his farm being USDA Certified Organic, Steve uses no cow manure, no organic fertilizers, no organic pesticides and no added minerals. Instead, he grows nitrogen fixing plants and trees that he uses as mulch to support the Noni trees' nitrogen needs. From his personal experience of over 40 years of growing organically and "mimicking nature," he uses an abundant amount of mulch in the orchards, occasional foliar spraying of compost teas, rock dust from a local quarry that is high in calcium and many trace minerals, and earthworms.

Over the years, Steve refined his agricultural practices to steadily increase yields from his trees. An extremely important part of his success story involves earthworms. On the tour, he shows the audience a large flat container full of earthworms, that he feeds regularly with pureed vegetarian food waste from the family's meals. He adds to the worm bed shredded paper and grass from mowing the lawn. It is important to keep the worm bed damp and to keep the worms in the shade and covered loosely with a board to keep out the sunlight. The worms love the pureed food and they produce worm castings that are even better than cow manure to fertilize the Noni trees. He stated that just one cup of the worm castings placed under mulch surrounding the trunk of a Noni tree will be enough to keep the tree producing fruit the whole year round.

During the show and tell on the tour about worms, Steve quotes from Charles Darwin who wrote: "There are few animals which have played so important a part in the history of the world as the earthworm." Noni trees are remarkably hardy. They can live up to 400 years, and the old trees still bear fruit.

Noni trees are unusual in that their flowers emerge from the fruit during the early growth stage. There are abundant honeybees on the property that are attracted to the Noni flowers in a mutual relationship where the bees benefit from the nectar while helping to pollenate the trees.

Steve sells not only the Noni fruit leather, but also various topical medicinal products where Noni is the primary ingredient. Noni is especially known for its ability to reduce arthritic pain, and many athletes have learned to take advantage of it for this reason.

Noni is not the only crop on Steve's farm. He also harvests apple bananas, papayas and mangoes, all certified organic.

https://www.rhi.bio/2022/05/29/farmingnatures

Editor's Note: Dr. Stephanie Seneff, well-known researcher, author and lecturer on many adverse health effects caused by toxic chemicals, visited Belize in 2017 and presented compelling evidence of her findings. Now living on Kauai, Hawaii, she continues her research on health issues.

See Belize Ag Report, issue 13, page 18 for more information on noni.

A Banana Fiber Enterprise
By Dottie Feucht

Eat the bananas but save the stalk, especially if the stalk is more than 4 feet long. It is the source material for the new cottage industry, *Belize Banana Fibers (BFB)*, established in January 2020 by Gary and Jerri Dennis and partner, Huberto Chulin. Having seen a video of using banana fibers to make baskets, hats, place mats, purses, back packs, hanging light shades, woven backs and seats of chairs, mirror frames, coasters, and many other useful items, Dennises became intrigued after considering the abundance of bananas in Belize. The BFB partners researched the process that the people in India successfully used to establish the cottage industry there. Dennises were keen to help the people in the Benque de Vejo vicinity make a living from Belize's natural resources.

The banana stalks that BFB prefers are the larger ones 10 – 11 feet in length and 14 inches in diameter. The stalk consists of different layers containing longitudinal fibers. Fibers can be extracted from the stalk manually which was their first experiment to see if the fibers were viable for processing into products. It is exceedingly tedious and time-consuming to cut the stalk through the vein, separate the 8 – 18 layers (sheaths) of stalk, and pull the fibers from the best (not coarse) outer layers. (The core of the stalk has too much pulp to be used.) So Dennises tried to purchase the machine that was being used in India but met with failure. Their next consideration was to have it made by some machine shop. That's when Huberto, with training in mechanical engineering many years ago in Benque, came through with the first of many expressions of ingenuity. He fabricated a machine called *Ecogator* that weighs about 300 pounds so it does not have to be bolted to the floor for stability. (Huberto has since fabricated two more Ecogators because the partners plan to establish the cottage industry as a total enterprise in the participating villages. The selling price has been set at $6,500.)

Now the strips of stalks can be fed into the Ecogator to produce the fibers which are then boiled in a 55 gallon drum for 5 – 10 minutes to destroy residual chemical or biological action that can degrade the fibers. The boiling process is carefully monitored; the fibers turn a dark color if boiled too long. Fresh water is used for each batch. Next the fibers are hung on lines to dry. The Dennises have recently built a covered structure suitable for stringing lines for the drying process. The drying period depends on the amount of the pulpy material adhering to the strips. When thoroughly cleaned, about 5 hours are required for drying on a normal dry day. These fibers are bright in luster and light or white in color.

At the beginning of their enterprise Dennises went to Punta Gorda to learn from the Belizeans there how to weave the fibers into products. Then they taught the Belizeans in the Benque area (and are continuing to hold classes as part of the enterprise for anyone interested in learning how to weave banana fibers). The "Women of Power" project sponsored by the Taiwanese embassy was the workshop that inspired the ladies of the Benque area to engage their creativity to produce items from the fibers. And they have been stunningly successful. The Dennises have a room full of shelves with the products of these creative women. The men have also joined in by weaving the backs and seats of chairs they make and other products.

Here's how the enterprise works: Banana Fibers Belize (BFB) accepts stalks from banana growers who want to donate their stalks. BFB then processes them into balls of fibers resembling giant yarn skenes that are given to the weavers. The weavers produce whatever item they can create using the fibers and sometimes other material such as craboo bark which adds another color. Jerri says that the only limitation put on the weavers is that the item must be of some use. BFB then buys the product from the weaver at ½ the wholesale price BFB assigns. The target market is the tourist trade, resorts and people who want to buy useful native products for home use or gifts. BFB also takes orders for customized products and has been successful in delivering top quality products to satisfied customers. Some of the weavers have made macramé products and some have tried crocheting with the fiber.

That's not all. The rejected part of the stalk called *skutcher*, the byproduct of the extraction process, is good for fertilizer. It feeds the soil and holds water very well. The core of the stalk is edible; it has the consistency of celery.

Huberto's latest fabricated machine splits the stalks that separates the layers, eliminating that manual process.

Youth Cultivate Bee-Love in The Mayan Golden Landscape Creative Advocacy Practicum (CAP)

By Isabel Carrió, *Project Manager and Community Engagement Specialist, Creative Action Institute*

The Maya Golden Landscape is in Southern Belize, formed by 275,000 hectares of biodiverse and fertile land. It includes protected areas, private lands, and Mayan communities. It plays an essential role in the Mesoamerican Biological Corridor by connecting the coastal plains (sea level) to the Maya Mountains, which elevate up to 1133 meters (3,700 ft) above sea level.

Our partner organization in Belize, Ya'axché Conservation Trust, conducted a native bee inventory within Maya Golden Landscape protected areas and the buffering communities' agricultural landscape between 2019 and 2021. As a result of this process, Ya'axché presented the guide *Native Bees of the Maya Golden Landscape* which includes photos, identifying features, geographic ranges, and plant associations for the 27 genera and 44 species of native bees found during the inventory.

While doing the inventory, Ya'axché recognized a need to engage local youth in conservation to create a sustainable relationship between people's livelihoods and forest biodiversity. Ya'axché identified their annual summer camp as an opportunity to address these issues with local youth.

Ya'axché, in collaboration with the Creative Action Institute (CAI) team, implemented a participatory workshop with the youth: creative advocacy practicum (CAP). CAI conducts numerous workshops (CAPs) each year that bring together community educators to improve their advocacy efforts through art and creative thinking to catalyze change in their communities.

CAI's transformational and art-based methodology enriched Ya'axché's education outreach component focused on preserving native bee diversity. During three days, 25 youths from three communities reflected on environmental and social issues around bees and increased their knowledge and skills related to beekeeping and conservation.

Using CAI creative methodology, participants transformed limiting beliefs, highlighted the environmental importance of bees, analyzed the root causes of the current threats to bee conservation, and devised actions to combat them. Once the participants identified critical ideas about bee conservation, they turned them into visual concepts. And then, in groups, they combined the drawings of all members to paint creative signs. The creative signs painted by the youth were presented in a community event that included the participation of local beekeepers. During the event, participants explained their process in creating the signs and the key ideas about bee conservation represented in them. The dialogues around the painted signs opened a platform whereby youth and beekeepers shared knowledge and experiences.

"Art is important because it colorfully expresses our opinions so that people can see them. I feel very inspired. I used to always think about bees being dangerous and that they are not supposed to be protected. Still, after they educated us about it, we learned that not all bees are dangerous but essential to our life," shares a female participant.

The community event was enriched by the openness of the Maya Golden Landscape beekeepers to share their experiences and answer the questions the youth had regarding beekeeping and the farming practices that indirectly contribute to native bee diversity. In addition, the beekeepers encouraged young people and women to consider becoming beekeepers to earn income by selling organic honey while protecting the environment.

As a closure to the dialogue, the youth committed to maintaining a healthy environment and preserving native bees' diversity. Likewise, the beekeepers reiterated their commitment not to use chemicals that would affect bee populations.

The creative signs made by youth from the Maya Golden Landscape were gifted to the beekeepers who attended the community event. They accepted the paintings from the participants to be placed at their farms to increase the awareness of bee species conservation and the benefits as an income-generating livelihood opportunity.

Because of the implementation of this workshop:

- 50 youth increased their knowledge of bee conservation and their importance in supporting climate-smart agriculture.
- 10 beekeepers displayed the signs made by the participants on their farms to educate visitors.
- Over 75% of the participants showed an increase in their knowledge about native bees and their ecological importance in supporting forested landscapes.

To learn more about this project go to: https://www.creativeactioninstitute.org/bee-conservation-belize

To learn more about Creative Action Institute go to: https://www.creativeactioninstitute.org

Transforming African Star Grass Area to a Fruitful Garden

By Deborah Harder

African star grass (Cynodon spp.), also known as Bermudagrass, was originally brought to Belize voluntarily. It was imported to Upper Barton Creek and other locations as a useful variety of pasture grass that would not need to be replanted, as it spreads by runners. Unfortunately, recalls an older resident, it never occurred to anyone to ask what it would do when it spreads to gardens. Hindsight being proverbially sharp in its vision, African star grass, indeed, established itself as a pasture grass and, reaching beyond its call of duty, spread further to become the bane of farmers in Upper Barton Creek - a garden weed that seemed impossible to eradicate, only spreading more with hoe or horse drawn cultivator. The community for many years took a position against the use of herbicides, but the problem became so bad that finally farmers were allowed to use herbicides to combat this imported pest. But even herbicides did not really get rid of it permanently; the roots were not always killed, but revived to vigorous growth. Eventually some residents who moved away in the last 15 years gave as one reason for moving that they were fleeing the encroachment of African star grass.

Forward to 2021: We had purchased an older farm that had been vacant and neglected for many years. Outside my back door I dug up and started a bed to grow a few herbs and greens close to the house, but it was beside a patch of African star grass that kept encroaching. I finally decided to use some cut-open cardboard boxes to spread around the bed to keep the grass at bay. As it seemed to work, I decided to try covering the whole patch, about an area 36 feet by 15 feet, with cardboard. A neighbour offered me hay from her bushhogged field, which my children helped me rake one day and load on to her pickup. We spread the hay over the cardboard to cover it, which was completed late in November. We have dairy cattle, so in December-January my husband spread a layer of cow manure about 1 inch thick over the whole patch, and I transplanted and sowed pumpkins by making holes with a hoe through the mulch and now-rotting cardboard. I broadcast black beans and black-eyed peas to cover the spaces between the pumpkin plants while they grew. Later I pulled some of the ground cover plants, leaving the rest as mulch, as the pumpkins grew and crowded them out. Some beans were left to harvest as green beans. I eventually harvested a good crop of pumpkins in late April 2022. In June we began digging up raised beds and planting vegetables, greens and herbs, adding compost, manure, and seaweed as available. Over the winter, we harvested tomatoes, Chinese cabbage, bok choy, green beans, okra, basil, oregano, papaya and more from this small space. This experiment in eradicating African start grass has proved to be a success; no trace of it has returned since cardboard and mulch were laid down 1 1/2 years ago.

Reprinted with permission from
Medicinal Plan used in northern Guanajuato
By Rosita Arvigo D.N.

MAÍZ - Corn
Zea mays L.

DESCRIPTION: Plant to 6 feet; drooping long leaves; flowers borne on spikes on top; kernels of various colors are borne on an "ear" in the axils of the leaves.

HABITAT: Cultivated

USES: Corn silk tea is an excellent remedy to **cleanse the lymphatic system, for urinary conditions such as retained urine, burning urine, kidney stones or bladder infections**. To prepare, boil the silk (hairs) from three ears of corn (either fresh or dried) in 3 cups of water for 5 minutes, steep for 20 minutes, strain and take in sips all day. To **relieve fever and itching with measles**, boil a handful of dried kernels in a quart of water for 20 minutes and drink in sips all day at room temperature. To prepare, roast dried kernels over a *comal* or a dry pan until well browned. When cool, grind and prepare as any coffee. This also has **diuretic** action. For **liver and heart ailments with swelling or retention of fluids**, prepare corn silk tea as above and take in sips all day. It may be used over a long period of time during any phase of life, including pregnancy, as it has no toxic or irritant effects. **Heart conditions with chest pain, difficult breathing and heart palpitations** caused by sudden shock respond well to regular doses of corn silk tea and atole made with cinnamon.

HISTORICAL NOTE: Used for swelling of dislocated bones and stubbed toes. Also used as an aphrodisiac, as a diuretic, to reduce fevers, and for ailments of the kidney and bladder, to ease menstruation and to purify the blood. Atole made with corn and chocolate was used to improve mother's milk.

ASK RUBBER BOOTS

Dear Rubber Boots,

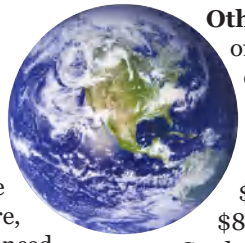
I have been growing a lot of plants inside my home but they are becoming too large and are probably pot bound. I would like to transplant them to my garden but am concerned about their survival. Do you have any advice?

Sincerely,
Black Thumb

Dear Black Thumb,

Yes we know only too well that plants can die of shock, so be prepared. Firstly I would allow plenty of time for the move so the plants can adjust to their new home. Start by putting them outside in their pots for a few hours a day, gradually increasing to full time. Choose locations where you think they will do best such as partial shade which will protect them from any extreme elements, i.e., strong winds, full sun, pests, heavy rain. Although they may be tropical plants their life indoors has made them more sensitive and they will need time to acclimatise and build survival traits. Check weekly weather forecasts before starting. You are their caregiver so I would suggest doing all this yourself to avoid potential damage. Loosen the soil around the potted plant while you dig holes three times larger than the pot they are in, prepare by adding quality soil and water. Carefully ease the plant from the pot keeping it in its ball. Lower into the hole and cover with soil, tamping down around plant. Water gently to begin with to help them settle. Do not swamp. Check on their progress daily, adjusting for shade, water and nutrients.

AG BRIEFS



FARMERS OF THE YEAR NATS 2024

The National Agriculture and Trade Show (NATS) Committee, under the auspices of the Ministry of Agriculture, Food Security and Enterprise, announced the winners of the Farmer of the Year 2024 competition as follows:

- Senior Farmer of the Year: Mr. Nandy Esban Aldana of the Corozal District
- Female Farmer of the Year: Mrs. Sarah Chub of the Belize District
- Junior Farmer of the Year: Ms. Maura Esther Escobar of the Cayo District

Formal sashing of the winners took place at the NATS opening ceremonies on 26th April.

Belize celebrated its 50th anniversary as a member of the Caribbean Community (CARICOM) on 1st May 2024. Current CARICOM members include the 15 countries of Antigua and Barbuda; Bahamas; Barbados; Belize; Dominica; Grenada; Guyana; Haiti; Jamaica; Montserrat; Saint Kitts and Nevis; Saint Lucia; Saint Vincent and the Grenadines; Surinam; Trinidad and Tobago; and 5 associate members: Anguilla; Bermuda; British Virgin Islands; Cayman Islands; and the Turks and Caicos Islands. More information: Caricom.org

Global citrus shortage: Although prices have risen, production is down for citrus leaders worldwide. Disease, unusually hot temperatures especially during flowering and soils with disrupted microbiomes all contribute to the decrease. Florida's 2023 citrus harvest was their lowest since 1968, and their 2023 imports of Brazilian citrus rose 55%. However, those imports may not be possible in 2024 as Brazil's 2024 citrus production is forecast to drop 24%, their lowest in 36 years. Belize's citrus exports declined: $4.9MBzD - March 2023 vs $0.7MBzD – March 2024, with no concentrate exports in March 2024.

Other ag exports: Belize's exports of animal feed, made partially from citrus byproducts, decreased by 73% in the first quarter of 2024 compared to that of 2023. Sugar revenues in the same quarter decreased from 2023's $15.6MBzD to $9.3MBzD in 2024. Banana revenues increased 2023's $8.7MBzD to $19.9MBzD in the first quarter of 2024. Crude soybean oil saw a combined increase in exports, from $9.4 million in 2023 to $12.6 million in 2024.
Source: Statistical Institute of Belize, 2024

Several ag readers have read articles and contacted us, inquiring about chlormequat chloride residues found in breakfast cereals of North America. This plant growth regulator is currently not registered or allowed to be used in Belize, yet imported foods may contain these residues. Full lists of Belize's registered pesticides can be found at www.pcbbelize.com

Good news with expanded Integrated Pest Management (IPM): With the Ministry of Agriculture's (MAFSE) support, Belize's Ministry of Economic Development, via Rural Resilient Belize (RRB) has invested Bze $250,000 to expand production of beneficial insects used in IPM. In an IPM system, biologicals such as live beneficial predator insects are applied to control insect pests such as the whitefly, spider mites, scale insects, leaf hoppers, thrips, aphids, mealybugs and borer pests. The goal to reduce the use of restricted pesticides, will reduce farmer input costs and diminish harmful side effects of pesticide residues in our soil, water and foods. The International Regional Organization for Health in Agriculture (OIRSA) has long been producing and sharing country-wide, several beneficial predators, such as *Chrysopterla carnea* and *Trichogramma pretiosum* in their bio-factory. The new funding will be used for farmer pilot projects and workshops highlighting IPM in Corozal, Orange Walk, Belize and Cayo Districts.

Local and Regional Fuel Prices

★ Same

All prices Bz$/Gal	Cayo, Belize	Quintana Roo, Mexico	Peten, Guatemala
REGULAR	↓ $12.83	↑ $10.12	↓ $10.29
PREMIUM	↑ $13.93	N/A	N/A
DIESEL	↓ $12.69	↑ $9.96	↑ $10.81

"Water is our most valuable crop."
Lois Henry, journalist Lords of Water: an Al Jazeera documentary

West Virginia University in the USA has developed a 6-arm pollinating bot for greenhouses, "to combat declining natural pollinator populations".

https://interestingengineering.com/innovation/stickbug-pollinating-six-robot-greenhouses

Neonicotinoids and other pesticides have long been known for decimating pollinators worldwide, especially bees. According to the Belize Pesticide Control Board, "Twenty-four neonicotinoid formulations are currently registered for use in Belize. Thirteen of those accounted for 7% of the total volume of imported agricultural use pesticides in 2021."

Optimizing crop yields for Mars: insights from Wageningen University

At Wageningen University & Research in the Netherlands, scientists have embarked on research to enhance space farming techniques, crucial for future human settlements on Mars. Exploring intercropping as a food production strategy in Martian colonies.

https://www.freshplaza.com/latin-america/article/9622813/optimizing-crop-yields-for-mars-insights-from-wageningen-university/?utm_medium=email

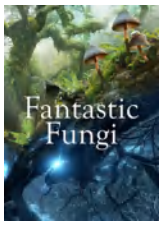
Food Freshly is a German company that has been exploring ways to extend the shelf life of vegetables using "powdery blends of vitamins and minerals" since 1994. These are said to increase the shelf life of cut fruits and vegetables to over 21 days. Some of their products are certified organic and "are approved worldwide by all major food regulatory authorities". They contain no sulfites, preservatives, allergens or GMO products and are manufactured in Germany. Instructions for use: dissolve the product in water, then dip veggies, such as cut potatoes and avocadoes, into the mixture.

https://www.food-freshly.eu/en/products

Residual waste from mushroom cultivation removes pollutants from water: Brigit van Brenk, Han Wösten, and colleagues have been doing research at Utrecht University using mushroom substrate (fungal filaments from white button mushrooms [*Agaricus bisporus*] and horse manure (previously composted and sterilized) to purify water. Previous to this finding, much of this waste product was exported to Germany for use as fertilizer.

https://www.uu.nl/en/news/residual-waste-from-mushroom-cultivation-removes-pollutants-from-water

Documentary movie about fungi:
Fantastic Fungi: Not Rated, 2019.
Narrated by Paul Stamets
Fantastic Fungi is a descriptive time-lapse journey about the magical, mysterious and medicinal world of fungi and their power to heal, sustain and contribute to the regeneration of life on Earth that began 3.5 billion years ago.



Staff from the World Vegetable Center (WorldVeg), headquartered in Taiwan, visited Belize the week of April 21st, 2024 for the 3rd LAC [Latin America and Caribbean] Vegetable Network Workshop, which was hosted by CARDI. Their goal here is "to promote vegetable diversity for more resilient livelihoods and healthier diets in the LAC region". Local stakeholders as well as Caribbean and Latin American visitors, attended the opening ceremonies on 22nd April. Many attended the various workshops held at CARDI's Central Farm nurseries during the days following, ending with field visits in the north and to Marie Sharpe's in the south. WorldVeg does not use GMOs. Many in attendance asked questions, especially details and accessibility of Integrated Pest Management (IPM) tools.

The USA makes business more difficult for small meat processors (link: April 2024 below). Enter headlines May 2024: "Eight tons of ground beef, processed at a Cargill Meat Solutions plant in Pennsylvania and distributed to Walmart stores nationwide, have been recalled due to potential E. coli contamination."

https://www.zerohedge.com/commodities/cargill-recalls-8-tons-ground-beef-walmart-stores-nationwide-over-possible-e-coli

The author suggests "re-evaluating food sources, moving away from big companies, and shifting towards more localized and transparent farming practices." E coli contamination primarily affects cattle who have been raised in confined animal feeding operations (CAFOs), and not those which have been pasture-raised.

Now read the April article discussing how proposed [USA] EPA regulations could easily put small meat processors out of business: limiting water pollutants – great thinking except that the proposed timeframes for these processing upgrades may leave many of the small guys unable financially to implement the changes in time. Small farmers do not have the clout of big ag; consumer organizations may be the key to thwart efforts to eliminate smaller local food options.

https://childrenshealthdefense.org/defender/epa-rule-small-meat-processors-business-water-pollution/?utm_source=luminate&utm_medium=email&utm_campaign=defender&utm_id=20240419

AG BRIEFS

"Scientists worry that the H5N1 strain of avian influenza will become endemic in cattle, which would aid its spread in people. Concerns that pasteurized milk in the United States is teeming with H5N1 avian influenza virus are over. But there's no sign that the outbreak in cows is over, and scientists are increasingly concerned that cattle will become a permanent reservoir for this adaptable virus—giving it more chances to mutate and jump to humans."Source: https://www.nature.com/articles/d41586-024-01333-9

The Northern Grain Co-op in Blue Creek, Orange Walk District, began processing soybeans into dry soybean meal in December of 2023. They set up a soy solvent extraction plant to make the dry soybean meals which have a lowered fat content of 1-2% and higher protein at 47-50%. Current price for the soybean meal is $65 for 100 lbs. Local production and processing has eliminated the need for importation of soy, previously entering Belize via Merida, Mexico.

Leu Book Review...Continued from page 45

of the most productive farms on the planet, with a wide variety of economically-viable plant species growing in them.

Various kinds of mechanized weeding are presented along with cover crops, mulching, sheet composting and shade for weed control. Organic herbicides are listed such as vinegar and soaps. The "worst weeds - the ones that grow rapidly and produce a lot of biomass - are the most useful when managed correctly, as they produce the most organic matter." (pp. 74, 75) The chapter concludes with "There is no such thing as a weed problem. There are only management problems, and these can be solved."

Chapter 3 brings attention back to the central theme of organic farming: soil health and nutrition. This chapter goes into detail about how to deliver soil nutrients to crops, what soil is, how to build it, the role of microorganisms, and compost. "Most agronomy texts are based on almost-200-year-old research and promote the out-of-date concepts that plants use only water-soluble minerals." (p. 105) "High levels of NPK will not increase yields if other minerals are deficient." (p. 113) The chapter also debunks other myths of modern farm practices, based on false assumptions and a lack of understanding of soil biochemistry.

Chapter 4 ties the previous chapters together into a system-level view of organic farming. It emphasizes knowledge of naturally occurring plants and organisms that reduce unwanted insects, pests, and diseases. Numerous practical methods are described. Finally, chapter 5 compares industrial with regenerative agriculture. The merits of organic farming are emphasized and why they compete favorably with non-regenerative farming. Appendix 1 is a list of organic insecticides, fungicides, and biological controls. It is followed by a 26-page index.

This book is strongly recommended to those who are open to a new and better way of farming than what has been practiced since the 19th century and before and is based on a growing body of biochemical and other scientific discovery that advances agriculture to a new phase of accomplishment.

"Forgiveness is a funny thing. It warms the heart and cools the sting."
William Arthur Ward

2024 Ag Calendar

Many agricultural events previously held annually in Belize are returning this year after a hiatus related to world health issues. Please send us your ag event details, and we will print them at no cost to you in our next issue.

- Every Month, 2nd & 4th Saturdays: **The Farmers and Artisans Market**, hosted by Trey's Barn & Grill, Mile 54 George Price Hwy, 11:AM to 3:PM. Info: Debby Chiang, chiang.debby@gmail.com 623-6129

- May 11-12: **Belize Cashew Festival and Agricultural Show**, Crooked Tree Village, Belize District

- May 17-19: **Chocolate Gala Signature Gala Event,** 17 May at Copal Tree Lodge, Toledo; **Celebrate Chocolate Market Event,** 18 May, Punta Gorda Market, Toledo. Info: https://chocolatefestivalbelize.com/event/

- May 25: **Let's Grow Bananas**, a multi-variety banana swap at the Pro-Organic Belize booth at The Farmers and Artisans Market, at Trey's Barn & Grill, 11:Am – 2:PM. Usual seeds, plants and small trees swap; Organically grown sweet potatoes. Info: proorganicbelize@gmail.com, 677-9658

- June 8: **Mango Street Fest**, hosted by Hopkins Village, Stann Creek District

- August 17: **Belize Beef Fest & Rodeo**, hosted by the Belize Livestock Producers' Association (BLPA), at the National Agriculture Grounds, Belmopan. 8: AM - 5: PM See ad pg. 36

- June 26 - 28: **Belize Archaeology Symposium**, hosted by NICH, San Ignacio Resort Hotel, Cayo District. Info: https://sites.google.com/site/belizearchaeologysymposium

- September 10-12: **Soil Fertility Course level 1**, presenter Neal Kinsey of Kinsey Ag, Spanish Lookout, Cayo District. Contact David Thiessen of AgroBase: agrobase.bz@gmail.com 670-4817

- Late October: **World Food Day**, hosted by Ministry of Agriculture, Food Security & Enterprise (MAFSE) and Food and Agriculture Organization (FAO); venue changes annually. Info: https://www.agriculture.gov.bz

- Mid November: **Feria Xmatkuil**, Xmatkuil, Yucatán, Mex. Yucatán's largest livestock & agriculture event of the year, close to Merida. https://www.zonaturistica.com/en/events-in/2024/yucatan/merida

- December 2-5: **49th Annual Eco-Ag Conference and Trade Show**, hosted by Acres USA, Madison, Wisconsin, USA. www.acresusa.com/eco-ag/

Does your community schedule farm market day? Send us your schedule or announcement and we will include it in our agriculture calendar of events.

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